Alternatives to the gas reference price

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Contents

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Boxes, figures, and tables

Glossary

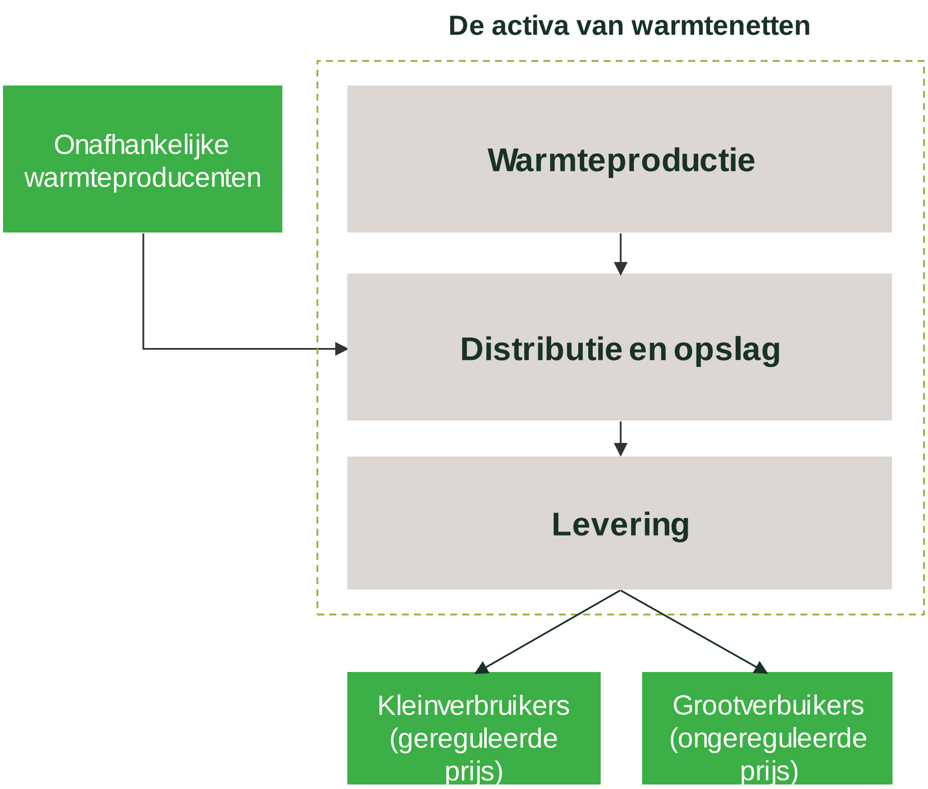
Term	Definition
ACM	Autoriteit Consument & Markt, the Netherlands Authority for Consumers and Markets (the Dutch competition authority and regulator of various sectors, of which the energy sector is one).
Climate Agreement target	The number of currently existing houses (as of 2018) connected to a DHN that is required to meet the target specified in the 2019 Dutch Climate Agreement—extrapolated to 2040. For 2040, this target is calculated to equal approximately 2 million existing households.
DHC	District heat company: a company (either publicly or privately owned) that owns and/or operates one or more DHNs.
DHN	District heating network. These networks supply heat to residential buildings, offices and other premises that require heat. DHNs consist of underground circulation pipelines that transport heat in the form of hot water from one or more heat sources—such as boilers and power stations, or industrial facilities that produce heat that would otherwise be wasted—to the buildings that require it; DHNs also often include the sources of heat, although some heat generation by third parties is feasible also.
Discount rate	The expected (annual) rate of return on capital required by investors to invest in DHNs.
EZK	Ministerie van Economische Zaken en Klimaat – Ministry of Economic Affairs and Climate.
Maximum tariff/ price cap	Maximum price DHCs can charge to small users, set by the regulator (ACM) following a certain pre-determined methodology.
Network costs	The total costs of building and operating the DHN, irrespective of who (e.g. the DHC or end users) incurs the costs. In particular, network costs also include the cost of heat. Network costs are expressed as yearly costs, with one-off investments discounted at the DHCs discount rate, and include a reasonable rate of return.
Overcompensation	Excess profits DHCs earn on top over their costs plus a reasonable return (i.e. their network costs).
Prices charged to households	Price paid by households which are connected to, and consume heat from, a DHN.
Regulatory accounting requirements (RAR)	A requirement for regulated companies to prepare and report their regulatory accounts to the regulator. Regulatory accounts are consistent across the industry and may include guidance from the regulatory on specific subjects such as cost allocation that are not included in the usual statutory accounts.
Regulated asset base (RAB)	The total value of assets on which the DHC owning the DHN is permitted to earn a return.
Small users/ customers	Customers with a connection up to 100Kw. These include several users types, of which households form the largest group.
Tariff	Price paid by users which are connected to, and consume heat from, a DHN.
Vesta	Vesta MAIS spatial energy model, a model developed by ‘Planbureau voor de Leefomgeving’ (PBL) which simulates (among other things) the rollout of heat networks and their economic and environmental impact.

Source: Oxera.

1 Dutch executive summary

Warmtenetten (ook wel stads- of blokverwarming genoemd)[1] leveren warmte aan woningen, kantoorpanden en andere gebouwen die warmte behoeven. Een warmtenet is een netwerk van ondergrondse leidingen die warmte, in de vorm van warm water, van één of meerdere bronnen transporteren naar de warmte behoevende gebouwen die aangesloten zijn op het net. Voorbeelden van bronnen die gebruikt worden om het water in warmtenetten te verwarmen zijn elektriciteitscentrales, aardwarmte of restwarmte (warmte afkomstig van bedrijven die overblijft na het productieproces en verloren zou gaan als het niet gebruikt zou worden door warmtenetten). Figuur 1.1 illustreert de verschillende schakels in de levering van warmtenetten.

Figuur 1.1 Waardeketen voor warmtenetten



Bron: Oxera analyse.

Omdat warmtenetten vaak over aanzienlijke hoeveelheid marktmacht beschikken, beschermt de huidige Warmtewet (hierna: 'Warmtewet 1.0') kleinverbruikers (met connecties tot 100kW) die afhankelijk zijn van lokale warmtenetten.[2] De Warmtewet reguleert de prijzen (tarieven) die kleinverbruikers betalen door een maximumprijs (prijsplafond) te stellen. Deze maximumprijs is gelijk aan de prijs die een gemiddeld huishouden zou betalen voor het verwarmen van hun woning met aardgas, het zogenaamde 'Niet Meer Dan Anders (NMDA) principe', en wordt aangeduid als de 'gasreferentieprijs'. Bepaalde onderdelen van de prijs die huishoudens betalen voor hun warmte worden echter nog niet gereguleerd. Een voorbeeld hiervan is de éénmalige

[1] Met 'warmtenetten' wordt in dit rapport gerefereerd naar het integrale systeem–waartoe naast het net ook de warmtebronnen en levering behoren. Tevens is warmte- en koudeopslag is in dit rapport meegenomen in de definitie van warmtenetten.
[2] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, pp. 2, 8–9.

betaling die bekend staat als de ‘Bijdrage Aansluitkosten’ (BAK). Een veelgehoord punt van kritiek is dat het vaak niet duidelijk is welke kosten in rekening worden gebracht middels de BAK.[3]

In het Klimaatakkoord (2019) zijn doelstellingen vastgelegd om de CO2-uitstoot van Nederland tot 2030 met 49% en tot 2050 met 95% terug te dringen (ten opzichte van het aantal emissies in 1990).[4] Het CO2-vrij maken van de aan gebouwen geleverde warmte zal een belangrijke rol spelen bij het bereiken van deze emissiereducties, aangezien de meeste warmte momenteel wordt geleverd door aardgasgestookte ketels. In het Klimaatakkoord is afgesproken dat 1,5 miljoen bestaande woningen in 2030 duurzaam moeten zijn (d.w.z. geen aardgas verbruiken).[5] Een aanzienlijke groei van het aantal, en de omvang van, warmtenetten zal naar verwachting nodig zijn om deze verduurzamingsstrategie te verwezenlijken. In het Klimaatakkoord wordt de ambitie uitgesproken om van 2025 tot 2030 jaarlijks 80.000 woningen aan te sluiten op een warmtenet.[6]

Het huidige regelgevingskader is echter niet bevorderlijk voor de uitbreiding van warmtenetten tegen redelijke prijzen voor de consument. De reden hiervoor is dat de Warmtewet 1.0 niet voorziet in de reguleringsinstrumenten die nodig zijn om te zorgen dat de warmtetarieven voor kleinverbruikers de kosten van een warmtenet reflecteren. Het doel van de gasreferentieprijs is om ervoor te zorgen dat afnemers van warmtenetten niet meer betalen dan aardgasverbruikers. Per definitie reflecteert de gasreferentieprijs dus niet de kosten van een warmtenet.

Sterker nog: de gasreferentieprijs zal in de toekomst vermoedelijk nog meer afwijken van de kosten van warmtenetten, aangezien de gasprijs naar verwachting zal stijgen als gevolg van wijzigingen in de energiebelasting op gas. Naar verwachting leidt dit tot hogere prijzen voor kleinverbruikers, meer overcompensatie voor warmtebedrijven en ontmoediging van de consument om over te stappen van aardgas op warmtenetten.

Tot slot zal de gasreferentie irrelevant worden indien, zoals het Klimaatakkoord beoogt, een alternatief regelgevend stelsel en marktordening het mogelijk maken om op grote schaal af te stappen van aardgas als bron voor warmtevoorziening.

Om de beoogde groei van de warmtemarkt mogelijk te maken, ontwikkelt het Ministerie van Economische Zaken en Klimaat (EZK) een nieuwe marktordening die geïmplementeerd zal worden in de aanstaande, vernieuwde Warmtewet (hierna: ‘Warmtewet 2.0’). Deze nieuwe wet zal ruimte bieden voor een 'wijkgerichte aanpak’ waarin gemeenten een belangrijke rol spelen, waarbij warmtekavels (een gebied waar mogelijk voor een warmtenet als energie infrastructuur wordt gekozen) worden vastgesteld en één warmtebedrijf per kavel wordt aangewezen om het warmtesysteem aan te leggen en te beheren. Het aangewezen warmtebedrijf is verplicht om elke klant die op het netwerk

[3] De BAK bestaat vaak uit een aansluitbijdrage en een projectbijdrage. Per 1 januari 2020 zal de aansluitbijdrage gereguleerd worden door een maximumprijs die gebaseerd is op de daadwerkelijke kosten van aansluiting. Er zijn echter geen plannen om de projectbijdrage te reguleren. Het blijft dus mogelijk voor warmtebedrijven om kosten die niet gedekt worden door de gasreferentieprijs terug te verdienen middels de projectbijdrage, waarbij het niet mogelijk is om te garanderen dat de projectbijdrage niet excessief hoog is (d.w.z. hoger is dan efficiënte kosten).
[4] Rijksoverheid (2019), 'Klimaatakkoord', p. 19.
[5] Rijksoverheid (2019), 'Klimaatakkoord - C Afspraken in sectoren - C1 Gebouwde omgeving', pp. 16 en 37.
[6] Rijksoverheid (2019), 'Klimaatakkoord - C Afspraken in sectoren - C1 Gebouwde omgeving', p. 37.

aangesloten wenst te worden te bedienen.[7] Als een warmtebedrijf eenmaal aangewezen is zal het de enige leverancier van warmte in het desbetreffende kavel zijn (hoewel andere vormen van warmtevoorziening nog wel beschikbaar blijven).

In dit kader is Oxera Consulting LLP (Oxera) gevraagd om alternatieven voor de gasreferentieprijs te analyseren en een aanbeveling te doen om de prijzen voor kleinverbruikers te reguleren. De reikwijdte van dit rapport is daarom beperkt tot de regulering van tarieven.[8] Echter is het belangrijk om de bredere beleidscontext en marktordening, alsmede andere facetten van het wettelijke kader in ogenschouw te nemen bij het ontwerpen van een economische reguleringsmethodiek. Deze worden derhalve meegenomen in Oxera's voorgestelde tariefregulering.

Concreet is Oxera gevraagd om de volgende vragen te adresseren:

1. Wat zijn concrete, geschikte en uitvoerbare alternatieven voor de gasreferentie gelet op de karakteristieken van de warmtemarkt en de doelen van netwerkregulering?
2. Wat is de verwachte kwantitatieve en kwalitatieve impact van deze alternatieven op de warmtetarieven en de realisatie van de doelen van netwerkregulering en van de Warmtewet 2.0?
3. Wat is op korte en lange termijn de meest geschikte tariefreguleringsmethodiek voor de bepaling van de tarieven voor kleinverbruikers van warmte?

Middels twee formele stakeholderworkshops hebben we belanghebbenden uit de sector betrokken bij onze analyse. Tijdens deze workshops kregen vertegenwoordigers van bestaande warmtebedrijven, potentiële toetreders tot de warmtemarkt, consumentenorganisaties en een vertegenwoordiger van de gemeenten de gelegenheid om commentaar te geven op de voorlopige uitkomsten van Oxera. De standpunten die tijdens deze workshops naar voren zijn gebracht, zijn zorgvuldig meegenomen en hebben geleid tot een gedetailleerde uitwerking van de overwogen reguleringsopties.

1.1 Alternatieven voor de gasreferentieprijs

Met de nieuwe regulering wil EZK de volgende hoofddoelstellingen bereiken.[9]

- De regulering moet garanderen dat warmtebedrijven geen overcompensatie ontvangen in vergelijking met het efficiënte kostenniveau en dat consumenten profiteren van eventuele toekomstige efficiëntieverbeteringen.
- De regulering moet garanderen dat de langetermijnbelangen van de consumenten worden beschermd in termen van de prijzen die zij betalen en de kwaliteit van de aan hen verleende diensten.

[7] Ministerie van Economische Zaken en Klimaat (2019), 'Warmtewet 2.0', brief aan de Tweede Kamer, p. 4, geeft aan dat de wijkgerichte aanpak zal worden gevolgd door de Warmtewet 2.0. Rijksoverheid (2019), 'Klimaatakkoord - C Afspraken in sectoren - C1 Gebouwde omgeving', pp. 24-25, legt uit hoe de wijkgerichte er in de praktijk uit zal komen te zien. Ministerie van Economische Zaken en Klimaat (2019), 'Voortgang wetstraject Warmtewet 2.0', brief aan de Tweede Kamer, pp. 3-4 and 10-11, geeft meer details over welke gevolgen de wijkgerichte aanpak voor de warmtemarkt zal hebben.
[8] Deze studie focust zich op de Nederlandse warmtemarkt en bevat geen systematische analyse van de warmtemarkten in andere landen. Oxera heeft, waar dit van toepassing was, gebruik gemaakt van haar ervaringen met warmtemarkten in andere landen en prijsregulering in andere sectoren in Nederland en daarbuiten.
[9] Deze doelstellingen zijn in meer detail uitgewerkt in hoofdstuk 5.2.

- De regulering moet garanderen dat warmtebedrijven redelijkerwijs in staat worden gesteld om een redelijk rendement te verdienen. Hiermee wordt de leveringszekerheid en uitbreiding van warmtenetten gefaciliteerd, hetgeen consumenten de mogelijkheid geeft om over te stappen op een duurzame warmtevoorziening.
- De regulering moet innovatie, netwerkintegratie en sectorkoppeling stimuleren, zodat de efficiëntie, de kwaliteit van de dienstverlening en de duurzaamheid van de warmtevoorziening op de lange termijn kunnen worden verbeterd. Concreet moet de regulering ervoor zorgen dat warmtenetten, gemakkelijker gebruik kunnen maken van duurzame warmtebronnen waar en wanneer deze beschikbaar komen.

Ook is het noodzakelijk dat warmtenetten onder consumenten breed geaccepteerd worden als een aantrekkelijke oplossing voor de lange termijn. Gedurende deze studie hebben een aantal stakeholders aangegeven dat het voor de acceptatie van warmtenetten door zowel bestaande als toekomstige consumenten noodzakelijk is dat de warmtetarieven transparant zijn en niet te veel variëren (over tijd of tussen verschillende warmtenetten). Er bestaan geen algemene definitie voor ‘excessief variabel’ (oftewel wanneer warmtetarieven te veel variëren). Sommige stakeholders definiëren excessief variabel als ‘ver onder 100%’ (waarvan onze interpretatie is dat de hoogste prijs niet meer dan twee keer zo mag zijn dan de laagste prijs). Een ander vereiste om de gewenste acceptatie en het vertrouwen van consumenten te winnen, is de waarborging van een redelijk kwaliteitsniveau van de warmtelevering.

Daarnaast moet het gekozen regime uitvoerbaar zijn en dienen de administratieve lasten voor de toezichthouder, gemeenten en warmtebedrijven van een redelijk niveau te zijn. Dit betekent dat de administratieve lasten die verbonden zijn aan de aanbevolen tariefregulering in verhouding moeten staan tot de voordelen die de regulering op kan leveren.

Er bestaan een groot aantal opties om de tariefregulering in vorm te geven, waarvan hieronder een (brede) selectie wordt besproken (zie Tabel 1.1). Voor elk van deze opties bestaan er vermoedelijk meerdere mogelijkheden om deze uit te werken. Dit betreft daarom ook geen uitputtend overzicht. Tabel 1.1 presenteert een breed scala aan mogelijke reguleringsmechanismen waaruit een short list van drie opties zal worden geselecteerd.

Tabel 1.1 Longlist van alternatieven voor de referentieprijs voor gas

Nummer	Optie	Beschrijving
1	Vrije prijsstelling en transparantie	De tarieven worden vrij vastgesteld door warmtebedrijven in samenspraak met consumenten en gemeenten/provincies. De rol van de toezichthouder is beperkt tot het publiceren van informatie over de rendementen van de warmtebedrijven
2	Vrije (maar gecontroleerde) prijsstelling, transparantie en ex-post regelgeving	De tarieven worden door warmtebedrijven vastgesteld in samenspraak met consumenten en gemeenten/provincies die door de toezichthouder worden gecontroleerd. De toezichthouder kan ingrijpen in de markt als de warmtebedrijven overwinsten behalen
3	Herziene gasreferentieprijs	Er geldt een maximumprijs die gebaseerd is op een herziene referentie aan de prijs van aardgas, conform de huidige wetgeving (die per 1 januari 2020 van kracht wordt)
4	Referentieprijs op basis van alternatieve brandstoffen	Er geldt een maximumprijs die wordt vastgesteld op basis van één of meer alternatieve brandstoffen of energiebronnen, zoals biomassa of elektriciteit, maar niet op basis van aardgas
5	Kostengebasseerde referentieprijs	De geldende maximumprijs wordt gebaseerd op een referentieprijs die de werkelijke kosten van warmtebedrijven op nationaal niveau weerspiegelt. Dit kan bijvoorbeeld betekenen dat energiebelastingen uit de gasreferentieprijs worden gefilterd of dat de tarieven worden verhoogd met behulp van een index voor de kosten van warmtenetten
6	Benchmarkregulering	Voor elk warmtenet geldt een maximumprijs die wordt vastgesteld aan de hand van een benchmark, waarbij deze benchmark wordt bepaald door de kosten van andere warmtenetten. Hierbij zouden aanpassingen gemaakt kunnen worden om rekening te houden met verschillen in kenmerken van het net (schaal, dichtheid) en warmtebronnen
7	Technisch-economisch ‘netwerk-referentiemodel’	Warmtenetten mogen kosten in rekening brengen tot aan een benchmark. Deze benchmark is gebaseerd op een technisch model dat schat wat de kosten van een efficiënt netwerk bedragen (dit in tegenstelling tot benchmarkregulering, waarbij de maximumprijs bepaald wordt op basis van de kosten van andere warmtenetten)
8	*Rate-of-return* regulering	Warmtebedrijven stellen prijzen met de beperking dat de toezichthouder een maximum rendementsmarge bepaalt.
9	Netwerk-specifieke regulering op basis van prikkels	Warmtebedrijven stellen *outputs* (bijvoorbeeld klanttevredenheidsscores) en prikkels tot kostenreducties voor als onderdeel van een businessplan. In combinatie met dit businessplan wordt het prijsplafond vastgesteld op basis van de efficiënte kosten van het warmtenet. Dit resulteert in een prijsplafond per netwerk op basis van netwerk-specifieke kosten

Bron: Oxera.

Om tot een short list van opties te komen, wordt elke optie beoordeeld in het licht van de eerder besproken beleidsdoelstellingen.

Box 1.1 Onafhankelijke warmtetransportbeheerders

Zoals eerder besproken zijn warmtebedrijven en -netten doorgaans verticaal geïntegreerd. Echter zal de warmtemarkt vermoedelijk ook enkele onafhankelijke warmtetransportbeheerders kennen. Een voorbeeld van een dergelijk onafhankelijk warmtenet is de geplande pijpleiding van Gasunie in Zuid-Holland. Gezien er naar verwachting slechts enkele van dergelijke netwerken zullen zijn, is er een apart regime nodig om deze bedrijven te reguleren. Het is namelijk onwaarschijnlijk dat er voldoende onafhankelijke warmtetransportbeheerders zijn om deze met elkaar te vergelijken. Bepaalde elementen van de kostenstructuren van deze netwerken zijn eventueel te vergelijken met die van warmtenetten. Het ontwerp van een reguleringsmethodiek voor deze onafhankelijke warmtetransportbeheerders valt buiten de focus van deze studie. De reguleringsopties die worden besproken in dit hoofdstuk en de rest van het rapport hebben betrekking op warmtenetten zoals deze eerder zijn gedefinieerd.

De eerste vier opties worden niet meegenomen in de short list, omdat deze overcompensatie van warmtebedrijven niet voldoende tegengaan en warmtebedrijven geen prikkels geven om consumenten te laten profiteren van efficiëntieverbeteringen.

Bij de eerste twee opties is dit omdat de toezichthouder geen directe invloed heeft op de tarieven van warmtebedrijven. Nadat warmtebedrijven zijn aangewezen (aanwijzingen zijn in principe voor altijd), zijn het lokale monopolies die waarschijnlijk niet geconfronteerd worden met effectieve concurrentie. Mogelijk bieden alternatieve warmtevoorzieningen enige vorm van concurrentie, maar deze concurrentie is hoogstwaarschijnlijk niet sterk genoeg om als bescherming voor consumenten te dienen, gezien de kosten die gepaard gaan met het overstappen naar een alternatieve warmtevoorziening en de beperkte aanwezigheid van dergelijke alternatieven op de Nederlandse markt.[10]

Er kan niet verwacht worden dat de voordelen van concurrentie die mogelijk ontstaan gedurende de aanwijzingsprocedure (concurrentie *voor* de markt) op de lange termijn van kracht blijven. Dit is ook het geval indien de projectontwikkelaar, gemeente en het aangewezen warmtebedrijf een langetermijncontract van bijvoorbeeld voor 10 of 20 jaar afsluiten. Een dergelijk contract zal flexibel moeten zijn om de risico's voor warmtebedrijven te mitigeren. Omdat het zeer lastig (dan niet onmogelijk) is om een contract op te stellen dat rekening houdt met alle mogelijke scenario's over een periode van 10 of 20 jaar, zal het contract in kwestie waarschijnlijk ruimte bieden voor aanpassingen aan onvoorziene ontwikkelingen. Ten tijde van deze heronderhandelingen is er één aangewezen warmtebedrijf. Derhalve is het niet mogelijk om te vertrouwen op concurrentie *voor* de markt om consumenten op de lange termijn te beschermen.

Dus: als gevolg van een gebrek aan concurrentie *op* en *voor* (in ieder geval op lange termijn) de relevante markt is een zekere mate van controle vanuit de toezichthouder over de tarieven nodig om overcompensatie en inefficiënte investeringsniveaus te voorkomen–wat kan duiden op zowel onvoldoende als onnodige investeringen (ook wel aangeduid als 'gold plating').

Bovendien is een hoge mate van vertrouwen van consumenten, gemeenten en toeleveranciers in het reguleringskader nodig. Het is onwaarschijnlijk dat *ex post* regulering dergelijk vertrouwen biedt.

De derde en vierde optie reflecteren de kosten van warmtebedrijven niet goed, waardoor deze het voorkomen van overcompensatie en een gewenst investeringsklimaat niet garanderen. De herziene gasreferentieprijs blijft een

[10] SiRM (2019), 'Tariefregulering warmtebedrijven voor kleingebruikers', pp. 11 and 44.

maximumprijs op basis van de kosten van aardgas, terwijl de vierde tariefoptie is gebaseerd op de gemiddelde kosten van alternatieve warmtevoorzieningen.

De zevende optie biedt geen stimulans voor een efficiënte uitbreiding van de warmtenetten, omdat het lastig is om netwerk-specifieke factoren en de onzekere effecten van innovaties op netwerkkosten expliciet mee te nemen in het model.

De achtste optie biedt negatieve prikkels voor kostenefficiëntie, omdat de winstgevendheid van de warmtenetten onder deze optie direct gekoppeld is aan de kosten van het netwerk. De beheerder van het warmtenet heeft daardoor de prikkel om waar mogelijk de kosten te verhogen indien er i) sprake is van een gebrek aan effectieve concurrentie (wat vermoedelijk het geval is) of ii) de gemeente (of andere autoriteiten) niet in staat is kostenefficiëntie te waarborgen door het gebrek aan transparantie op het niveau van het netwerk.

Dit leidt ertoe dat de volgende opties, hernummerd tot opties 1 tot en met 3, de short list vormen.

1.1.1 Kostengebasseerde referentieprijs (short list optie 1)

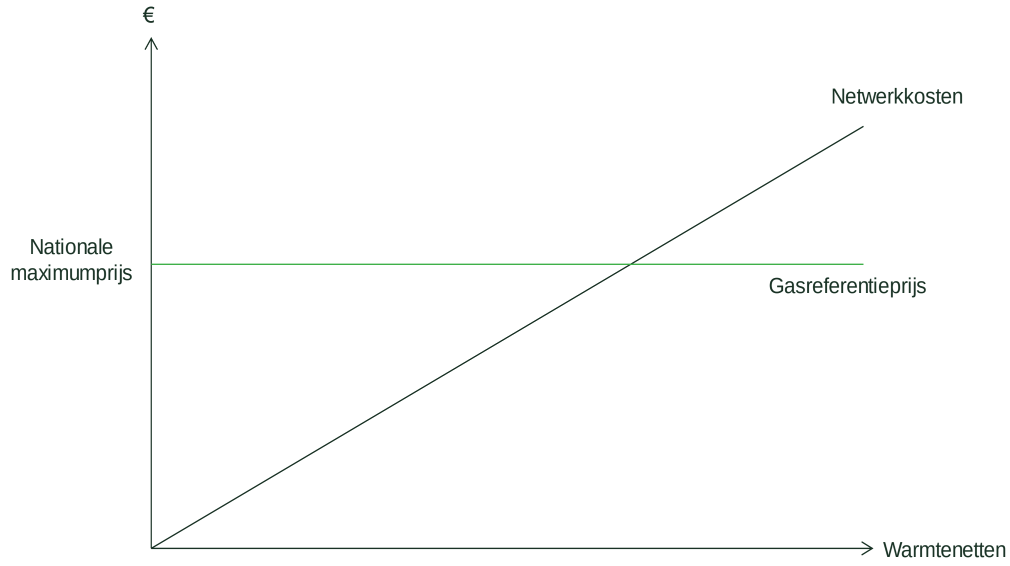
Korte beschrijving

Onder deze optie zouden alle warmtebedrijven onderworpen zijn aan een nationale maximumprijs, berekend op basis van een basisprijs die in de loop der tijd wordt aangepast met een index die de nationale ontwikkeling van de kosten van warmtebedrijven weerspiegelt. Deze methode wijkt af van de gasreferentie, omdat meerdere kostencomponenten van warmtebedrijven in de index kunnen worden opgenomen, zoals de arbeids-, grondstof- en warmtekosten. Optie 1 wordt geïllustreerd in Figuur 1.2: stel dat alle huidige en potentiële warmtenetten in toenemende volgorde van kostenniveaus worden gerangschikt (de ‘netwerkkostenlijn’). Alle warmtenetten links van het snijpunt van de gasreferentieprijs en de netwerkkostenlijn—oftewel, waar de gasreferentieprijs hoger is dan de netwerkkosten—zijn commercieel levensvatbaar.[11]

Figuur 1.2 laat zien dat er—net als in het huidige regime—sprake zou zijn van één nationale prijs.

[11] Subsidies voor netwerken met hogere kosten kunnen ervoor zorgen dat marktpartijen deze alsnog aanleggen.

Figuur 1.2 Illustratie van short list optie 1



Bron: Oxera analyse.

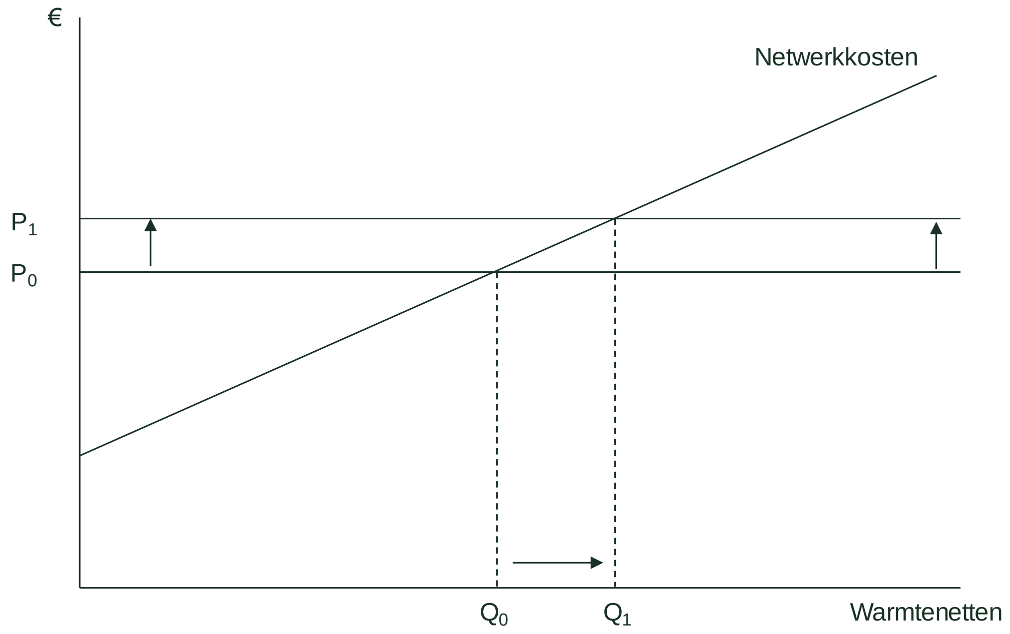
Net als de gasreferentieprijs biedt deze optie warmtebedrijven geen noemenswaardige prikkels om de consument te laten profiteren van eventuele efficiëntieverbeteringen. Warmtebedrijven hebben de prikkel om enkel uit te breiden of te investeren in nieuwe netwerken waar dat commercieel aantrekkelijk is: in netwerken die lage kosten meebrengen (links van het snijpunt van de lijnen).

Er kan rekening gehouden worden met verschillen in warmtebronnen door veranderingen in de kosten van verschillende bronnen mee te nemen in de index.

Het belangrijkste nadeel van deze optie is echter dat er met één nationale prijs geen inzicht verkregen wordt in de kosten van een warmtenet in een lokale regio. Omdat warmtebedrijven hun prijzen momenteel in hoge mate gelijk stellen aan het plafond[12], en we daarom verwachten dat warmtebedrijven dit ook doen onder het prijsplafond van optie 1, is een kostenreflectie van de tarieven nodig om het risico van overcompensatie te verminderen en tegelijkertijd de uitrol van warmtenetten te stimuleren. Dit wordt geïllustreerd door Figuur 1.3.

[12] SiRM (2019), 'Tariefregulering warmtebedrijven voor kleinverbruikers', p. 45.

Figuur 1.3 Uitrol stimuleren met nationale prijzen (gestileerd voorbeeld)



Bron: Oxera analyse.

Wanneer er sprake is van één nationale prijs, moet de prijs voor alle warmtenetten (zowel bestaande als nieuwe) worden verhoogd (van P_0 tot P_1) om de aanleg van nieuwe warmtenetten (of uitbreiding van bestaande netwerken met hogere kosten) economische rendabel te maken (van Q_0 tot Q_1), wat leidt tot overcompensatie van de bestaande warmtenetten. Deze optie dwingt tot een afruil tussen het voorkomen van overcompensatie en het stimuleren van de uitrol van nieuwe netwerken. **Deze twee doelen kunnen enkel tegelijkertijd verwezenlijkt worden met kosten reflecterende tarieven die van warmtenet tot warmtenet verschillen**.[13]

Administratieve lasten

Deze optie zou zowel voor de ACM als de warmtebedrijven relatief weinig administratieve lasten met zich meebrengen. De ACM zou verantwoordelijk zijn voor het verzamelen van de door de warmtebedrijven gerapporteerde data (die overeenkomstig met de door de ACM vastgestelde accounting voorschriften worden verstrekt) en het analyseren van die gegevens om de index bij te werken. De ACM publiceert vervolgens de index, naar aanleiding waarvan de warmtebedrijven hun tarieven kunnen herzien.

1.1.2 Benchmarkregulering (short list optie 2)

Korte beschrijving

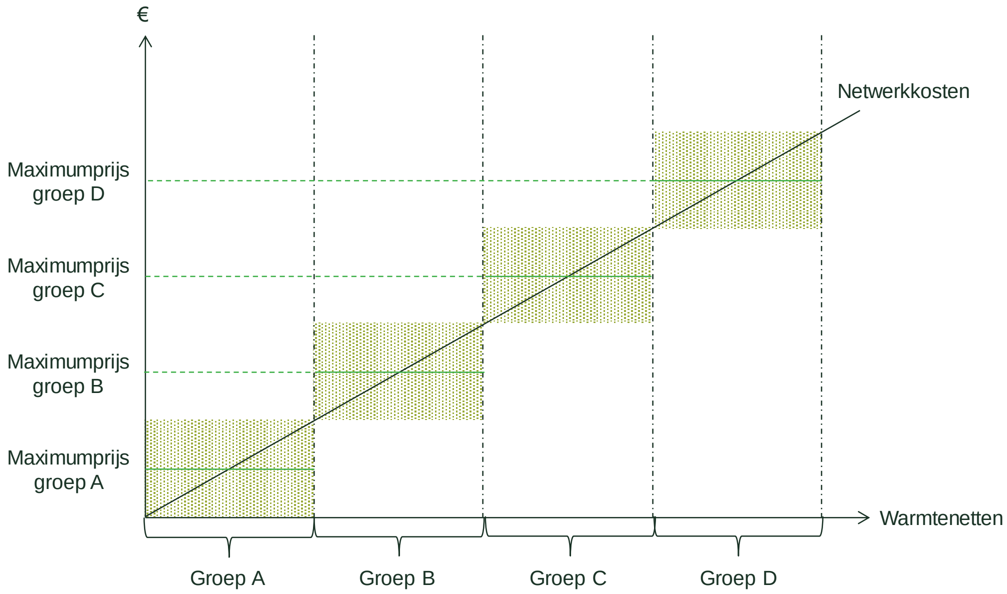
De tarieven die warmtebedrijven mogen in rekening mogen brengen is gemaximeerd door een benchmark, die wordt vastgesteld aan de hand van de kosten per warmtenet van alle Nederlandse warmtebedrijven. De toezichthouder rangschikt alle netwerken op basis van kosten en stelt de benchmark vervolgens vast na een analyse van de kosten plus een redelijk

[13] Men zou één nationale prijs kunnen handhaven en de uitrol van nieuwe netwerken tegelijkertijd kunnen stimuleren door een subsidie te verlenen aan de warmtenetten waarvan de kosten de nationale prijs overstijgen. Binnen dit systeem kan overcompensatie van een netwerk echter alleen worden voorkomen door de nationale prijs gelijk te stellen aan de kosten van het netwerk met de laagste kosten.

rendement. Aangezien warmtenetten sterk kunnen verschillen in bijvoorbeeld de schaalgrootte van het netwerk, warmtebronnen en dichtheid van aansluitingen, moeten de toegestane tarieven worden aangepast aan deze verschillen. Uiteraard werkt deze methode niet wanneer de verschillen in karakteristieken van de warmtenetten (zowel fysiek als in servicekwaliteit) niet gevangen kunnen worden middels de benchmark analyse. Echter verwachten wij dat het aantal netten en datapunten voldoende is om een dergelijke exercitie robuust uit te voeren–met name gezien de verwachte toename in het aantal warmtenetten.[14]

Optie 2 wordt geïllustreerd in Figuur 1.4.

Figuur 1.4 Illustratie van short list optie 2



Opmerking: in de figuur worden vier groepen weergeven. Dit is enkel ter illustratie: het exacte aantal groepen zal bepaald worden gedurende de benchmarkanalyse en ligt waarschijnlijk een stuk hoger gegeven de heterogeniteit die warmtenetten kenmerkt.

Bron: Oxera analyse.

Zoals de bovenstaande figuur illustreert, werkt de benchmarkingmethode in essentie als volgt. Verschillende warmtenetten worden in verschillende groepen ingedeeld, op basis van de kostkarakteristieken en *outputs*. Vervolgens wordt voor elk van deze groepen een aparte maximumprijs vastgesteld. Het bepalen van het aantal en de compositie van deze groepen, alsmede de praktische uitwerking van de benchmarkmethodiek vereisen verder analyse en vallen buiten de focus van deze studie. De voorgestelde rol van de ACM in deze analyse en het regulatorische proces wordt in detail besproken in hoofdstuk 6.2.

Deze optie biedt warmtebedrijven een voortdurende prikkel om de efficiëntie van hun netwerk(en) te vergoten.[15] Het ‘verslaan’ van de benchmark (bijvoorbeeld door bovengemiddeld kostenefficiënt te zijn) zou namelijk

[14] Deze optie vergt onder andere dat de ACM wettelijke regulatorische accounting kaders opstelt, welke het mogelijk maken om de data van warmtenetten te verkrijgen die nodig is om de benchmarkanalyse consistent en gestandaardiseerd uit te voeren. De praktische aspecten van deze optie worden in detail besproken in hoofdstuk 1.3.

[15] In principe hebben warmtebedrijven onder optie 1 en het huidige reguleringsregime een sterke prikkel tot efficiëntieverbeteringen omdat dit zich vertaalt in hogere winsten voor het warmtebedrijf. In de praktijk varieert de mate waarin deze prikkel aanwezig is sterk binnen de sector als gevolg van de verschillen in eigendomsstructuren en omvang van warmtebedrijven.

resulteren in hogere winsten. De benchmark wordt echter elke prijscontroleperiode herzien, waardoor de efficiëntieverbeteringen gedurende deze iedere periode een drukkend effect hebben op de benchmark. Prikkels om netwerken uit te breiden of in nieuwe netten te investeren worden geïntroduceerd doordat de karakteristieken van een warmtenet vertaald worden in de benchmarkprijs/toegestane kosten. Als een expansie van een netwerk leidt tot een verandering in de kenmerken van dat netwerk, wordt hier rekening mee gehouden door een verandering in de benchmarkprijs: bijvoorbeeld door een verschuiving van ‘Groep A’ naar ‘Groep B’. Verschillen in warmtebronnen kunnen op eenzelfde wijze vertaald worden in de benchmarkprijs door deze mee te nemen in de indeling van de groepen.

Daarnaast vermindert deze optie het risico op overcompensatie aanzienlijk, omdat de prijzen op het niveau van het warmtenet worden vastgesteld en de concurrentie tussen de warmtenetten om de benchmark te ‘verslaan’ er op termijn toe leiden dat de efficiënte kosten van die netwerken duidelijk wordt. De hoge mate van kostenreflectie in de netwerktarieven die deze optie met zich meebrengt, zou ook de kostenrisico’s die warmtebedrijven in het huidige reguleringsregime dragen verminderen. Deze risicoreductie zou investeringen in netwerkuitbreidingen of nieuwe warmtenetten aantrekkelijker maken, en neemt de noodzaak voor een ongereguleerde BAK weg, aangezien de efficiënte kosten van het netwerk meegenomen worden in de benchmarkprijs.

Kostenreflecterende prijzen op niveau van het warmtenet zullen resulteren in landelijke prijsvariaties. De mate waarin deze variaties ontstaan hangt af van of er subsidies (of kruissubsidies van netten met lage kosten) worden verleend aan netten met hoge kosten en de hoeveelheid netwerken met hoge kosten worden aangelegd. Ongewenst hoge prijsniveaus of prijsverschillen kunnen gemitigeerd worden door de introductie van subsidies (of kruissubsidies) voor netwerken met hoge kosten.

Gemeenten zullen een grote rol krijgen in het bepalen van warmtekavels en het aanwijzen van een warmtebedrijf per kavel. De benchmarkingmethodiek houdt echter rekening met productkwaliteit. Hierdoor is er ruimte voor concurrentie waarbij verschillende warmtebedrijven ‘prijs versus kwaliteit’ anders tegen elkaar afwegen.

Administratieve lasten

Deze optie vereist dat de ACM de wettelijke accounting vereisten specificeert, een benchmarkingmethode ontwikkelt, deze handhaaft en toepast om het toegestane kostenniveau per netwerk te bepalen en het toegestane rendement vast te stellen. Warmtebedrijven zouden gedetailleerde data moeten verstrekken en zich aan moeten passen aan een breder scala aan technische analyses van de ACM dan in het verleden het geval was. Vanwege de resulterende administratieve lasten zouden de kleinste warmtenetten redelijkerwijs vrijgesteld kunnen worden van dit regime (‘de minimis’ in termen van schaalgrootte).[16] Een toename van de administratieve lasten zou als proportioneel kunnen worden beschouwd indien dit leidt tot significante

[16] Voorbeelden van de criteria voor het bepalen van de minimis zijn netwerken met één warmtebron of netten die minder dan 50 gebouwen voorzien. Een netwerk dat voor deze uitzondering in aanmerking komt kan gevraagd worden om 1) een gesimplificeerde regulatorische boekhoudingen te deponeren, 2) zich te committeren aan een gedragscode en 3) de contactdetails van de ACM met consumenten te delen, zodat deze klachten in kunnen dienen. De dreiging van regulering is vermoedelijk voldoende om het risico op overcompensatie voor deze zeer kleine netwerken te mitigeren. Uiteraard bestaat er een hoge mate van vrijheid voor EZK en ACM om deze uitzondering vorm te geven.

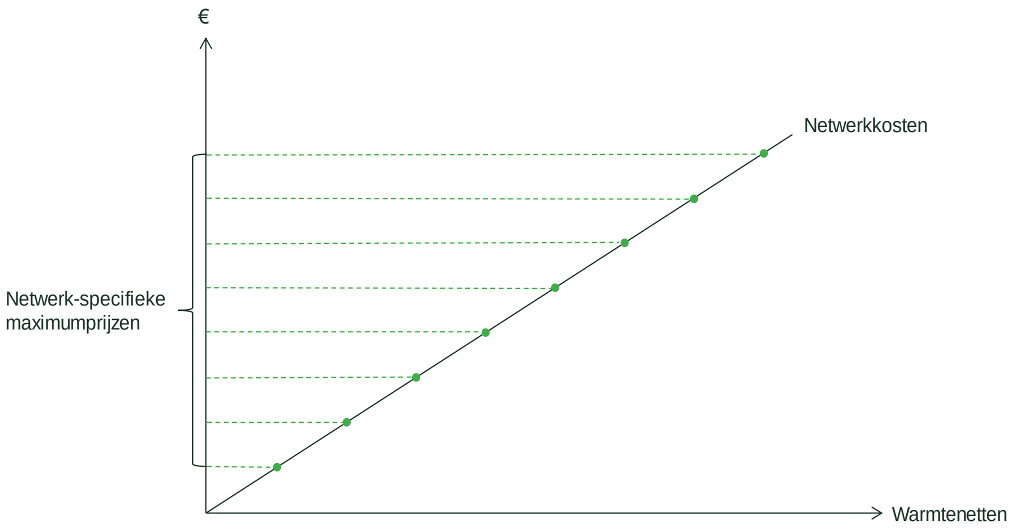
economische of maatschappelijke voordelen. De administratieve lasten onder deze optie zijn hoger dan die van optie 1, maar lager dan die van optie 3.

1.1.3 Netwerk-specifieke regulering op basis van prikkels (short list optie 3)

Korte beschrijving

Onder deze optie zou een maximumprijs tot stand gebracht worden op basis van twee beginselen: ten eerste wordt het efficiënte kostenniveau van het warmtenet weerspiegelt; ten tweede wordt het warmtenet gestimuleerd om extra output te leveren die aansluit bij de beleidsdoelstellingen. Deze beleidsdoelstellingen kunnen onder meer betrekking hebben op het accommoderen van CO2-arme warmtebronnen, het mogelijk maken van nieuwe aansluitingen die voorheen werden vermeden door warmteleveranciers, netwerkintegratie, sectorkoppeling, etc. Optie 3 wordt geïllustreerd in Figuur 1.5.

Figuur 1.5 Illustratie van short list optie 3



Bron: Oxera analyse.

Deze optie biedt een aantal belangrijke voordelen. Ten eerste worden, net als bij optie 2, efficiëntieprikkels geboden door regelmatige benchmarking van kosten. Ten tweede is het risico op overcompensatie laag, aangezien de prijzen rechtstreeks gerelateerd zijn aan de kosten plus een passend, naar risico gewogen rendement. Ten derde wordt het aantrekken van financiering voor extra investeringen mogelijk gemaakt door de gereguleerde activabasis (RAB)[17] te vergoeden via tarieven voor toekomstige afnemers.

Een hogere mate van vertrouwen in de mogelijkheid om kosten terug te verdienen maakt de uitbreiding van bestaande netwerken en de ontwikkeling van nieuwe warmtenetten mogelijk. Net als onder optie 2 kan dit leiden tot substantiële verschillen in tarieven tussen warmtenetten. De mate van tariefvariatie hangt af van hoeveel netwerken met relatief hoge kosten ontwikkeld worden en in hoeverre er subsidies (of kruissubsidies van netten met lagere kosten) aanwezig zijn. Net als onder optie 2 wordt er middels het benchmarking proces rekening gehouden met kostenverschillen die voortkomen uit het gebruik van verschillende bronnen.

[17] De totale waarde van de activa waarop het bedrijf dat het warmtenet bezit een rendement mag behalen.

Administratieve lasten

Dit alternatief brengt hoge administratieve lasten met zich mee (hoger dan onder opties 1 en 2). Onder deze optie wordt voor elk warmtenet een prijs vastgesteld op basis van de efficiënte kosten voor levering van het netwerk. Net als in andere netwerkindustrieën worden investeringen in infrastructuur vergoed middels een RAB, waarover een toegestaan rendement wordt verdiend. De toegestane inkomsten voor een warmtenet zijn gelijk aan de som van de exploitatiekosten, de afschrijvingskosten en een rendement op de RAB, onderhevig aan een vaststelling van het efficiënte kostenniveau. Echter zou zelfs een forse toename in administratieve lasten als proportioneel kunnen worden beschouwd indien het regime substantiële voordelen met zich meebrengt.

1.2 Verwachte impact van de opties in de short list

1.2.1 Aanpak

We hebben de drie opties in de short list vergeleken met een basisscenario (van de herziene gasreferentieprijs zoals deze sinds 1 januari 2020 geldt) ter ondersteuning van onze aanbeveling voor een reguleringsregime.[18]

Het is belangrijk om in ogenschouw te nemen dat de *impact assessment* niet als doel heeft om toekomstige prijzen of netwerkkostontwikkelingen te voorspellen. De impact assessment biedt een vergelijking tussen de drie opties in de short list en het basisscenario. Lezers dienen zich daarom te focussen of de relatieve uitkomsten in plaats van absolute getallen.

1.2.2 Vergelijking van de opties

De belangrijkste resultaten van de *impact assessment* zijn samengevat in Tabel 1.2.[19] Er is een afweging tussen administratieve lasten enerzijds en lage netwerkkosten en een verminderd risico op overcompensatie anderzijds.

Tabel 1.2 Samenvatting van de resultaten van de impact assessment in 2040

	Basis-scenario	Optie 1	Optie 2	Optie 3
Resultaten				
Gemiddelde prijs per aangesloten huishouden (€/jaar)[1]	1.331	1.296	610	600
Risico op overcompensatie[2]	Hoog	Medium-hoog	Laag	Laag
Administratieve lasten[3]	Laag	Laag-medium	Medium-hoog	Hoog

Opmerkingen: [1] Kwantitatieve resultaten zijn gespecificeerd voor 2040 in 2010 prijzen. Prijzen in rekening gebracht aan huishoudens zijn gebaseerd op de gemiddelde opbrengsten per

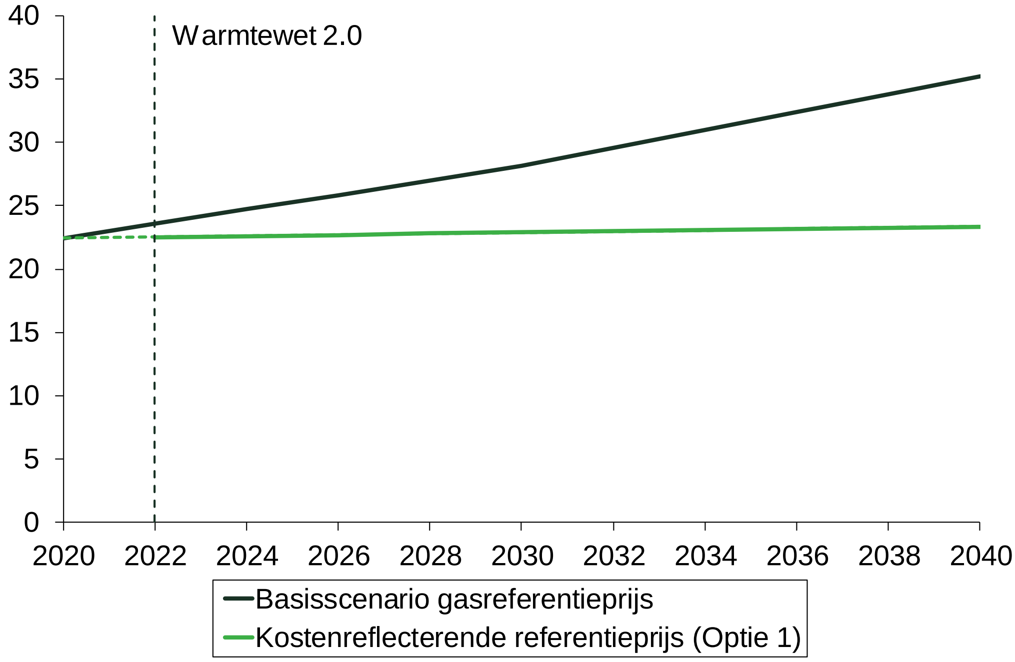
[18] Voor het kwantitatieve deel van de impact assessment is het ruimtelijk energiemodel Vesta (Vesta) gebruikt om de verschillende opties en een basisscenario te simuleren. Vesta is een ruimtelijk technisch-economisch model, ontwikkeld door het Planbureau voor de Leefomgeving (PBL). Zie hoofdstuk 7 voor een gedetailleerde uitleg over hoe we het Vesta-model hebben aangepast, de assumpties die we hebben gemaakt en een overzicht van de resultaten.
[19] Het reguleringsregime moet de vermindering van de CO2-uitstoot stimuleren. Aangezien deze doelstelling echter die niet één op één en enkel middels de gekozen tariefregulering bereikt wordt, is de vermindering van CO2-uitstoot niet in de impact assessment opgenomen. Daarnaast worden in dit rapport de doelstellingen voor de uitrol van warmtenetten uit het Klimaatakkoord, en niet de doelstellingen voor emissiereducties gebruikt als een referentiepunt. Zie Appendix A7 en A8 voor een uitgebreidere behandeling van emissiereducties.

eindgebruiker. Alle prijzen zijn berekend voor een scenario waarin er precies genoeg warmtenetten zijn om de doelstelling uit het Klimaatakkoord dat 2 miljoen bestaande huishoudens een warmtenet als warmtevoorziening gebruiken, waarbij de goedkoopste netten eerst gebouwd worden. Voor opties 2 en 3 nemen we aan dat er geen sprake is van overcompensatie (zie Table 7.5 voor meer uitleg). [2] In meer detail besproken in hoofdstuk 7.2.4. [3] In meer detail besproken in hoofdstuk 7.3.

Bron: Oxera analyse, met behulp van het Vesta-model.

Het belangrijkste voordeel van optie 1 is de relatief lage administratieve kosten. De kostengebasseerde referentieprijs voor optie 1 zou vermoedelijk minder snel stijgen dan de gasreferentieprijs in het basisscenario, omdat de verhogingen van de energiebelasting op gas onder optie 1 niet meer mee worden genomen in de referentieprijs (zie Figuur 1.6). Er zijn onder optie 1 echter geen prikkels voor bedrijven tot het doorberekenen van efficiëntiewinsten aan consumenten om de beleidsdoelstelling van EZK te behalen en, tegelijkertijd, te garanderen dat met één nationale prijs overcompensatie van warmtebedrijven wordt voorkomen. Deze factoren maken dat optie 1 geen geschikte oplossing voor de lange termijn is. Het is echter een verbetering ten opzichte van de herziene gasreferentieprijs.

Figuur 1.6 Referentieprijs in het basisscenario en optie 1 (€/GJ[1])



Opmerking: Exclusief BTW en BAK. [1] GJ staat voor gigajoule.

Bron: Oxera.

De resultaten van onze impact assessment suggereren dat, onder opties 2 en 3, in vergelijking met het basisscenario en optie 1, de in het Klimaatakkoord nagestreefde hoeveelheid warmtenetconnecties behaald kunnen worden tegen lagere gemiddelde prijzen voor huishoudens en ruwweg dezelfde netwerkkosten[20]. Hiervoor zijn de volgende verklaringen:

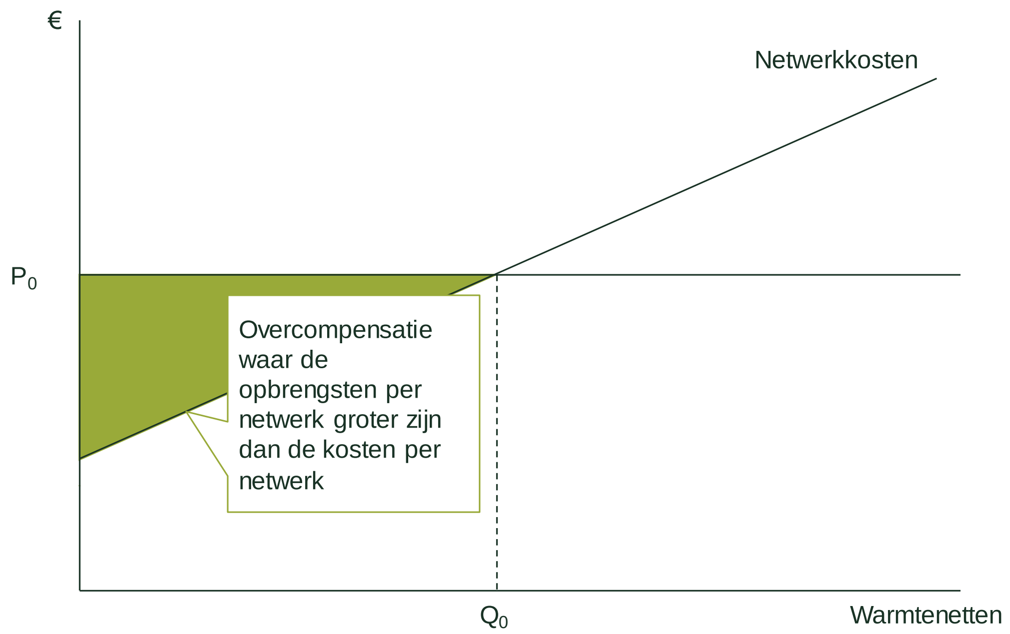
- onder opties 2 en 3 verwachten we dat de kostenefficiëntie van de warmtenetten hoger zal zijn en het vereiste rendement lager (omdat warmtebedrijven minder risico dragen);

[20] Netwerkkosten omvatten investerings- en exploitatiekosten.

- onder de opties 2 en 3 maken de netwerk-specifieke tarieven het mogelijk dat de prijzen lager zijn voor warmtenetten met lagere kosten en hoger voor warmtenetten met hogere kosten.

Samengevat kunnen opties 2 en 3 overcompensatie voorkomen en een toename van het gebruik van warmtenetten mogelijk maken door de kosten en opbrengsten van warmtenetten beter op elkaar aan te laten sluiten (zie Figuur 1.7) Zoals geïllustreerd in de figuur: in het basisscenario of optie 1 zullen sommige warmtenetten (met lagere kosten) inkomsten ontvangen die hun kosten (inclusief een redelijk rendement) overstijgen als de beheerders van deze netten de prijs gelijkstellen aan het plafond (de referentieprijs). Dit wordt weergegeven door de groene driehoek. Onder opties 2 en 3 is een dergelijke overcompensatie een stuk minder waarschijnlijk, omdat de maximumtarieven per warmtenet een nauwkeurigere afspiegeling zijn van de netwerkkosten. Deze verbeterde koppeling van kosten en opbrengsten verkleint daarnaast het risico dat de exploitanten van warmtenetten hun kosten niet terug kunnen verdienen in het geval van een negatieve kostenschok.

Figuur 1.7 Het voorkomen van overcompensatie onder opties 2 en 3 (illustratief)



Opmerking: Een 'redelijk rendement' voor de warmtebedrijven is verwerkt in de lijn die de netwerkkosten weergeeft. De groene driehoek bestaat derhalve uitsluitend uit overcompensatie.

Bron: Oxera analyse.

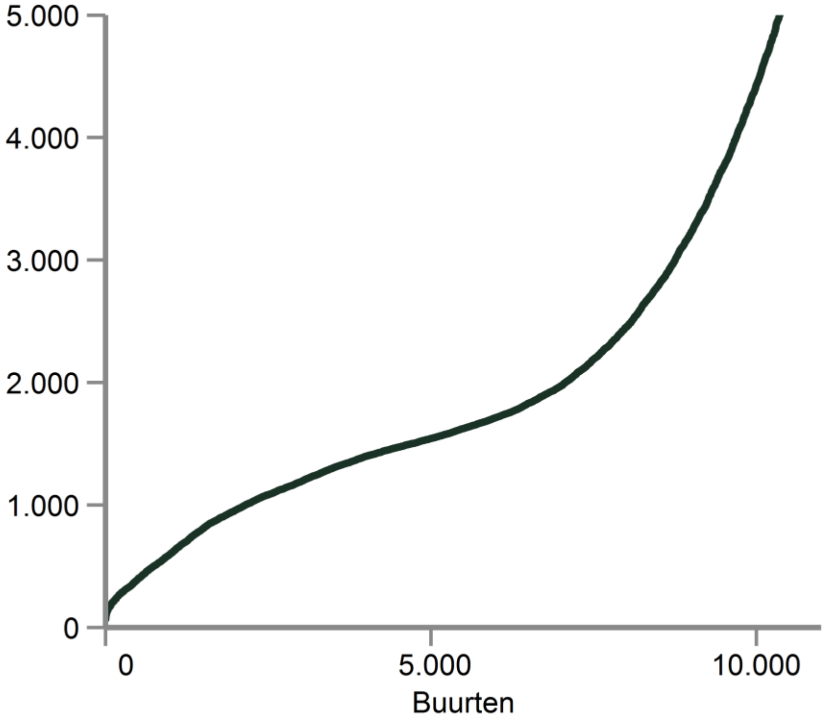
Wel neemt de variatie in prijzen die in rekening worden gebracht aan consumenten mogelijk toe (zowel over tijd als tussen warmtenetten) wanneer de tarieven een betere afspiegeling zijn van de kosten. In het basisscenario en optie 1 geldt landelijk dezelfde prijs, wat betekent dat er weinig tot geen variatie in prijs is tussen de gebruikers.[21] Zoals Figuur 1.8 laat zien, verschillen de kosten sterk per wijk, zowel bij optie 2 als bij optie 3, tussen de wijken.[22]

[21] Behalve mogelijk voor grootverbruikers.
[22] De figuur toont de variatie in de gemiddelde netwerkkosten per aansluiting, berekend op buurtniveau. Het is ons bekend dat warmtekavels niet noodzakelijkerwijs op buurtniveau zullen worden gedefinieerd en dat de omvang per kavel kan verschillen. De kostenverschillen tussen warmtekavels zijn echter vooral te wijten aan fundamentele geografische verschillen. Het is dan ook onwaarschijnlijk dat de variatie in kosten aanzienlijk zullen veranderen als gevolg van een verandering in de grootte van de warmtekavels.

Onder optie 3 worden de consumentenprijzen voor elk netwerk afzonderlijk gespecificeerd, terwijl deze onder optie 2 gelijk kunnen zijn voor een groep aan warmtenetten. In vergelijking met optie 2 is de variabiliteit van de prijzen voor de consument dan ook groter dan onder optie 3.

De kwestie van de prijsverschillen tussen huishoudens is ook aan de orde gesteld tijdens de stakeholdermeeting over de Warmtewet 2.0 op 3 oktober 2019. Zoals besproken kunnen ongewenste prijsverschillen worden voorkomen doormiddel van socialisatie, bijvoorbeeld in de vorm van (kruis)subsidies voor bepaalde groepen huishoudens.[23]

Figuur 1.8 Variatie van de gemiddelde netwerkkosten per aansluiting, berekend op buurtniveau (€/jaar)



Opmerking: De figuur representeert de totale netwerkkosten–de kosten van de warmtebron inbegrepen–voor één aansluiting, berekend op buurtniveau.

Bron: Oxera analyse, met behulp van het Vesta-model.

1.3 De meest geschikte tariefreguleringsmethodiek

De keuze voor een aanbevolen methode van tariefregulering gaat gepaard met een weging van verschillende aspecten van het reguleringsregime. Verschillende partijen kunnen hierbij tot verschillende conclusies komen. Op basis van de informatie waarover Oxera beschikt, concluderen we dat optie 2 op lange termijn de meest geschikte manier van tariefregulering is, omdat deze optie overcompensatie kan voorkomen en tegelijkertijd een toename in het gebruik van warmtenetten mogelijk maakt; optie 1 doet dit niet. Ook zijn de efficiëntieprikkels onder optie 2 groter dan onder optie 1. Optie 2 brengt deze voordelen met zich mee tegen lagere administratieve lasten (zowel voorafgaand aan de invoering van het regime als wanneer het regime volledig geïmplementeerd is) in vergelijking met optie 3.

[23] De exacte uitwerking van een socialisatiemethodiek valt buiten de reikwijdte van deze studie.

De invoering van kostenreflecterende prijsplafonds zoals onder optie 2 zou een grote verandering betekenen voor de warmtemarkt, en zou een aanzienlijke verandering in de processen en kennis van warmtebedrijven en de ACM vereisen. De voordelen van een dergelijke verandering—het mogelijk maken van een toename in het gebruik van warmtenetten en het voorkomen van overcompensatie—zullen naar verwachting echter aanzienlijk groter zijn dan deze kosten. Een dergelijke wijziging dient over een langere periode, zoals 5-10 jaar, te worden doorgevoerd. De aanbevolen overgangsperiode zou er als volgt uit kunnen zien.

Op korte termijn zou de referentieprijs voor gas op nationaal niveau meer kostenreflecterend kunnen worden gemaakt. Tegelijkertijd kunnen de belangrijkste bouwstenen die nodig zijn voor kostengebasseerde regulering op netwerkniveau geleidelijk worden geïmplementeerd. Deze bouwstenen omvatten:

1. het formuleren van de benodigde boekhoudkundige vereisten;
2. het ontwerpen van de benchmarkmethodologie die zal worden toegepast (bijvoorbeeld welke warmtenetten moeten worden opgenomen en hoe de verschillen in kenmerken tussen de netwerken moeten worden gecontroleerd) om het toegestane kostenniveau per netwerk te bepalen;
3. het bepalen van de aanpak om het toegestane rendement te bepalen dat de bedrijven mogen verdienen.

Deze bouwstenen kunnen worden gebruikt om de prijsbenchmark geleidelijk te verfijnen door de index te verfijnen tot optie 2 wordt ingevoerd. Tariefschokken worden voorkomen door de referentieprijs voor gas geleidelijk te vervangen door de benchmarkprijs.

Als gevolg van onzekerheid over hoe het toekomstige reguleringsregime eruit zal komen te zien, bestaat de kans dat investeringen afnemen gedurende de transitieperiode. Om de risico’s voor bedrijven gedurende de transitieperiode te verminderen is het belangrijk dat de exploitanten van warmtenetten duidelijkheid krijgen van EZK en ACM over wat er te gebeuren staat, zodat de warmtebedrijven gedurende deze overgangsperiode blijven investeren. Aan te raden is daarom dat EZK en ACM een duidelijk plan voor het transitieproces opstellen en regelmatig verslag uitbrengen over de voortgang van dit plan aan de stakeholders.

1.4 Andere benodigde beleidsmaatregelen

Naast de beslissing over de methode van tariefregulering dient het wetgevende kader ook ander ondersteunend beleid te omvatten, zoals bijvoorbeeld (in acht nemend dat een deel van deze maatregelen reeds onderdeel is van de Warmtewet 1.0):

- het creëren van prikkels voor warmtebedrijven om duurzame of CO_2-vrije bronnen te ontwikkelen die tevens kostenefficiënter zijn dan de bronnen die ze momenteel gebruiken, of dergelijke warmtebronnen te contracteren;
- het ontwerpen van een regeling om de leveringszekerheid te waarborgen, inclusief een regime om de leveringskwaliteit en robuustheid van het systeem te monitoren en stimuleren;
- de invoering van wettelijke regulatorische accounting kaders;

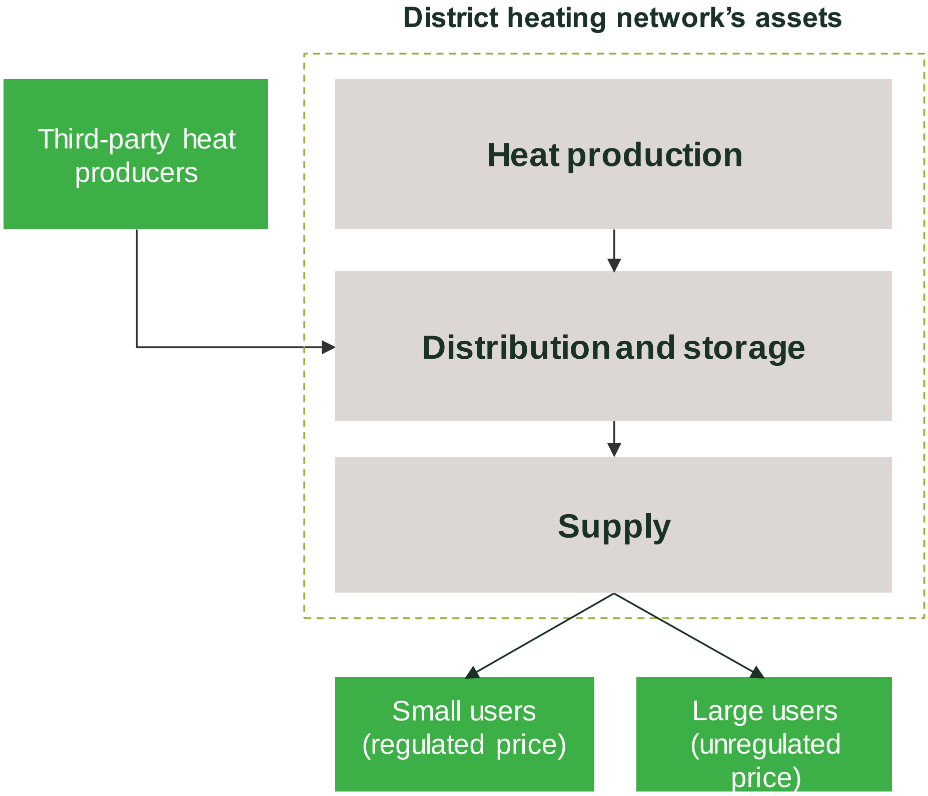
- een regeling ter bescherming van de consument, inclusief een geschillenbeslechtingsprocedure;
- een mechanisme voor de socialisatie van de risico's en de bijbehorende financiering (indien nodig);
- een mechanisme om dure netwerken te (kruis)subsidiëren (indien gewenst).

Deze zaken zijn belangrijk voor het succes van de warmtemarkt, maar vallen buiten de reikwijdte van deze studie. Derhalve worden deze niet in detail geadresseerd.

2 English executive summary

District heating networks (DHNs)[24] supply heat to residential buildings, offices and other premises that require heat. These networks consist of underground circulation pipelines that transport heat in the form of hot water from one or more heat sources—such as boilers and power stations, or industrial facilities that produce heat that would otherwise be wasted—to the buildings that require it. Figure 2.1 illustrates the different stages in the delivery of district heating services.

Figure 2.1 District heat value chain



Source: Oxera analysis.

As DHNs often have a substantial amount of market power, the current Heat Act (in this report referred to as 'Heat Act 1.0') protects small customers (with connections of up to 100kW) that depend on local heating networks.[25] The Heat Act 1.0 regulates the prices (tariffs) paid by small customers by setting a maximum price (price cap) that equals the price that an average household would pay to heat their property with natural gas—this is the 'gas reference price'. However, there are other aspects of the price paid by small customers for their heating that are not regulated, such as the one-off fee known as the

[24] Since district heating networks are usually vertically integrated, our definition of DHNs also includes the sources and supply of heat. Heat and cold storage provided by a ground-coupled heat exchanger (WKO) is included in the definition of district heating in this report.
[25] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, pp. 1–2, 8–9.

'Bijdrage Aansluitkosten' (BAK). A common criticism is that it is often not clear what costs or risks this fee is intended to cover.[26]

The 2019 Climate Agreement sets out goals to reduce CO_2 emissions from the Netherlands by 49% in 2030 and by 95% in 2050 (relative to 1990 emission levels).[27] Decarbonisation of heat supplied to buildings will play an important role in achieving this target as most heat is currently provided by natural gas-fired boilers. The Climate Agreement specifies that 1.5m existing houses should be made sustainable (i.e. not consuming natural gas) by 2030.[28] A substantial growth in the number and scale of DHNs is expected to be required to contribute to this decarbonisation strategy. The Climate Agreement proposes that 80,000 houses should be connected to a DHN per year from 2025 to 2030.[29]

However, the current regulatory framework is not conducive to enabling the expansion of DHNs at reasonable prices for consumers. This is because the Heat Act 1.0 does not provide the regulatory instruments necessary to ensure small customers' heating tariffs are cost reflective. The aim of the gas reference price is to ensure that customers of DHNs do not pay more for heating than natural gas users. By construction, the gas reference price does not reflect the costs of DHNs.

Indeed, the gas reference price is expected to diverge further from DHNs' costs in future since the gas price is expected to increase due to changes in energy taxation. In turn, this would be expected to increase prices charged to small DH customers, potentially increase overcompensation, and disincentivise consumers to switch from natural gas heating to DH.

Finally, a reference price linked to natural gas would increasingly become irrelevant over time if, as the Climate Agreement intends, a reformed DH policy enables widespread adoption of alternatives to heating buildings and premises by means other than natural gas.

To enable the expansion of the DH sector, the Ministerie van Economische Zaken en Klimaat (EZK) is developing a new market design that will be implemented in the forthcoming Heat Act (hereafter referred to as 'Heat Act 2.0'). In particular, this legislation will enable a 'Neighbourhood Orientated Approach' for DH expansion (in which municipalities will have a large role), whereby catchment areas will be delineated and a single District Heating Company (DHC) will be appointed to run the network in each area with an obligation to serve any customer who wishes to be connected to the network in that area.[30] Once appointed, the DHC would be the only provider of DH within that area (although other forms of heat provision will continue to be available).

[26] The BAK often consists of a connection fee and a 'project fee'. As of 1 January 2020, the connection fee is based on actual costs and subject to a regulated fee cap, but there are currently no plans to regulate project fees. As such, while project fees provide a flexible means by which DHNs can recover costs that are not covered by the gas reference price, there is currently no way of ensuring that project fees are reasonable in the sense that they reflect efficient costs and are not excessive.
[27] Rijksoverheid (2019), 'Climate Agreement', p. 19.
[28] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', pp. 16 and 37.
[29] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 37.
[30] Ministry of Economic Affairs and Climate Policy (2019), 'Heat Act 2.0', letter to parliament, p. 4, mentions that the Neighbourhood Oriented Approach will be followed by the new Heat Act. Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', pp. 24–25, sets out what the Neighbourhood Oriented Approach will entail. Ministry of Economic Affairs and Climate Policy (2019), 'Progress of the legislative process regarding Heat Act 2.0', letter to parliament, pp. 3-4 and 10-11, discusses in more detail which consequences of the implementing the Neighbourhood Oriented Approach has for the DH market.

In this context, Oxera Consulting LLP (Oxera) has been appointed to recommend an alternative to the gas reference price for regulating the prices charged to small consumers for DH. The scope of the assignment is therefore limited to price regulation,[31] however, when designing any method of economic regulation it is important to also consider the wider policy context and market design as well as other facets of the regulatory regime, and these are accounted for in Oxera's recommended approach.

In particular, Oxera was asked to address the following questions:

1. What are concrete, suitable and practical alternatives to the gas reference in view of the characteristics of the heat market and the goals of network regulation?
2. What is the expected impact of these alternatives on DH tariffs and the realisation of the objectives of network regulation and the Heat Act 2.0?
3. What is the most suitable method for regulation of DH tariffs for small customers over the short and long term?

We have conducted a stakeholder engagement exercise for this assignment, involving two formal stakeholder workshops. During these workshops, representatives from existing DHCs, potential new entrants, consumer organisations, and municipalities were given the opportunity to comment on Oxera's interim work products. The viewpoints raised in these workshops have been carefully considered and have informed the detailed design of the regulatory options considered.

2.1 Alternatives to the gas reference price

With the new regulatory regime, the EZK is looking to achieve the following key objectives.[32]

- The regulatory regime must ensure that DHCs are not overcompensated relative to the efficient level of costs, and consumers should benefit from any future improvements in efficiency.
- The regulatory regime should ensure that the long-term interests of consumers are protected in terms of the prices they pay and the quality of services provided to them.
- The regulatory regime should ensure that, in expectation, DHCs earn a reasonable rate of return, thereby facilitating security of supply and the expansion of DHNs so that consumers have the opportunity to switch to sustainable heating sources.
- The regulatory regime should provide incentives for innovation, network integration, and sector coupling, thereby enabling improvements in efficiency, quality of service, and decarbonisation of the heat sector over the long term. In particular, the regulatory regime should facilitate DHNs adopting sustainable heat sources where and when these become available.

In addition to these policy objectives, it is necessary that DH gains widespread acceptance from consumers as an attractive long-term solution. During this

[31] This study is focussed on the Dutch DH sector and it has not included a systematic review of DH sectors elsewhere. Where appropriate, Oxera has drawn on its experience of DH sectors in other countries as well as its experience of price regulation in other sectors in the Netherlands and elsewhere.
[32] These objectives are broken down into more detail in the body of the report.

study a number of stakeholders stated that in order for DH to be accepted by existing and future customers it is necessary that DH tariffs are both transparent and not excessively variable (either over time or across networks). There is no general definition of 'excessively variable'. Some stakeholders define excessively variable as 'far below 100%' (which we interpret as the highest price being not more than twice as high as the lowest price). Another critical requirement to achieve consumer acceptance is securing a reasonable level of service quality.

Also, the regulatory regime must be feasible to implement and the administrative burden imposed on the regulatory authority, municipalities, and companies must be reasonable. That is to say that the administrative burden associated with the recommended regulatory regime should be proportionate to the benefits that can be achieved and not excessively high in absolute magnitude.

There are many options for how tariffs can be set, a broad selection of which are outlined below (see Table 2.1). Within each option there is also more than one way for the option to be implemented. Accordingly, this list is not intended to be comprehensive. Instead, it aims to provide a wide range of possible regulatory regimes from which to select a set of three shortlisted options.

Table 2.1 Longlist of alternatives to the gas reference price

Number	Option	Description
1	Free prices and transparency	Tariffs are freely set by DHCs in dialogue with consumers and municipalities/provincial authorities. The role of the regulator is limited to publication of information on profitability levels
2	Free (but scrutinised) prices, transparency and ex post regulation	Tariffs are set by DHCs in dialogue with consumers and municipalities/provincial authorities under scrutiny of the regulator. The regulator can intervene in the market if DHCs are excessively profitable
3	Revised gas reference price	DHCs set prices subject to a maximum price according to a revised gas reference price based on the currently enacted legislation (which is to be implemented by January 2020)
4	Alternative fuels reference price	DHCs set prices subject to a price cap that is set with reference to one or more other fuels or energy sources, such as biomass or electricity but not natural gas
5	DH cost-based reference price	DHCs have a maximum price based on a reference price that is reflective of the actual costs of DHCs at a national level. For example, this could involve removing energy taxes from the gas reference price or escalating tariffs using a DH cost index
6	Comparator-based regulation	Each network has a maximum price established by reference to a benchmark, where that benchmark is determined by the costs of other DHNs. The methodology could allow for adjustments to reflect differences in network characteristics (e.g. scale, density) and heat sources
7	Engineering-economic 'network reference model'	DHNs are allowed to set tariffs that reflect benchmark costs, established using an engineering model the efficient network (this is in contrast to the comparator-based regulation, where the benchmark is determined with reference to other DHNs' costs)
8	Rate of return regulation	DHNs are able to set prices subject to the limitation of maximum rate of return set by the regulator
9	Network-specific, incentive-based regulation	DHNs propose outputs (e.g. customer satisfaction scores) and cost-reduction incentives as part of a business plan. Along with this business plan, the price cap is established based on the efficient costs of the DHN. This results in a price cap per network based on network-specific costs

Source: Oxera.

In order to construct a shortlist of tariff regulation designs, each option is assessed against the key policy objectives outlined above.

Box 2.1 Independent heat transport networks

As discussed, DHNs and DHCs are usually vertically integrated. However, there are likely to be only a few heat transport networks. Gasunie's proposed pipeline in South Holland serves as an example of such an independent heat transport network. Since there are expected to be at most a few of these networks, a separate regulatory regime will be required for them because it is unlikely that there will be enough of them to be benchmarked against each other. However, some elements of their cost structures that are comparable with DHNs might be compared with DHNs. The design of a regulatory regime for these heat networks is out of the scope of this study. The regulatory options discussed in this section and the rest of the report only apply to DHNs as defined earlier.

The first four options are not considered further, because these do not sufficiently prevent overcompensation of DHCs or provide incentives for improvements in efficiency to be shared with consumers.

For the first two options, this is because there is a lack of direct regulatory control over the tariffs set by the DHCs. After DHCs have been designated (designation is expected to last forever), they will be local monopolies and are unlikely to face effective competition. There may be some competition from alternative heat sources, but the extent of this competition seems unlikely to be a sufficient constraint to be relied on to protect consumers given the high upfront costs of introducing an alternative heat supply and the limited market penetration of (affordable) alternative heat sources in the Dutch market.[33] Any benefits of competition that might arise during the process of appointing a DHC (i.e. competition *for* the market) in a given DH catchment area cannot be assumed to last forever. That is the case, even if the municipality, project developer and the appointed DHC sign a long term contract (e.g. 10 or 20 years) because such a contract will either need to be flexible (to mitigate risks to DHCs). As it is very hard (if not impossible) to write a contract that covers all eventualities over a 10 or 20 year time frame, it is likely that the contract will allow adjustments to cover unanticipated developments. At the time of contract renegotiation, there is then only one appointed DHC and therefore it is not possible to rely on competition *for* the market to provide long-term protection to consumers.

Thus, in the absence of effective competitive pressure *in* and *for* (in the long run) the relevant market, some degree of regulatory control over tariffs is necessary to prevent overcompensation and inefficient levels of investment, which could take the form of either insufficient or unnecessary investment (i.e. inefficient over-specification of networks, sometimes referred to as 'gold-plating'.

Moreover, a high degree of trust in the regulatory regime is needed by customers, municipalities, and suppliers alike, and ex post regulation is unlikely to provide this trust. In particular, the third and fourth options would not ensure that DHCs' tariffs reflect their costs and therefore these options would not prevent overcompensation or ensure that a favourable investment climate is achieved. This arises because the revised gas reference price remains a maximum price based on the cost of natural gas, while the fourth tariff option is based on the average costs of alternative heat sources.

As regards the seventh option, this may not provide an incentive for efficient expansion of DHNs due to the challenges of explicitly accounting for network-specific factors and the uncertain effects of innovations on network costs within the reference model.

Also, the eighth option is likely to provide poor incentives for cost efficiency, because the profits of the DHNs are directly linked to the incurred costs of the DHN under this option. As a result, the DHN has the incentive to increase costs where possible if, as seems likely in the absence of further regulatory reform, there is a lack of effective competition or the constraints applied by municipalities or other authorities are unable to ensure cost efficiency due to limited transparency at the DHN level.

The three remaining options, renumbered as options 1 to 3, are as follows.

[33] SiRM (2019), 'Tariefregulering warmtebedrijven voor kleingebruikers', pp. 11 and 44.

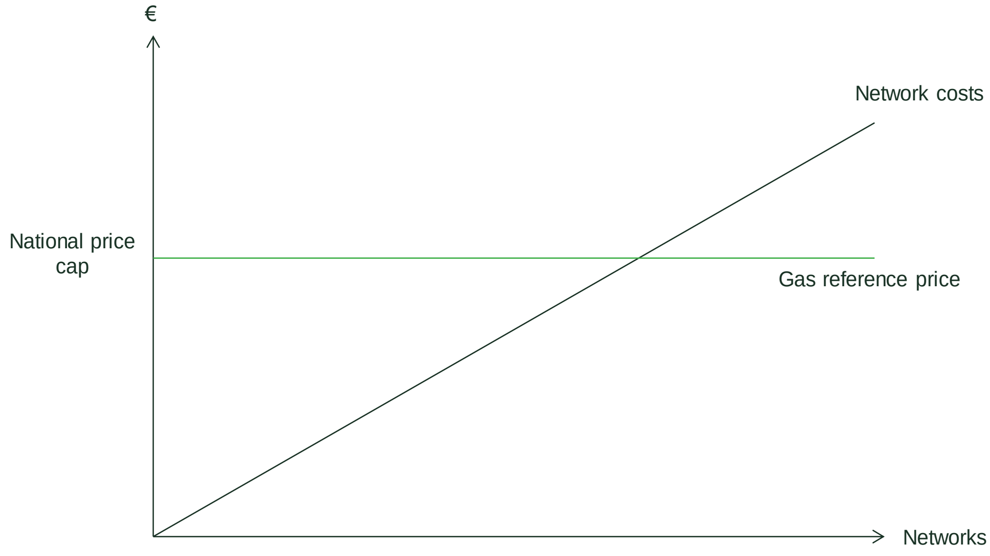
2.1.1 DH cost-based reference price (shortlisted option 1)

Short description

All DHCs would be subject to a national maximum price, calculated with respect to a base price that is increased over time by an index that reflects the national evolution of DHC costs.[34] This differs from the gas reference price because multiple components of DHC costs could be incorporated into the index, e.g. the labour, raw material and heat costs. Option 1 is illustrated in Figure 2.2: imagine that all the actual and potential DHNs are arranged in increasing order of cost (the 'network costs' line). For any given price, a certain number of networks will be commercially viable, to the left of where the 'gas reference line' intersects with the 'network costs' line.[35]

Figure 2.2 shows that there would be a single national price.

Figure 2.2 Illustration of shortlisted option 1



Source: Oxera analysis.

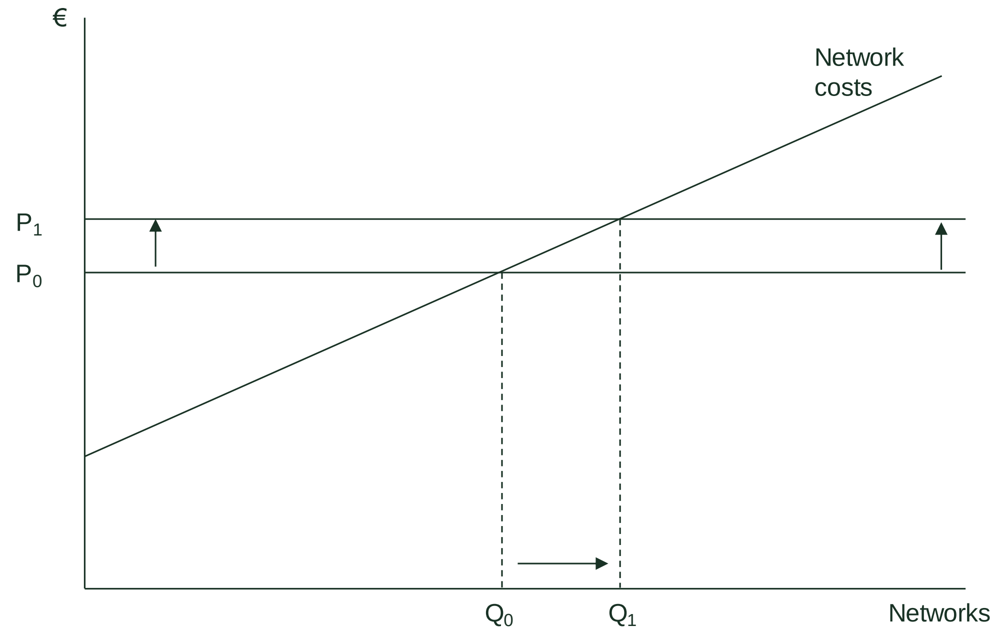
Like the gas reference price, this option does not provide DHCs with significant incentives to pass on any efficiency improvements to consumers. DHCs would have an incentive to expand or invest in new networks where it is commercially appealing to do so, and particularly in lower-cost network areas (to the left of where the lines intersect).

The impact of different heat sources could be captured by including the changes in the costs of the different sources in the cost index.

However, the most significant disadvantage of this option is that a single national price would not reveal the cost of DH in a local region. Because DHCs currently largely price up to the cap,[36] and we therefore expect DHCs to do so with the option 1 price cap, cost-reflectivity of tariffs is needed to reduce the risk of overcompensation and incentivise roll-out simultaneously. Figure 2.3 illustrates this.

[34] The base price could be based on the level of the gas reference price at the time the legislation enters into force for existing properties, or set at the time of connection for new properties.
[35] A subsidy could be made available to the high-cost networks to enable them to be commercially delivered.
[36] SiRM (2019), 'Tariefregulering warmtebedrijven voor kleingebruikers', p. 45.

Figure 2.3 Incentivising roll-out with national prices (stylised example)



Source: Oxera analysis.

Where there is a single national price, for new networks (or expansion of higher-cost existing networks) to become commercially viable (Q_0 to Q_1) the price charged across all networks (new and existing) would need to increase (P_0 to P_1) overcompensating the existing DHNs. Under this option, there would be a trade-off between the prevention of overcompensation and incentivising the roll-out of new networks. **These two aspects can only be aligned with cost-reflective tariffs that vary across networks**.[37]

Administrative burden

This option would impose a relatively low administrative burden on both the ACM and the DHCs. The ACM would be responsible for collating data submitted by the DHCs (provided according to regulatory accounting requirements set by the ACM) and analysing that data to update the index. The ACM would then publish the index and the DHCs would review network prices accordingly.

2.1.2 Comparator-based regulation (shortlisted option 2)

Short description

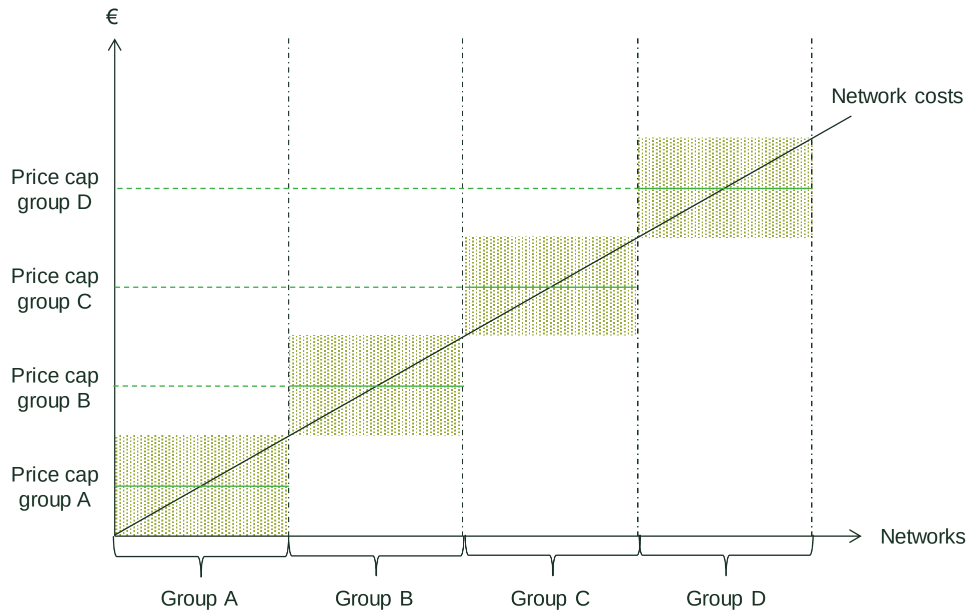
DHCs would be allowed to charge prices up to a benchmark, where this benchmark would be determined with reference to the costs per network of all Dutch DHCs. The regulator would rank the costs and then set the benchmark at an appropriate level following analysis of the costs plus a reasonable rate of return. As DHNs can differ significantly in, for example, network scale, heat generation sources, and density of connections, the allowed charges would need to be adjusted for these differences. Of course, if the benchmarking cannot accurately capture the differences in the DHNs characteristics (either

[37] One could maintain a single national price and incentivise the roll-out of new networks by providing a subsidy to networks that would incur costs higher than the national price. However, within this system, overcompensation of any network could only be prevented by setting the national price equal to the costs of the lowest network.

physical or quality of service) then the model will not work appropriately. However, we expect the number of networks and datapoints to be sufficient to conduct such an exercise robustly—especially given the expected increase in the number of DHNs.[38]

Option 2 is illustrated in Figure 2.4.

Figure 2.4 Illustration of shortlisted option 2



Note: there are four groups presented for illustration only: the precise number of groups will be determined within the benchmarking analysis and are likely to be substantially more given the heterogeneity of the DHNs.

Source: Oxera analysis.

As illustrated in the figure above, the benchmarking effectively functions by putting different DHNs into different groups defined by their cost characteristics and outputs and establishing maximum prices for those networks. Each group has a separate maximum price. Defining the number and composition of these groups and practical workings of the benchmarking methodology will require further detailed analysis and is not within the scope of this study. Please refer to section 6.2 for a detailed description of the proposed role of the ACM in this and the regulatory process.

This option would provide an ongoing incentive for DHCs to increase the efficiency of their network(s),[39] since beating the benchmark (e.g. by being above average in terms of cost efficiency) would result in greater financial performance in the current regulatory period, but this efficiency would be reflected in the benchmark in future price control periods when the benchmark is reset. Incentives to expand or invest in new networks would be provided because the allowed costs that are determined through the benchmarking would reflect the characteristics of the network. Therefore, if expansion of a network results in a change to the characteristics of that network, this would

[38] Among others, this option would require ACM to formulate regulatory accounting requirements, which allows it to gather the data from DHNs needed to conduct the benchmarking analysis in a standardised and consistent manner. The practicalities of implementing this option properly are discussed in section 2.3.
[39] In principle, under option 1 and the current regulatory set-up, the DHCs have strong efficiency incentives because they are able to keep any benefits from efficiency improvements as increased profits. In practice, this incentive is likely to be of varying strength across the sector because of the mix of ownership models and size of DHCs.

also be reflected in the allowed costs—for example, by changing from ‘Group A’ to ‘Group B’. Different heat sources could be reflected in allowed costs in a similar way, i.e. by inclusion in the benchmarking process.

Also, this option significantly reduces the risk of overcompensation because prices would be set at the network level and over time the competition between DHNs to ‘beat’ the benchmark would result in the efficient costs of those networks being revealed. The high degree of cost-reflectivity in network prices that this option imposes would also reduce the cost risks that DHCs currently face. This risk reduction would make investments in network expansions or new networks more attractive, and takes away the need for an unregulated BAK as the efficient costs of the network will be reflected within the allowed costs of the network.

Of course, by making prices reflect costs at the network level, this would result in a variation in prices across the country. The extent of this will depend on whether high-cost networks receive a subsidy (or cross-subsidy from other networks) and how many of the higher-cost networks are developed. Undesirable price differences or unacceptably high prices for certain consumer groups could be avoided by introducing a subsidy (or cross-subsidy from lower cost networks) for high-cost networks.

Municipalities will take a large role in determining DH catchment areas and appointing DHCs to them. However, the benchmarking methodology accounts for product quality. Hence, there is still room for local competition with different DHCs balancing ‘price versus quality’ differently.

Administrative burden

This option would require the ACM to specify regulatory accounting requirements; develop, maintain and apply a benchmarking methodology to determine the allowed level of costs per network; and determine the allowed rate of return. DHCs would need to provide detailed accounting data and engage with a wider range of technical analysis from the ACM than has historically been the case. Because of this administrative burden, it would be reasonable to exempt very small DH networks from the regime (‘the minimis’, in terms of scale).[40] An increase in the regulatory burden could be considered proportionate if it were to lead to material benefits to the economy or society. The administrative burden of this option is higher than that of option 1, but lower than that of option 3.

2.1.3 Network-specific, incentive-based regulation (shortlisted option 3)

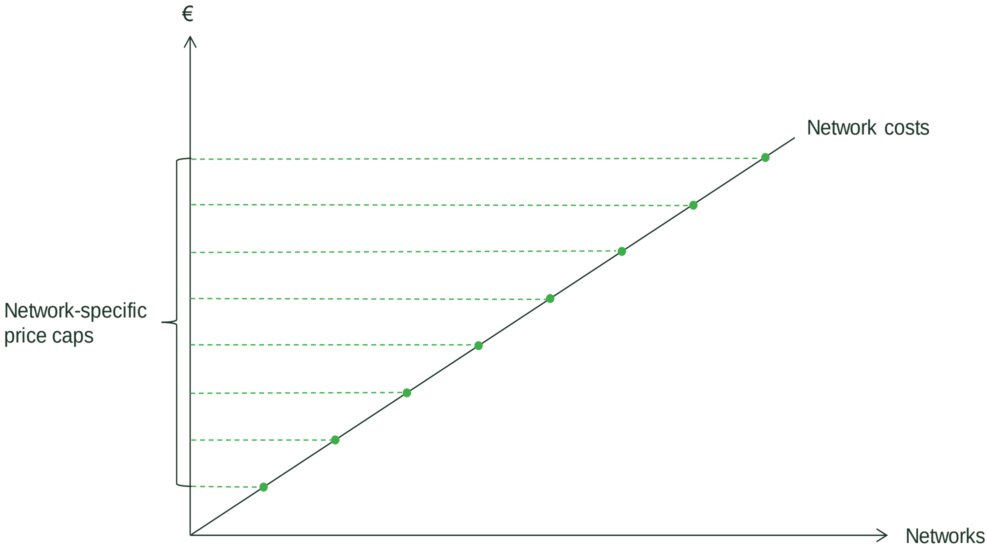
Short description

Network-specific, incentive-based regulation would provide a price on the basis of two principles: first, that it reflects the efficient costs of the DHN; and second, that it provides incentives to the DHN to deliver additional outputs that align with policy objectives. These policy objectives could include accommodating low-grade, low-carbon heat sources, allowing new

[40] Examples of the criteria for defining the minimis might include networks with a single source of heat and serving fewer than 50 properties. A network qualifying for this de minimis exemption might only be required to file a simplified set of regulatory accounts; be a member of a ‘trusted trader’ scheme, requiring the network to sign up to a code of conduct; and publicise the contact details of the ACM for customers to complain to. The threat of regulatory enforcement might be sufficient to mitigate the risks of overcompensation for these very small networks. Of course, there would be substantial discretion available to the EZK and the ACM on the design of this exemption.

connections previously avoided by heat suppliers, network integration, sector coupling, etc. Option 3 is illustrated in Figure 2.5.

Figure 2.5 Illustration of shortlisted option 3



Source: Oxera analysis.

This option would provide a number of important benefits. First, as with option 2, efficiency incentives would be provided through regular benchmarking of expenditure. Second, the risk of overcompensation would be low, as prices would relate directly to expenditure and an appropriate risk-adjusted rate of return. Third, raising financing for incremental investments would be facilitated by the regulated asset base (RAB) being remunerated through charges to future customers.

Expansion of existing networks or development of new networks would be facilitated by increased confidence in cost recovery. As with option 2, this may result in substantial price differentiation across networks depending on how many of the higher-cost networks are developed and the presence or absence of any subsidy (or cross-subsidy from lower-cost networks). As with option 2, the variation in costs arising from the use of different sources of heat would be addressed through the benchmarking process.

Administrative burden

This alternative comes with a high administrative burden (higher than option 1 or option 2). Under this option, a price would be established for each DHN based on the efficient costs of delivering the network. As in other network industries, investments in infrastructure would be remunerated using a RAB,[41] on which an allowed rate of return would be earned. The allowed revenue for a DHN would be based on the sum of operating costs, depreciation, and a return on the RAB, subject to an assessment of efficient costs. However, even a substantial increase in administrative burden could be justified with respect to the delivery of substantial benefits.

[41] 'Regulated asset base' means the total value of assets on which the company owning the DHN is permitted to earn a return.

2.2 Expected impact of the shortlisted options

2.2.1 Approach

We have compared the three shortlisted options against a baseline (of the revised gas reference price as it is since 1 January 2020) to inform our recommendation for a price regulation approach.[42]

It is important to note that the purpose of the impact assessment is not to forecast future price or network cost developments. Rather, the impact assessment serves as a comparison between the shortlisted options and the baseline. Hence, one should focus on the relative outcomes, rather than the absolute numbers.

2.2.2 Comparison of options

The main results of the impact assessment are summarised in Table 2.2.[43] There is a trade-off between the administrative burden, and low prices charged to households and reduced risk of overcompensation.

Table 2.2 Summary of the impact assessment results in 2040

	Baseline	Option 1	Option 2	Option 3
Results				
Average price per household connection (€/year)[1]	1,331	1,296	610	600
Risk of overcompensation[2]	High	Medium–high	Low	Low
Administrative burden[3]	Low	Low–medium	Medium–high	High

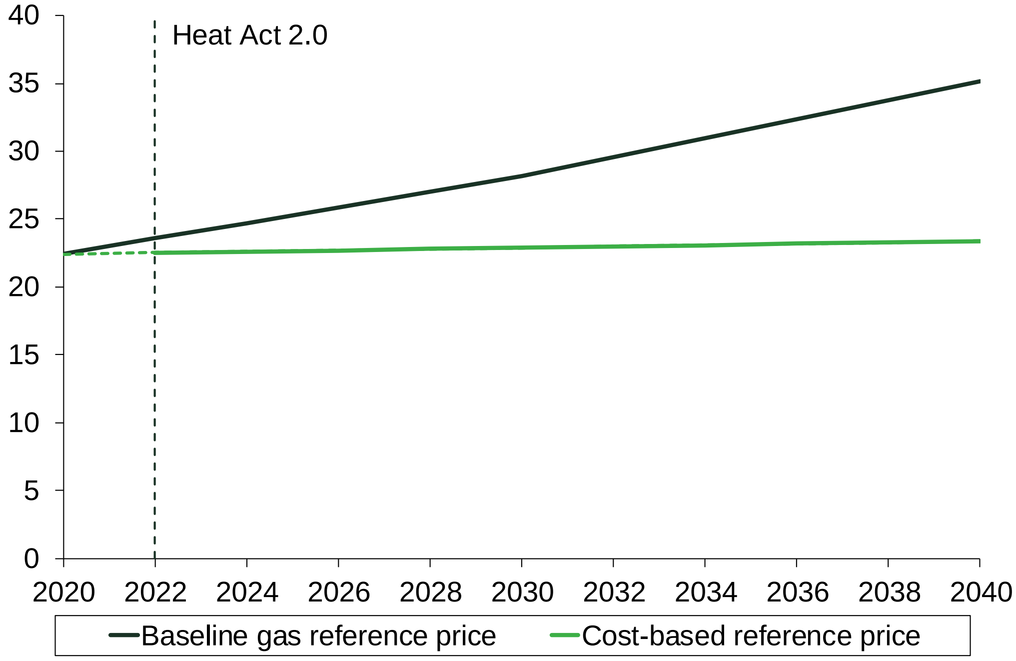
Notes: [1] Quantitative metrics are specified for 2040 in 2010 prices. Prices charged to households are based on the revenue collected from the end-users. All prices (i.e. for the baseline and options 1-3) are calculated for a scenario where there are just enough DHNs for meeting the Climate Agreement target of 2 million existing households using DH, with the most profitable DHNs being built first. For options 2 and 3, it is assumed that there is no overcompensation (see Table 7.5 for more detailed discussion). **[2]** Discussed in more detail in section 7.2.4. **[3]** Discussed in more detail in section 7.3.

Source: Oxera analysis.

The main benefit of option 1 is the relatively low administrative burden. It seems likely that the DH cost-based reference price would increase at a lower rate under option 1 than under the baseline because of the removal of energy tax increases (see Figure 2.6). However, there are no incentives for companies to pass efficiency gains on to consumers under this option that would achieve the EZK's policy objective and, at the same time, ensure that a single national price does not prevent the risk of investors being overcompensated. These factors mean that option 1 is not a suitable long-term solution. However, it may provide a small improvement over the revised gas reference price.

[42] For the quantitative part of the impact assessment, the Vesta MAIS spatial energy model (Vesta) was used to simulate the different options and a baseline. Vesta is a geospatial economic-engineering model developed by the Netherlands Environmental Assessment Agency (PBL). See section 7 for a detailed explanation of how we amended the Vesta model, the assumptions Oxera made and an overview of results.
[43] The regulatory regime should facilitate the reduction of CO_2 emissions. However, since this is not an objective that would be directly achieved by the tariff regime alone, reduction of CO_2 emissions are not included in the impact assessment. Moreover, we use the DH roll-out targets from the Climate Agreement as a reference point, rather than the emission reduction targets. See Appendices A7 and A8 for further discussion of emission reductions.

Figure 2.6 Reference price in the baseline scenario and option 1 (€/GJ)



Note: Excluding VAT and BAK.

Source: Oxera.

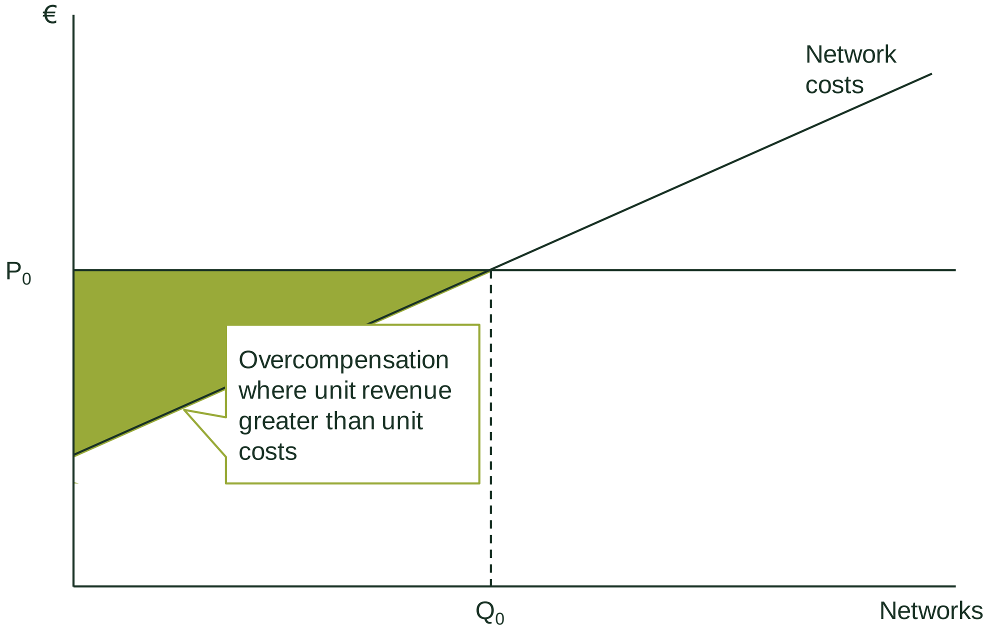
The results of our impact assessment suggest that, under options 2 and 3 compared with the baseline and option 1, the target formulated in the Climate Agreement can be achieved at lower average prices charged to households than the baseline at roughly the same network cost.[44] That is because:

- under options 2 and 3, we expect the DHNs' cost efficiency to be higher and the required rate of return to be lower (reflecting lower cost risk);
- under options 2 and 3, the network-specific prices allow the prices to be lower for DHNs with lower costs and higher for DHNs with higher costs.

Overall, options 2 and 3 would be better able to prevent overcompensation while also facilitating the expansion of the DH sector by better linking the costs and revenues of DHNs, as illustrated in Figure 2.7 below. Under the baseline or option 1, some (low-cost) DHNs would receive revenue above their costs (which already include a reasonable rate of return on invested capital) if they price up to the benchmark price, illustrated by the green triangle. Under options 2 and 3, because prices charged to households reflect network costs, such overcompensation is much less likely or is likely to be lower overall. In addition, this better linking of costs and revenues reduces the risks that DHNs will be unable to recover their costs in the event of an adverse cost shock because DH prices would be more closely aligned to DH costs, thereby reducing risk.

[44] Network costs include investment costs and operating costs.

Figure 2.7 Preventing overcompensation in options 2 and 3 (illustrative)



Note: The line representing network costs includes a ‘reasonable profit’ for DHCs.

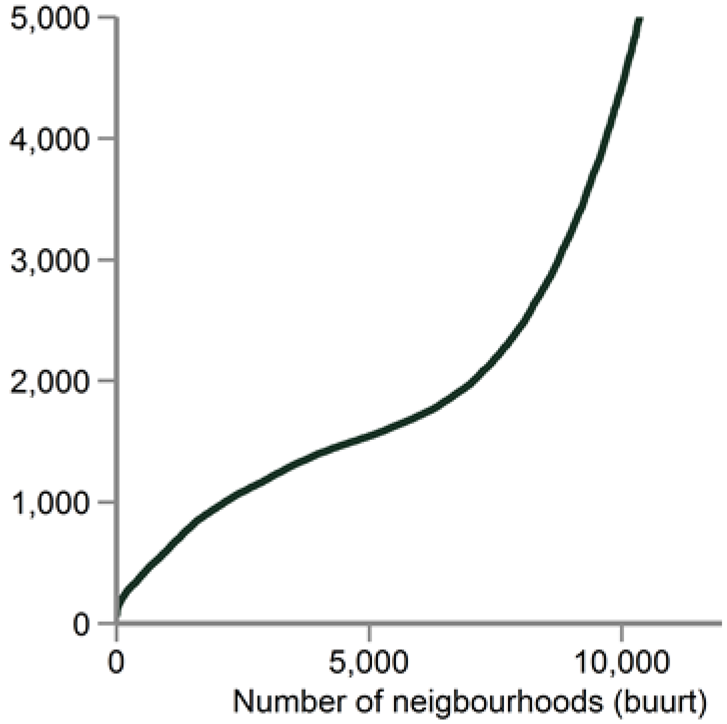
Source: Oxera.

That said, the variability of prices offered to customers potentially increases when tariffs reflect costs more accurately, both across DHNs and over time. In the baseline and option 1, the same price applies nationwide, meaning that there would be little or no price variation across users.[45] As Figure 2.8 below shows, costs differ strongly across neighbourhoods.[46] Under option 3, the prices charged to households are specified individually for each network, whereas under option 2, the prices may be the same for a group of networks. Therefore, compared with option 2, the variability of prices charged to consumers is expected to be greater than under option 3.

The issue of price variability across households was also addressed during the stakeholder meeting regarding the Heat Act 2.0 on 3 October 2019. As discussed, undesirable price differences across DHNs could be overcome by introducing a socialisation scheme, for example in the form of subsidies for certain households and customer groups.[47]

[45] Except potentially for large users.
[46] The figure shows the variation of average DH costs per connection, calculated at the neighbourhood level. We recognise that DH areas will not necessarily be defined at the neighbourhood level in the ‘Neighbourhood Orientated Approach’ and that the size of DH areas may differ from one area to another. However, cost differences across DH areas are mostly due to fundamental geographical differences and therefore there is likely to be substantial cost variation across DHNs.
[47] The design of a subsididaton scheme is outside the scope of this report.

Figure 2.8 Variation of average DH costs per connection, calculated at the neighbourhood level (€/year)



Note: The figure represents the total network costs–which include heat source costs–associated with a single DH connection, calculated at the neighbourhood (buurt) level.

Source: Oxera analysis, using Vesta.

2.3 The most suitable tariff regulation method

Deciding on a preferred tariff regulation method involves weighing up various aspects of the regime, and different parties could reach different conclusions. On the basis of the information that Oxera has available, the conclusion is that option 2 is preferable in the long run because it is able to prevent overcompensation while also facilitating the expansion of the DH sector. Option 1 does not achieve these goals. Moreover, efficiency incentives are larger under option 2 compared to option 1. Option 2 realises these benefits at a lower level of administrative cost (both in setting up the regime and ongoing once the regime is set up) compared with option 3.

Introducing a more cost-reflective price regulation regime like option 2 would represent a large change for the DH sector, and would require a substantial change in processes and capabilities of DHNs and the ACM. However, the benefits of such a change in enabling the roll-out of further DHNs while preventing overcompensation are likely to be substantially larger than these costs. As a result, a change would need to be implemented over an extended period, such as 5–10 years, to allow the time necessary for the change in processes and capability to be implemented. The recommended transition period could look as follows. In the short run, the gas reference price could be made more cost-reflective at a national level. In parallel, the key building blocks required for cost-based regulation at the network level could be progressively implemented. These building blocks include 1) formulating the regulatory accounting requirements needed, 2) designing the benchmarking methodology that will be applied (e.g. which networks to include and how to control for differences in characteristics between networks) to determine the allowed level of costs per network, and 3) deciding on the approach to determine the allowed rate of return the companies are allowed to earn. These building blocks can be used to progressively refine the price benchmark by refining the index until option 2 is introduced. Tariff shocks could be prevented by gradually replacing the revised gas reference price with the benchmark price.

There is the potential for a reduction in investment during the transition period because of the uncertainty around what the final regulatory regime will look like. It is important for the reduction of regulatory risk that DHNs receive clarity from the EZK and the ACM on what will happen so that they continue to invest during this transitional period. The EZK and the ACM should therefore set out a clear plan for the transition process and regularly report progress against this plan to the stakeholders.

2.4 Other policies needed

In addition to deciding on a price-setting methodology, a regulatory package needs to include other policies, such as (noting that some of these are already included in the Heat Act 1.0):

- creating incentives to DHCs to develop renewable or low- carbon heat sources that are also more cost efficient than the sources they currently deploy, or otherwise to contract for such heat;
- designing a regime to ensure security of supply, including a regime for monitoring the financial viability of suppliers and to ensure system resilience;
- introducing robust regulatory accounting requirements;
- introducing a consumer protection regime, including a dispute resolution procedure;
- providing a mechanism for the socialisation of risk and associated funding (if necessary; and
- providing a mechanism to subsidise high-cost networks or their customers;

These are important issues for the success of the DH sector, but are beyond the scope of this study. They are therefore briefly raised here for completeness, but are not considered in detail.

3 Introduction

3.1 Oxera's assignment

Oxera has been commissioned by the Ministry of Economic Affairs and Climate Policy (EZK) to provide a practical and evidence-based assessment of the alternatives to the gas reference price. Our review and assessment of the potential options to regulate district heating networks (DHNs) is intended to support the transition to zero-carbon heat to achieve the objectives set out in the Climate Agreement.

We were commissioned to follow a research methodology based on three distinct phases:

1. a high-level review of suitable and feasible alternatives to the gas reference price;
2. the detailed design of three suitable and feasible alternatives to the gas reference price;
3. an impact analysis of three alternatives.

On the basis of this analysis, we were asked to make a recommendation to the EZK on the preferred option. Our assignment constitutes a step towards the development of the Heat Act 2.0.

3.2 Overview of key challenges for the economic regulation of the district heating sector

The Climate Agreement envisages a substantial roll-out of DHNs to assist in the decarbonisation of heat.[48] However, this roll-out of the infrastructure needs to be accompanied by the development of zero-carbon heat sources if it is to make a difference.[49]

To achieve this objective, it is necessary that the economic regulation of the DH sector provides an environment that is conducive to investment by private capital; supports the development of low- or zero-carbon heat sources; and supports customer recognition of DH as a viable and acceptable source of heat.

A wide range of broader policy and market design issues are being discussed in this sector, and economic regulation is just one part. It is therefore not possible for our assignment to address all of the issues. Nevertheless, we have taken into account the wider policy context and components of economic regulation (explained further below) in considering the form of tariff regulation that should replace the gas reference price.

Our assignment is summarised in the table below, which sets out which sections address the questions put forward by the EZK in the initial phase of the assignment.

[48] The wider market and policy context is described in more detail in section 4.
[49] Low-carbon heat sources are utilised in the transition towards zero-carbon heat sources.

Table 3.1 Summary table

Tasks from scoping document provided by the EZK	Where addressed in report?
What are concrete, suitable and practicable alternatives to the gas reference in view of the characteristics of the heat market and the goals of network regulation?	Section 6
What is the expected quantitative and qualitative impact of these alternatives to the heat rates and the realization of the objectives of network regulation and the Heat Act?	Section 7
What is the most suitable in the short and long term tariff regulation method for determining the rates for small consumers of heat?	Section 7.4

Source: Oxera.

Any regulatory framework combines individual policies and regulations to deliver desired outcomes. In this case, the desired outcome is to develop a regulatory package for current and future DHNs that enables their efficient expansion to facilitate the decarbonisation of heat and support customer acceptance of DH as an appropriate solution.

The elements that form a regulatory package in this context need to address the following questions.

1. How are network prices or tariffs regulated? How are tariffs structured?

   This is addressed by the choice of price-setting methodology. It forms the core of the regulatory package, and other complementary policies form around it.

2. How are consumers protected?

   In other words, how are both no overcompensation and the provision of high-quality DH services ensured at the same time?

3. How are expectations of fair returns to investors ensured?

   This requires a regulatory regime that, while ensuring no overcompensation, creates an investment environment in which investment risks are appropriately priced into the rate of return.

4. How should incentives be provided to district heating companies (DHCs) to contract external low-carbon heat sources that are more efficient then their own?

   This ensures that external low-carbon heat sources can access the heat networks, which are owned by the DHCs.

5. What incentives and arrangements are in place to ensure appropriate levels of innovation, network integration, and sector coupling?

   This requires further complementary policies as part of the regulatory package, which ensures a form of profit-sharing for DHCs.

The core question of this study is: how should prices for DH be regulated? Where elements 1 to 3 are (partially) dealt with while determining the right tariff regime, the other elements on incentive setting (4 and 5) are dealt with once the tariff regime is chosen. Elements 4 and 5 are needed to modulate behaviours of market participants to ensure consistent delivery of the desired outcomes.

Moreover, the report focuses on the Dutch DH market and considers the broader Dutch policy context. Analysis of DH markets in other countries are not in the scope of this report. Naturally, however, experiences from other countries and sectors are used as an input in constructing the recommended tariff regime.

3.3 Stakeholder engagement

As part of this assignment, we engaged with selected stakeholders to inform and receive responses on provisional results. Specifically, two formal stakeholder workshops were organised, which provided ample opportunity for stakeholders to raise concerns and provide suggestions. Stakeholders included representatives from the DH industry (including existing DHCs of various sizes as well potential new entrants to the industry, such as network companies), consumer organisations, and municipalities. The organisations involved in this stakeholder engagement are listed in Appendix A9.

The first stakeholder workshop on 28 August 2019 introduced the assignment; gathered stakeholders' views on the criteria used to assess options; gathered views on the longlist of regulatory options considered; and identified the key challenges affecting the feasibility and practicality of different regulatory regimes as well as the challenges to building trust and acceptance with consumers for DH.

The second stakeholder workshop on 13 September 2019 was used to listen to concerns from the industry; outline the three shortlisted regulatory options; and gather stakeholder feedback on those options; as well as to discuss stakeholder views on some of the key trade-offs.

3.4 Structure of the report

The report is structured as follows:

- the wider policy context of the Dutch DH sector is presented in section 4.1;
- the current market context is considered, including the challenges that the DH sector is facing section 4.2;
- section 5.1 sets out the need for regulation and which parts of the DH market require this;
- section 5.2 details the objectives that the EZK would like to achieve in the DH market through regulation;
- section 5.3 sets out the criteria that must and should be met by the new regulatory regime;
- section 5.4 describes and assesses the wide spectrum of regulatory approaches (the 'longlist') and presents a shortlist;
- section 6 sets out a detailed description of regulatory packages for the three shortlisted regulatory options;
- section 7 presents the process and results of the impact assessment;
- section 8 discusses other necessary policy interventions;
- section 9 outlines key issues for the transition period;

- section 10 concludes, with the appendices providing additional technical details on selected issues.

4 Context

This section first provides an overview of the policy context (section 4.1), in particular introducing the current Heat Act (which entered into force in 2014, but is referred to in this report as 'Heat Act 1.0'), the Climate Agreement, the amendment to the Heat Act (sometimes referred to as 'Heat Act 1.1') on 1 July 2019, and the forthcoming Heat Act (expected to enter into force in 2022, and hereafter referred to as 'Heat Act 2.0'). Second, we describe the market context (section 4.2), setting out the value chain and the current status of the DH market, assessing the merits and drawbacks of the current regulatory regime and the implications for future regulation that can be drawn based on these.

4.1 Policy context

DH has been subject to policy initiatives for some time. Moreover, DH has some particular characteristics that lead to unusual market conditions. In this section, we will review the key elements of the policy and market context around DH in the Netherlands.

4.1.1 Heat Act 1.0

In 2014, the Dutch Heat Act entered into force.[50] The Heat Act protects small users[51] that depend on local heating networks[52] against excessively high prices. Protection of these small customers is considered necessary, because (i) heat is considered an essential good in the Netherlands, (ii) heat suppliers have monopoly power, and (iii) there are no (competitive) substitutes available to small customers.[53]

As discussed in section 4.1.2, DH areas are relatively isolated markets. Moreover, DHNs are natural monopolies[54] (it is not efficient to build two networks serving the same customer) and the DH market is vertically integrated, and so the EZK has concluded that unbundling is beneficial for society (see section 4.1.5). Hence, in the absence of other competitive, alternative heating technology readily available to the consumers connected to a DHN,[55] there are limited competitive forces **within** the DH market. Furthermore, heating is considered to be an essential service and disconnection from a DHN incurs costs (see section 4.1.4). This means that the demand response from consumers due to price changes can be expected to be limited, thus limiting the competitive pressure on DHCs.

The Heat Act regulates the price that can be charged to households for DH and imposes several other protective measures, such as security of heat supply, limitations to when customers can be disconnected from the network, and the possibility for customers to consult a disputes committee.

[50] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, p. 9.
[51] Small users are considered to be users with a connection of up to 100 kWh.
[52] A heat network—sometimes called district heating—is a distribution system of insulated pipes that takes heat from a central source and delivers it to a number of domestic or non-domestic buildings. The heat source may be a facility that provides a dedicated supply to the heat network, such as a combined heat and power plant; or heat recovered from industry and urban infrastructure, canals and rivers, or energy from waste plants. BEIS (2019), 'Guidance Heat networks', https://www.gov.uk/guidance/heat-networks-overview.
[53] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, p. 9.
[54] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, p. 9.
[55] SiRM (2019), 'Tariefregulering warmtebedrijven voor kleingebruikers', pp. 11 and 44.

Under the Heat Act, DH prices are regulated by reference to the price of natural gas: the gas reference price.[56] The key parameters are based on the costs of gas central heating for a notional ‘average’ household. The purpose is to ensure that DH customers do not pay more than customers of central gas heating. More generally, the gas reference price is designed in a way that means it remains unaffected by DH market outcomes. This implies that, under this regime, cost and volume risks[57] are in principle borne by the DHCs that own the DHNs.

Hence, while the price cap provides some comfort to customers that the price of DH will (if available in their area) remain broadly similar to the price of gas central heating, the price cap also increases the risk that the price DHCs can charge may not cover their costs or lead to overcompensation. In response to the risk of not covering their costs, DHCs often charge an additional, unregulated fee. Also, the degree of cost-reflectivity and risk of overcompensation differs across networks, since the gas reference price is the same for all networks—and DHCs tend to price up to or close to the cap[58]—while DHNs differ in underlying costs. Moreover, regulation is conducted at the level of the DHCs instead of at the network level. This means that DHCs have no incentive to invest in networks that are costlier than the reference price and enables overcompensation for DHCs that own multiple networks.

There are no special requirements for cost reporting (other than standard accounting rules). Hence, the cost reporting could potentially be inconsistent over time and across DHCs. It is questionable whether the existing knowledge on DHC costs is sufficient for any enforcement action to be plausible.

Not all prices are regulated under the current regime. The Heat Act applies to prices charged to small, domestic customers. As a result, tariffs for large customers are not regulated. Also, the Heat Act does not regulate costs remunerated through deals with intermediaries, even though customers are likely to fund a large proportion of these anyway. An example of this is the one-off fee paid to the DHCs for connection of a building to the network, the ‘Bijdrage Aansluitkosten’ (BAK).

The BAK often consists of a connection fee and a ‘project fee’. As of 1 January 2020, the connection fee is based on actual costs and subject to a regulated fee cap, but there are currently no plans to regulate project fees. As such, while project fees provide a flexible means by which DHNs can recover costs that are not covered by the gas reference price, there is currently no way of ensuring that project fees are reasonable in the sense that they reflect efficient costs and are not excessive.

The BAK is in most cases paid by a housing project developer,[59] and is usually passed to users by including the BAK into the sale price or in the rent of a house or apartment.[60] The municipality, project developer and DHC negotiate over the level of the BAK. The BAK is only regulated for connections to existing DHNs; as regards newly built DHNs there is no maximum tariff for the BAK.[61]

[56] ACM (2013), ‘ACM sets tariffs of New Dutch Heat Act’, https://www.acm.nl/en/publications/publication/12530/ACM-sets-tariffs-of-new-Dutch-Heat-Act.
[57] Volume risk refers to the potential variation in both the number of connections and the heating demand for each connected customer.
[58] SiRM (2019), ‘Tariefregulering warmtebedrijven voor kleingebruikers’ p. 45.
[59] CE Delft (2018), ‘Aansluiten op een warmtenet’, p. 15.
[60] Ecorys (2016), ‘Evaluatie Warmtewet en toekomstig marktontwerp warmte’, p. 148.
[61] Parlementaire Monitor (2017), ‘Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)’, Kamerstuk 34723, nr. 3, pp. 12–13.

This, in combination with the negotiating power of DHCs, results in the BAK usually serving as a complement to the heat tariff.[62] Hence, it is unclear what cost the BAK covers and to what extent it leads to overcompensation. It could be that the BAK often includes other costs on top of the costs of connection, making sure the DHNs' business case is positive.[63] However, the BAK could also generate extra profits for the DHCs and lead to overcompensation.

4.1.2 Climate Agreement and roll-out targets for district heating

As part of the Climate Agreement (2019), the Netherlands intends to reduce CO_2 emissions by 49% relative to 1990 levels before 2030 and by 95% before 2050.[64] To achieve such targets the government is (and has been) implementing policies targeted at relevant sectors including power generation, transport and heating. Targeting the reduction of emissions from heat supplied to the built environment, it is agreed in the Climate Agreement that 1.5m existing houses need to be sustainable (or 'sustainable-ready' by being connected to potentially sustainable infrastructure) by 2030.[65] Municipalities have an important role in determining the alternative infrastructure for gas in each area as part of the 'Neighbourhood Oriented Approach', which stems from the Climate Agreement: each municipality will need to decide what source of heat is most appropriate for its area to replace natural gas.[66] Where a municipality decides that DH is the appropriate source of heat, it will then need to appoint a DH supplied with the obligation to connect all households who wish to be connected.

An ambitious roll-out of DH is part of the Dutch government's strategy to decarbonise heat supply, alongside other measures such as the increase of energy taxation to incentivise investments in sustainability.[67] As of 2017, around 420,000 homes had been connected to DHNs.[68] The Climate Agreement recognises the importance of DH in reaching its goals, envisaging a yearly DH demand of 40 PJ in 2030.[69] This target is to be achieved by an annual adoption (houses connecting to a DHN) of 80,000 houses from 2025 to 2030.[70] By 2030, 750,000 additional existing houses are expected to be connected to DHNs.[71]

However, the sector faces several challenges to delivering this ambitious DH roll-out. The most important challenges identified by stakeholders at the stakeholder workshop were as follows.

- **Roll-out of the needed infrastructure**. To achieve the desired increase in houses connected to DH, numerous additional networks are needed.[72] Parties should be found that are willing and able to take on these

[62] This is partly induced by the fact that the heat tariff is capped by the gas reference and therefore may not cover the costs incurred by a DHC.
[63] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, pp. 12–13; Ecorys (2016), 'Evaluatie Warmtewet en toekomstig marktontwerp warmte', p. 148.
[64] Rijksoverheid (2019), 'Climate Agreement', p. 19.
[65] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 16.
[66] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 27.
[67] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', pp. 16–23.
[68] CBS, TNO and ECN (2019), 'Heat Monitor 2017', p. 45.
[69] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 37.
[70] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 37.
[71] Planbreau voor de Leefomgeving (2019), 'Effecten ontwerp Klimaatakkoord', pp. 71–72 and 78.
[72] Berenschot (2018), 'Het 'warmtescenario': Beelden van een op warmte gerichte energievoorziening in 2030 en 2050', pp. 5 and 14.

investments. However, there are currently several barriers to the required development of infrastructure.

- Transportation costs associated with DH grids are relatively high compared with other energy carriers, such as natural gas or electricity. Therefore, heat has an inherent local character, which makes a nation-wide DH grid economically infeasible.[73] Hence, mismatches in heat source availability and demand in a certain region are difficult to overcome. Moreover, certain regions are economically more attractive than others, because density is higher or more heat sources are available.

- The gas reference price means that cost and volume risks are borne by DHCs, making investments in DH infrastructure less attractive.

- DH grids require pipelines to connect each building. The roll-out of this infrastructure is sometimes limited, either by law (e.g. the protection of monumental buildings), or by the lack of space (e.g. in the case of historical city centres).[74]

- **Developing and decarbonising heat sources**. In addition to extra infrastructure, there is a need for additional DH sources to achieve the desired roll-out. The future availability, costs and practicality of these sources is unclear.[75] Furthermore, as of 2017, about 75% of heat delivered by DHNs comes from fossil power plants (gas or coal) or gas-fired boilers 2017.[76] Heat sources deployed by DHNs should be decarbonised to ensure the positive impact of DH on the goals of the Climate Agreement.

- **Creating and maintaining local support for DHNs**. There is a certain level of controversy regarding DHNs. Dutch media has reported on the dis-satisfaction of households connected to DHNs on several occasions.[77] This dis-satisfaction mostly relates to the gas reference price methodology, lack of choice, and high costs for detachment from a DHN. Creating local support for DHNs and maintaining support of citizens connected to DH is crucial in order to achieve the desired adoption of DH.

4.1.3 Political debate

Several concerns with respect to the current Heat Act have been raised in motions to Parliament.[78] These have varied from issues with market design and sustainability to the regulation of tariffs. Regarding market structure, a motion was adopted that asked the cabinet to investigate when and to what extent production of heat and transportation/network operation could be

[73] Oei, A.H. (2016), 'Designing a new regulatory framework for the Dutch district heating sector: Combining theoretical insights with empirical evidence', Delft University of Technology, pp. 2–3.
[74] Oei, A.H. (2016), 'Designing a new regulatory framework for the Dutch district heating sector: Combining theoretical insights with empirical evidence', Delft University of Technology, pp. 2–3.
[75] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 38.
[76] Natuur & Milieu (2019), 'Geef warmte de leiding', p. 2.
[77] NOS (2019), 'Warmtenetten nog niet duurzaam, en wel duur', 17 January, https://nos.nl/artikel/2267880-warmtenetten-nog-niet-duurzaam-en-wel-duur.html.
Algemeen Dagblad (2019), 'Waarschuwing: "Geen monopolie energiebedrijf op warmtenet"', 11 February, https://www.ad.nl/wonen/waarschuwing-geen-monopolie-energiebedrijf-op-warmtenet~ae0dd0ee/.
Van der Veen, M.E. and Mulder, R. (2017), 'Opinie: Wie loopt er warm voor stadsverwarming?', Vereniging Eigen Huis, 6 December, https://www.volkskrant.nl/columns-opinie/opinie-wie-loopt-er-warm-voor-stadsverwarming~baf0d172/.
[78] Plenary Report (2018), 'Heat Act is amended after evaluation', 20 February, https://www.tweedekamer.nl/kamerstukken/plenaire_verslagen/kamer_in_het_kort/warmtewet-wordt-aangepast-na-evaluatie.

separated to enhance the functioning of the market.[79] EZK has investigated whether this form of separation would contribute to serving public interests. The Ministry concluded that for the DH market, unlike the gas and electricity markets, the disadvantages of separation exceed the potential benefits.[80]

As for sustainability, motions were submitted with the aim of increasing the effectiveness of DH to decarbonise heat supply.[81] In contrast, one member of Parliament proposed stopping both the roll-out of DHNs and the energy transition in general, claiming that they impose unwarrantable high costs for households.[82] Several motions argued for an alternative to the gas reference price,[83] one of which has been adopted.[84] The adopted motion asks the cabinet to investigate what alternatives there are to the gas reference price.

In light of the envisaged large-scale roll-out of DHNs and the challenges/concerns mentioned above and in section 4.1.2, the government intends to revisit the regulatory policies for DHCs that are currently in place to encourage customers to trust in the technology and potential investors to invest in the industry. This report focuses on the tariff design and works towards an alternative to the gas reference price. Although market design and sustainability issues are not in the scope of this report, the tariff package should be consistent with other policy developments regarding DH.

4.1.4 Amendment to the Heat Act

An amendment to the Heat Act (sometimes referred to as 'Heat Act 1.1') was made in early 2019.[85] Some parts of the amendment were implemented in July 2019, other parts were implemented in January 2020. The amendment sets out the following changes.

- The obligations that the Heat Act imposes on suppliers no longer apply to agents that simultaneously act as heat suppliers and landlords. The reasoning behind this is that tenants are already well protected by tenancy law. The prices that these users pay for their heat consumption are prescribed to be cost-reflective at the household level.
- The dispensation from supplier obligations imposed by the Heat Act also applies to owners associations that supply heat to their members. It is reasoned that agents who consume heat from an association of which they are members do not need extra protection from the Heat Act—i.e. they have influence on that association's policy.
- Two exceptions are introduced regarding the obligation to compensate households for failure of heat supply. First, one malfunction to the network is allowed per year without compensation. Second, there is no obligation to compensate whenever the source of the malfunction is not on the network or the supply failure is the result of force majeure.

[79] Kamerstuk 34723-13.
[80] Ministry of Economic Affairs and Climate Policy (2019), 'Heat Act 2.0', letter to Parliament.
[81] Kamerstuk 34723-16 and Kamerstuk 34723-20.
[82] Kamerstuk 34723-26.
[83] Kamerstuk 34723-15, Kamerstuk 34723-30 and Kamerstuk 32813-382.
[84] Kamerstuk 34723-19.
[85] 'Besluit van 26 maart 2019 tot wijziging van het Warmtebesluit (wijzigingen ter uitvoering van de wet tot wijziging van de Warmtewet naar aanleiding van de evaluatie van de Warmtewet)', *Staatsblad van het Koninkrijk der Nederlanden*, **133**, 26 March 2019.

- Since 1 January 2020, maximum tariffs are in force regarding the supply of cooling[86] and low-temperature heat. Moreover, maximum tariffs are introduced for the BAK charged for connections to new DHNs[87], the price consumers pay for detachment from the network and use of delivery sets.[88]

- Lastly, the amendment imposes the obligation for network operators to inform, on request, potential third-party producers about the networks' main characteristics. Moreover, deadlines will be imposed for negotiations between the producer and network operator. The aim is to strengthen the position of new heat producers.

The amendment was introduced to solve some of the issues with Heat Act 1.0 (see above) that could be addressed without a major change in the law. However, the amendment cannot solve all issues surrounding the Heat Act and DH market. The regulated tariff, for instance, continues to be indexed to the gas price and will apply nationwide independent of individual network costs.[89] That is why 'Heat Act 2.0' was announced in early 2019.[90]

4.1.5 Heat Act 2.0

On 13 February 2019, the Minister of Economic Affairs and Climate Policy updated Parliament about the planning regarding implementation of the 'Heat Act 2.0', which is aimed to be in force by 1 January 2022.[91] Subsequently, on 20 December 2019, Parliament was informed about the status of the legislative process regarding Heat Act 2.0.[92] While the new act is still being developed, it is expected to include the following components.

- Specifications on the role of municipalities, provinces and central government in defining heat catchment areas and determining which DHC will operate in which of these areas in perpetuity.[93] As part of the 'Neighbourhood Orientated Approach', municipalities should have an important role in these specifications.[94]

- An outline of the general obligations of DHCs and DHNs. Examples of these include the obligation to supply, or to connect each household that wants to be connected to the network. Moreover, full responsibility for DHCs to ensure sustainable production, distribution and good-quality supply towards end-customers at efficient costs is envisaged (unbundling is not foreseen).

- Although unbundling is not foreseen to be beneficial in most instances, Heat Act 2.0 will allow for the designation of independent heat transport networks.

[86] The maximum tariff only applies to cooling in case the supplier only offers heat in combination with cooling.
[87] It follows from the stakeholder meetings that the BAK consists of a project fee and a connection fee, and regulation applies to the connection fee.
[88] A delivery set is the link between the heating network, heaters and the hot water tap.
[89] CMS (2017), 'Bill to amend the Dutch Heat Act', https://www.cms-lawnow.com/ealerts/2017/06/bill-to-amend-the-dutch-heat-act.
[90] Ministry of Economic Affairs and Climate Policy (2019), 'Heat Act 2.0', letter to parliament.
[91] Ministry of Economic Affairs and Climate Policy (2019), 'Heat Act 2.0', letter to parliament. On 25 June 2019, a motion was adopted by Parliament to implement the Heat Act 2.0 by 1 January 2021 instead (Kamerstuk 30196, nr. 663; Tweede Kamer (2019)) – Stemmingen moties Klimaat en energie – 97-26-1). However, since the Minister of EZK, Eric Wiebes, advised against the motion because he believes it is practically impossible to accelerate the legislative process by a year (Tweede Kamer (2019) – Plenaire verslagen – 96e vergadering – Klimaat en energie), we continue to assume the Heat Act 2.0 will be implemented by the start of 2022.
[92] Ministry of Economic Affairs and Climate Policy (2019), 'Status of the legislative process regarding Heat Act 2.0', letter to parliament.
[93] As part of the Climate Agreement, a separate legal act specifying local strategies to decarbonise heat supply to the built environment is on its way. These local strategies should be aligned with Heat Act 2.0. Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 27.
[94] Ministry of Economic Affairs and Climate Policy (2019), 'Heat Act 2.0', letter to parliament.

Examples of the general obligations of these networks include regional coordination between sources and customers, capacity management and maintenance of the pipelines.[95] The treatment of independent heat networks within this report is discussed in Box 5.1.

A market design is envisaged where an appointment process will be initiated by the municipality government in a particular area, where DHCs apply to be the appointed heat supplier by providing a business plan. Depending on its overall heating strategy, the municipality will appoint the most suitable and efficient operator.[96] Ideally, this process would create competition among DHCs and possibly with other renewable heating technologies (such as heat pumps).[97] However, once a DHC is appointed to the project of developing the local DHN, this company would then hold a monopolistic position in the local area. In the absence of other competitive, alternative heating technology readily available to the consumers connected to a DHN, there are rather limited competitive forces **within** the DH market. In addition, heating is considered to be an essential service and disconnection (and connection to another heating technology) is costly,[98] such that a demand response by consumers to price increases is unlikely to be sufficient to provide a material competitive constraint on a DHC.

Under the appointment process outlined above, municipalities have an important role in protecting small customers by choosing the heat solution that is the most appropriate for their area under the 'Neighbourhood Orientated Approach'.

4.1.6 Conclusions to policy context

In this report, we develop a regulatory regime with components that are designed to be compatible with the forthcoming Heat Act 2.0 and energy policy in general, insofar as the parameters of this act can be known. In our policy scenario, we assume the following.

- The energy tax on natural gas, and as a consequence the gas reference price, will keep increasing. At the same time, the energy tax on electricity will decrease.[99]
- The current SDE+ subsidies, which support the development of carbon-neutral energy technologies such as solar panels, will become more accessible to wider renewable technologies and other sectors.[100] The scheme will support CO_2 reduction from some additional DH techniques.[101]
- The Levy Renewable Energy ('Opslag Duurzame Energie', ODE) will also be increased. The charge would be increased in the two highest tranches, since the cabinet's goal is to make sure a larger part of costs in relation to the energy transition are borne by companies.[102]

[95] Ministry of Economic Affairs and Climate Policy (2019), 'Status of the legislative process regarding Heat Act 2.0', letter to parliament, p. 9.
[96] This usually also includes an estimate of the BAK.
[97] District heating needs to compete on price against other alternative heating technologies, which are also considered by municipalities.
[98] SiRM (2019), 'Tariefregulering warmtebedrijven voor kleingebruikers', p. 44.
[99] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 23.
[100] E&C Energy Consulting (2019), 'How could the Dutch climate agreement impact your energy spend?'.
[101] Ministry of Economic Affairs and Climate Policy (2019), 'Verbreding van de SDE+ naar de SDE++', pp. 4–5.
[102] E&C energy consulting (2019), 'How could the Dutch climate agreement impact your energy spend?'.

- A Minimum Carbon Levy will be introduced for electricity producers.[103]
- Legally obliged unbundling of production of heat and transportation/network operation for all undertakings in the sector is considered undesirable.[104]

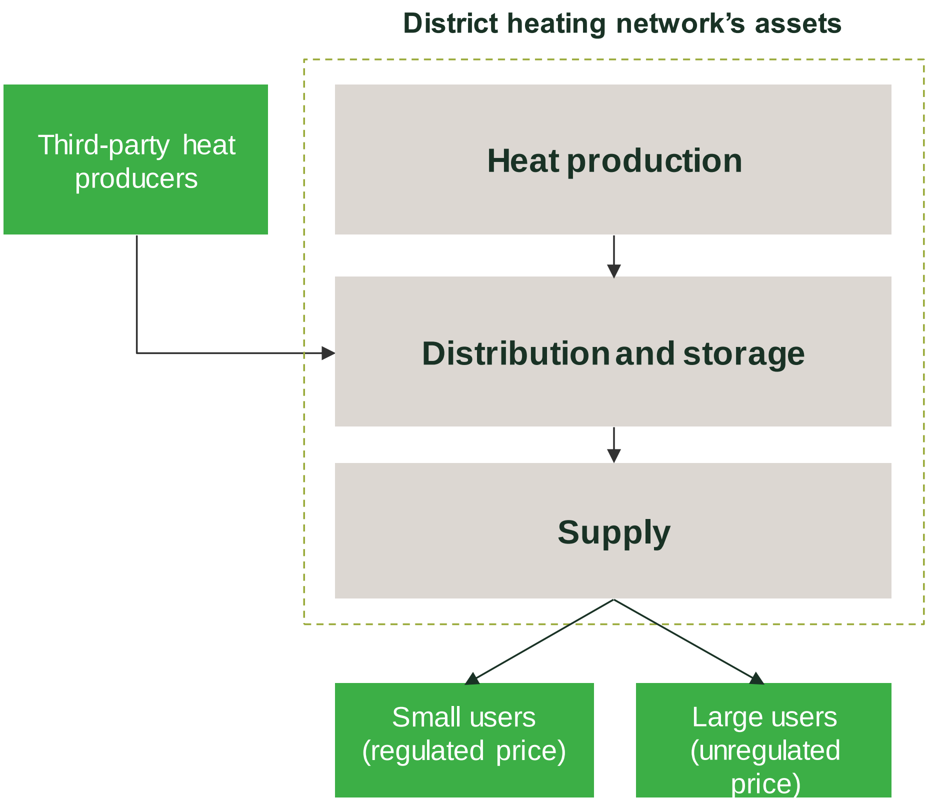
4.2 Market context

In this section we describe the context of the DH market, first introducing the value chain of the sector, before describing the status quo in terms of market development, and lastly setting out implications for future developments.

4.2.1 An introduction to the value chain

Figure 4.1 illustrates the value chain of an illustrative DHN that is typically vertically integrated between heat production, network, storage and retail. At the same time, external, independent heat sources, such as waste heat from industry, can possibly feed into the network. Consumers contract with one DHC rather than contracting with various heat retailers, as is the case in the electricity market.

Figure 4.1 District heat value chain



Source: Oxera analysis.

Regulation of DHCs that determines the regulated tariffs also takes into account the different levels in the value chain. On top of the value chain, with heat production, regulation needs to ensure that low-carbon heat sources can access the distribution networks; therefore, DHCs should be given an incentive to contract or develop low-carbon heat sources that are more efficient than the sources they current deploy. This would require regulatory scrutiny, if not

[103] E&C energy consulting (2019), 'How could the Dutch climate agreement impact your energy spend?'.
[104] Ministry of Economic Affairs and Climate Policy (2019), 'Heat Act 2.0', letter to parliament.

intervention, at different levels in the value supply chain, while regulating DH tariffs seemingly is a process at the retail level only.

As discussed in sections 4.1.1 and 4.1.5, the small end-users of DH are exposed to a company with a monopolistic position in its locality—i.e. there is a lack of competitive pressure on DHCs *in* the market, for various reasons. First, DH areas are relatively isolated markets, the value chain of DH is vertically integrated and DHNs are natural monopolies. Moreover, there may not be any alternative heating technologies directly available to the small users connected to a DHN. The response of customer demand to prices is not likely to provide competitive pressure on DHCs either, since heat is considered an essential good and disconnection from a DHN incurs costs.

Ideally, the appointment process carried out by the municipalities (see section 4.1.5) creates a certain degree of competition *for* the market: (i) between DHCs and (ii) between the appointed DHC and alternative renewable heating technologies. However, the benefits of this potential competition for the market are not expected to last in the long run. That is the case, even if the municipality, project developer and the appointed DHC sign a long term contract (e.g. 10 or 20 years)–which should not be confused with the appointment in itself, which lasts forever–because such a contract will either need to be flexible (to mitigate risks to DHCs) or will include a risk premium thereby increasing the cost of the DHN. As it is very hard (if not impossible) to write a contract that covers all eventualities over a 10 or 20 year time frame, it is likely that the contract will allow adjustments to cover unanticipated developments. At the time of contract renegotiation, there is then only one appointed DHC and therefore it is not possible to rely on competition *for* the market to provide long-term protection to consumers.

As a result, tariff regulation is needed to ensure the affordability of DH services. It is considered that there is no need to regulate tariffs for larger users, because these will often have more alternative heating options and greater buyer power.[105]

In addition to the vertically integrated DHCs, the main stakeholders in the emerging DH market are investors, municipalities and consumers.

4.2.2 Current status of the district heating sector

DHNs held a market share of 5.6% in the market for household heating in 2017 connecting 420,000 houses to networks.[106] Networks as well as companies can vary largely in size. There are 13 large-scale heat distribution networks and 6,900 small-scale networks (some of which are very small).[107] Some networks spread across large cities, while other systems, called communal heating, connect a single building block. Ownership is in the hands of energy supply companies (around 300 networks), small firms, associations of homeowners, housing associations and municipalities.[108] While two networks (in Utrecht and Rotterdam) were developed in the early 20th century, a moderate uptake of associated DH schemes has been emerging since the late 1980s in response to a rapid growth of small-scale and industrial combined

[105] The general presumption is that larger users do have a stronger bargaining position when negotiating with DHCs.
[106] CBS, TNO and ECN (2019), 'Heat Monitor 2017', p. 45.
[107] Climate Change (2018), 'Lessons from European regulation and practice for Scottish district heating regulation', p. 23.
[108] Ibid., p. 23.

heat and power (CHP).[109] In addition, there is also a variety of technologies employed, and heat sources used.

DH technology facilitates both high and low temperatures (slightly above 23°C) to heat and cool most building types, both residential and non-residential. In the case of the provision of domestic hot water, temperatures in the range of 50°C should generally be sufficient. Both renewable and surplus energy sources, which can be harvested very efficiently at low temperature levels, can fulfil this energy demand.[110]

The current regulation requires that small users connected to a DHN pay a DH tariff consisting of a fixed and a variable component. Both fees are currently are regulated. BAK payments for connections to new DHNs are currently not regulated (see section 4.1.1).[111]

DHCs seem to not utilise cost-based pricing but rather price up to or close to the cap—the externally imposed gas reference price.[112] This is likely to be a consequence of there being limited competition.

Although the DH technology provides the possibility for sustainable heating (energy from sustainable sources), about 75% of heat generated and fed into the DHNs was provided by conventional energy sources (coal, gas and gas-fired boilers) as of 2017.[113] Oxera understands from EZK that, as part of the Heat Act 2.0 and the Climate Agreement, DHCs will be incentivised or required to connect to sustainable heat sources in the future.

4.2.3 Advantages and disadvantages of the current regulatory regime

The gas reference price (see section 4.1.1) establishes a single national maximum price with, among other things, separate limits on fixed and variable rates as well as for customer contributions to connection costs. Further, the current regulatory environment allows for DHCs to charge the unregulated BAK. This will partly be regulated as of 2020 (see section 4.1.1). Our understanding is that the BAK is intended to recover initial roll-out costs and, sometimes, covers a cash-flow challenge faced by DHCs in bridging the gap between the DHC incurring capital expenditure on the network and received revenue from users. We also understand that this is not regulated or transparent.

The advantages and disadvantages of the gas reference price are set out in Table 4.1 below.

[109] Climate Change (2018), ‘Lessons from European regulation and practice for Scottish district heating regulation’, p. 23.
[110] Schmidt, D., Kallert, A., Blesl, M., Svendsen, S., Li, H., Nord, N. and Sipilä, K. (2017), ‘Low temperature district heating for future energy systems’, p. 28.
[111] They are partly be regulated since 1 January 2020 onwards as part of the amendment to Heat Act 1.0.
[112] SiRM (2019), ‘Tariefregulering warmtebedrijven voor kleingebruikers’, p. 45, shows that most (large) DHCs price up or close to the cap. CE Delft, Abbel (2019), ‘Rendementsmonitor Warmteleveranciers 2017 en 2018’, p. 30, shows that the average revenue per connection is only slightly lower than the yearly costs of an ‘average’ household (35 GJ) if being charged the maximum price, and roughly follows the trend.
[113] Natuur & Milieu (2019), ‘Geef warmte de leiding’, p. 2.

Table 4.1 Advantages and disadvantages of the current framework

Advantages	Disadvantages
Low regulatory burden for both regulator and companies	Allows for unregulated additional payments (ex. BAK)
Results in one single national price cap (i.e. a single national maximum price)	DH tariffs are not cost-reflective
	DHCs can potentially earn excessive returns
	The ACM effectively cannot request adjustments of high rates of return
	Higher-cost DHNs that cannot be financed with the gas reference price are not being developed (i.e. there is cherry-picking of favourable catchment areas) without additional subsidies or payments to DHCs like the BAK
	Lack of transparency in pricing
	Unfavourable investment climate, as cost and volume risks for DHNs are borne by DHCs

Source: Oxera analysis.

Further relevant aspects of the current regime are explained in more detail below.

- The simplicity of the current regulatory regime on the side of DHCs means that there are few reporting requirements imposed on the companies. The burden on the regulator to implement the gas reference price is also relatively low—it needs to provide the yearly heat monitor in addition to setting the single national gas reference price. Thus, the regulatory burden is very moderate on both sides—for the regulator and for the DHCs.

- We understand from the stakeholder workshops that the current variation in prices across DHCs is low[114] and that most DHCs price (almost) to the gas reference price cap. This means that there is relatively limited price differentiation across DHCs. However, there is very limited information available on DHCs' costs to serve different consumer groups (i.e. consumers in different localities with different usages and needs) as well as the respective margins earned. As mentioned in section 4.2.2, DHCs price up or close to the cap (likely due to a lack of effective competitive pressure), implying prices are not cost- reflective.

- That DHCs can potentially earn excess returns is in line with the result of the recent heat supply efficiency monitor for 2017 and 2018 ('Rendementsmonitor'). The report reviews various indicators of the return on the invested capital of DHCs (including gross margin, EBITDA, EBIT and ROIC[115]) and compares these with both levels from previous years and an indicative range for the reasonable rate of return (currently 5.2–6.6%). The monitor shows that the weighted average return on capital employed in 2017 was within this indicative range. In 2018, for the first time since the entry into force of the Heat Act in 2014, average returns exceeded the indicative range by 0.2%. It further states that there was an observed gradual increase in the returns on capital and investments over the period from 2013 to 2018.[116] These results are however limited to reporting the

[114] This is something that market participants at the stakeholder workshop indicated they consider to be necessary for DH prices to be seen by customers as 'fair'.
[115] The acronyms refer to standard financial figures, 'earnings before interest, taxes, depreciation and amortisation', 'earnings before interest and taxes' and 'return on invested capital', respectively.
[116] CE Delft, Abbel (2019), 'Rendementsmonitor Warmteleveranciers 2017 en 2018' (pp. 3-4).

average performance and profitability of the market rather than releasing detailed rate of return statistics for each DHC or DHN. This would enable consumers to review their heat supplier and understand whether the price they are paying is justified.

- Further, the results from the current heat monitor are not robust enough to enable the ACM to appeal to excessive returns and request adjustments to tariffs. Ultimately, the review of a profitability monitor requires standardised regulatory accounting requirements (RAR), such that the financial figures across DHCs are comparable.
- The current regulatory environment allows DHCs and their respective investors to develop and operate networks, where expected costs are covered by the national gas reference price (and the BAK) for DH, and not serve—i.e. not develop networks—in other higher-cost regions in the first place. The result of this pricing regulation is the potential for so-called 'cherry picking' by DHCs of lucrative regions to develop DHNs. Ultimately, in regions that would entail higher development costs that are unlikely to be fully covered by the gas reference price (and the BAK), networks are not being developed—even in instances where DH offers the most economic carbon-neutral technology. Further, DHCs would not have any commercial incentive to improve quality of service, pursue network integration and sector coupling initiatives, or otherwise provide innovative services unless there were opportunities to reduce costs or to increase demand.[117]
- Another effect of the current regulations is that the extent of existing cost-based price differentiation and cross-subsidisation by DHCs across their portfolio of customers is largely unknown to both the customers themselves and the regulator. This lack of transparency might be a factor in consumers' low levels of trust and acceptance of DH technology.[118]
- In addition, under the current regulatory regime, cost and volume risks for DHNs are not mitigated and are largely borne by DHCs and their investors. This can discourage further investment or result in higher rates of return for investors in order to compensate for these risks.

In light of the government's plans for a large-scale roll-out of DH technology to comply with its decarbonisation targets, both market design and price regulation of DH need to be adjusted to overcome these challenges. Specifically, the adjustments need to enable a further 80,000 connections per year during 2025-2030 to an existing or new DHN.[119] This extension and new roll-out of DHNs will require a new regulatory approach that enables further investment of existing and new DHCs and increases consumer trust in DH technology.

4.2.4 Implications for further developments

On the basis of the performance of the current regulatory regime described above, the implications for the future regulatory regime are specified in the outputs below:

[117] Network integration and sector coupling measures may also fail to be realised due to coordination failures at the local level.
[118] van Lidth de Jeude, M. and Midden, C. (2014), 'Veronderstellingen eindgebruikers collectieve warmtelevering Rotterdam. Consultancy study on customer preferences'; Janssen, B. (2015), 'De consument en de collectieve warmtevoorziening'.
[119] Rijksoverheid (2019), 'Climate Agreement'.

- prices need to ensure cost-reflectivity to (i) prevent overcompensation, and (ii) help municipalities make efficient decisions (e.g. in defining catchment areas);
- prices need to be predictable and allow for the necessary productive, allocative and dynamic efficiencies required for the expansion of the DH sector and meet climate accord targets;
- greater transparency of prices and costs across networks and customers need to be made available to:
  - enable cost-reflective and efficient regulation;
  - inform policies regarding taxation, socialisation and subsidies—aligning those with price regulation—and holistically form part of the regulatory package;
  - enable municipalities and customers to make an informed heating choice according to their needs, preferences and budgets;
  - continuously review affordability considerations while pursuing the objective of increased DH roll-out;
  - provide for customer acceptance.

The intention of this regulatory package is to regulate the payments to DHCs, specifically: the tariffs charged to consumers; the annual fixed fees (often referred to as ‘vastrecht’); and the BAK, a one-time payment to the DHCs. The BAK, which is currently not regulated, is also included as Oxera considers that there is no need for an unregulated lump-sum payment under efficient regulation.

In light of this list of outputs to be achieved by the next regulatory regime, it is important to keep in mind that achieving specified outputs through regulation comes at the ‘cost’ of a higher regulatory burden. Hence, a balance needs to be struck between regulatory outputs and the feasibility of implementing a regulatory regime.

5 Assessment of regulatory approaches

5.1 Clarification on what needs to be regulated

Since competition within the DH market is limited (see section 4.2.1), regulation is needed to ensure that market outcomes are optimal for consumers and society. This section introduces and assesses the wide range of available regulatory methods for setting DH prices that recover the costs of the full DH value chain (see Figure 2.1). Note that this assignment concerns ‘price regulation’. Further considerations about the tariff structure are discussed in Box 6.1, although this is ultimately at the discretion of the EZK. As set out in section 3.1, this study is concerned mainly with price regulation—i.e. the level and mechanisms of cost-recovery for DHCs.

In addition, prices charged to end-users could potentially be adjusted (upwards or downwards) through subsidies or cross-subsidy, ultimately resulting in a difference between the costs that DHCs are allowed to recover for DH services and the prices paid by end-users. These policy considerations are outside the scope of this work but can form part of the comprehensive policy package.

This section considers the EZK’s objectives in implementing a new regulatory regime, forms assessment criteria based on these objectives, and presents and assesses a longlist from the spectrum of regulatory approaches.

5.2 Objectives of the EZK

The choice of regulatory approach depends on a range of factors. To form a set of criteria against which to assess the regulatory options, we first looked at the main results (or outcomes) that the EZK intends to achieve with the new regulatory regime. These are:

- consumers are protected from being trapped in costly DH services (including ultimately benefiting from efficiency improvements) resulting in overcompensation of DHCs, and consumers and municipalities can take appropriate decisions based on prices that are transparent and reflect costs;
- DHCs earn fair returns (in expectation);
- the roll-out of DHNs is expedited to replace gas-fuelled boilers (thus supporting the increased sustainability of the heat sector);
- DHNs use sustainable (i.e. very-low- or zero-carbon) heat sources (in the long run);
- there are incentives for innovation, network integration, and sector coupling. Through these, ongoing efficiency enhancements, cost savings, decarbonisation and a general increase in DH adoption are facilitated.

Institutional circumstances and other constraints are important when developing any regulatory option. In this case, such considerations include (i) practical limits to the costs of regulation for both the regulator and DHCs; (ii) what is ‘politically acceptable’ in light of the ‘not more than the alternative’ commitment made in the Climate Agreement;[120] and (iii) what is ‘acceptable to consumers’ and restores/enhances their trust in DH technology. While these considerations provide an important context, they do not constitute policy objectives, and therefore constitute constraints on the policy objectives outlined above.

[120] Rijksoverheid (2019), ‘Climate Agreement’.

These policy objectives provide useful high-level guidance on the desired outcomes from the economic regulation of DHNs. However, they need to be turned into more detailed criteria that can be used to directly assess potential price regulation options. This is discussed below.

5.3 Assessment criteria

We have developed the following criteria against which options can be assessed, in conjunction with the EZK and the ACM and taking into consideration responses received from stakeholders.

A. The regime **must** ensure **no overcompensation** for DHCs.

   This first criterion ensures that small consumers do not pay excessive prices to DHCs for the provision of heat through DHNs. There are many ways in which this overcompensation test can be implemented, but it would normally mean that the DHCs must not be not more profitable than is needed to compensate them for the risks that their owners have taken (i.e. fair returns). The prevention of overcompensation to companies that have monopoly characteristics is a standard part of economic regulation. This prevention of overcompensation can either be ex ante (preventing overcompensation before the event through an appropriate method of price control) or ex post (preventing overcompensation after the event by requiring the DHCs to take some action if overcompensation is identified).

B. The regime **must** provide **incentives to deliver an overall high quality** of DH services to consumers.

   As there is only limited competition in the DH market once a DHN has been designated, there will be at most weak incentives for DHCs to improve service quality at reasonable costs. However, delivering a reasonable service quality will be an important component of achieving consumer acceptance and trust in the DH technology required to enable a substantial roll-out of DHNs. As with the prevention of overcompensation, providing incentives for regulated companies to improve quality of service (or minimum required standards) is a standard part of regulatory regimes in many sectors and jurisdictions.

C. The regime **must** encourage **efficient expansion and maintenance of existing networks** (including heat sources), as well as the entry of new (potentially smaller) firms into the DH market.

   In light of the challenging roll-out requirements to meet the sustainability targets, it is necessary for the regulatory regime to enable existing companies to maintain, expand and decarbonise existing DHNs. At the same time, the envisaged large-scale DH roll-out also depends on there being substantial new investment in DHNs. This can be achieved only through a supportive investment environment—by promoting stable and predictable regulation of the sector and an appropriate allocation of risk—and by enabling DHCs to earn a reasonable rate of return (in expectation), and pricing in risks on that investment.

D. The regime **must** be **feasible** and impose a **reasonable administrative burden**.

   The assessment of what is considered a reasonable administrative burden and feasibility was discussed with both the EZK and the ACM. It was agreed that changes in the administrative burden should be considered in light of the benefits that this burden would deliver. Nevertheless, there are limits to what level of administrative burden is feasible for both DHCs and the ACM.

Another important aspect of feasibility is to allow for the current market situation and the capacity of the DHCs and the ACM/EZK to implement any changes to the economic regulation of the sector: this will take time, and the transition to a new regime will need to be carefully planned.

E. The regime **should** provide **incentives for appropriate innovation**.

DHCs generally choose to invest, including in innovative projects, where they see efficiency and cost-saving potential. Such efforts should be encouraged. This translates into allowing companies to financially benefit from such innovative efficiency-enhancing or cost-saving investments in an appropriate way (given the risks taken by the DHCs in developing these measures).

F. The regime **should** provide **incentives** for appropriate network integration.

If efficiency gains can be achieved from the integration of neighbouring networks, for instance to enable the sharing of heat sources, the regulatory regime should allow for such investments (and a reasonable rate of return) in order to perform such network integration. Ultimately, both consumers and firms should benefit from network integration.

G. The regime **should** give due regard to **sector coupling opportunities**.

Similarly, sector coupling can constitute an opportunity for the use and integration of innovative and sustainable heat sources. For instance, residual heat generated from urban public transport has the potential to be used as a heat source when connected to a DHN. Waste heat is also generated in other sectors, such as the energy sector (when producing electricity from gas). The regulatory regime should allow for such investments (and a reasonable rate of return) in order to pursue sector coupling opportunities such as this.

Criteria A–G must be holistically applied in a proportionate way, and inevitably some judgement is required when deciding which trade-offs are expected to lead to the optimal outcomes. Of course, different perspectives on these trade-offs are possible, and we have been commissioned to provide our perspective. We have discussed the criteria with EZK, the ACM and stakeholders. Nevertheless, in progress of this study, these criteria ensure that these aspects of any potential price control are considered and not overlooked. Table 5.1 illustrates how criteria reflect the EZK's objectives.

Table 5.1 Mapping of criteria to objectives

The EZK's objectives of regulation	Criteria that reflect the EZK's objective
That (both new and existing) DHCs, in expectation, earn fair returns	C
That consumers are protected from being trapped in costly DH services resulting in overcompensation of DHCs	A, B
That the roll-out of DH is expedited to replace gas-fuelled boilers (thus supporting the increased sustainability of the heat sector)	C, D
That DHNs utilise decarbonised heat sources (for example, through ensuring that low-carbon heat sources have access to the network) and fully decarbonise in the long run	C
That there are incentives for innovation, network integration, and sector coupling to facilitate ongoing efficiency enhancements, cost savings, decarbonisation and a general increase in DH services	E, F, G

Note: We do not consider issues around the development of decarbonised heat sources, merely the ability of the costs of those sources to be incorporated in DH tariffs.

Source: Oxera analysis.

Other considerations were voiced during the stakeholder engagement process—such as the importance of stable prices for ensuring that customers see DH as an acceptable heat solution. However, there is an important trade-off in the allocation of changes in costs between DHCs and customers: if customers are to have more stable prices then this implies that more risk will need to be taken by DHCs. The allocation of this risk is an important consideration in the design of the economic regulation framework but how it is achieved will depend on a range of detailed factors within the regulatory framework, such as the balance between fixed and variable tariffs and the duration of regulatory cycles. We have therefore not included this consideration as a separate criterion. At the same time, we do acknowledge that stable prices are important to achieving consumer acceptance of DH technology and price stability is taken into account in the detailed design of the shortlisted options.

There was also disagreement among stakeholders about whether a single national tariff for consumer acceptance is required or, if not, what degree of price differentiation across DHNs would be acceptable both politically and to consumers. While the longlist of regulatory options does consider a simpler price regulation methodology, resulting in one national tariff for households, our analysis is not constrained by this and will also review more complex and cost-reflective price regulation methodologies. However, any price regulation approach could be combined with a nationwide socialisation or cross-subsidy programme to achieve a single national tariff—although this would have a number of consequences, including removing the price signals for consumers and municipalities and substantially reducing the transparency of prices. Such socialisation questions are, however, outside the scope of this study.

Having developed a set of criteria against which regulatory options for price regulation can be assessed, the next step is to consider the available options and assess them against the criteria.

5.4 Spectrum of regulatory approaches (longlist)

We have considered a wide spectrum of options for the price-setting methodology in the context of DH in the Netherlands. While not every possible methodology is included in the longlist below, the list captures the wide spectrum of choices, ranging from light-touch to more intrusive regulation. We are aware that several of these options have already been implemented in other jurisdictions to regulate DHNs, while others are the standard price-setting mechanisms for gas or electricity networks. However, this study has not explicitly reviewed precedent or best practice in other jurisdictions. The national context and market situation are deciding factors in determining the right regulatory framework. The success of a certain regime in country A does not ensure that the same regime will generate the same positive outcomes in country B.

Box 5.1 Independent heat transport networks

As discussed, DHNs and DHCs are usually vertically integrated. However, there are likely to be only a few heat transport networks. Gasunie's proposed pipeline in South Holland serves as an example of such an independent heat transport network. Since there are expected to be at most a few of these networks, a separate regulatory regime will be required for them because it is unlikely that there will be enough of them to be benchmarked against each other. However, some elements of their cost structures that are comparable with DHNs might be compared with DHNs. The design of a regulatory regime for these heat networks is out of the scope of this study. The regulatory options discussed in this section and the rest of the report only apply to DHNs as defined earlier.

The list below presents nine options for the price-setting methodology and assesses these against criteria A–G outlined above. We have not assessed each option against all criteria: for the purpose of identifying options to take forward to a more detailed design, it is sufficient for an option to be excluded from further consideration if it would not meet a 'must' criterion.

1. **Free prices and transparency**: tariffs freely set by DHCs in dialogue with consumers and municipalities/provincial authorities. No stakeholder has any power of veto over the DHC's decision.

   Role of DHCs: DHCs are required to engage in dialogue during the price-setting process. They also need to make annual profitability records available.

   Role of regulator: the role of the regulator is very limited—the ACM can publish information annually on the level of profitability, but has no mandate to enforce adjustments in DHCs' rates of return.

   Option assessment

   This is the most light-touch regulatory option available. It leaves pricing decisions entirely free to DHCs. This option could only work in a case where a competitive market provides sufficient incentives to deliver high quality of service, reasonable prices and ongoing incentives for efficiency improvements. This option would have very low administrative costs and would be straightforward to implement.

   However, as explained in section 4.2.1, the market for DH will not be characterised by effective competition, which makes some degree of regulatory control over tariffs necessary to prevent overcompensation and inefficient levels of investment (which could take the form of either insufficient or unnecessary investments—the latter is sometimes referred to as 'gold-plating'). Thus, this option would not regulate any market power experienced by DHCs, which means that 'must' criteria A and B—ensuring no overcompensation of DHCs and incentivising the delivery of overall high-quality service—are not met. Therefore, this option is not considered further.

2. **Free (but scrutinised) prices, transparency and ex post regulation**: tariffs are set by DHCs in dialogue with consumers and

municipalities/provincial authorities under the scrutiny of the regulator. This also involves profitability monitoring by the regulator and the introduction of respective regulatory accounting requirements.

Role of DHCs: DHCs are required to engage in dialogue during the price-setting process. Further, they are obliged to report their costs and annual rate of return at a network level, according to the regulatory accounting requirements.

Role of regulator: the ACM is required to publish the heat monitor annually, reviewing the profitability of DHCs. It can also intervene in the market if DHCs are shown to be excessively profitable on an ex post basis.

Option assessment

Option 2 offers a regulatory approach that either requires substantial upfront investment from the regulator and the DHCs (for example, in understanding the rate of return that would be considered ‘reasonable’ from an ex post perspective) or would introduce significant regulatory uncertainty (if the DHCs do not know what would be considered ‘reasonable’). When the regime is established, the ongoing administrative burden is likely to be relatively low but the uncertainty would remain with respect to both the regulator’s interventions and their effectiveness in providing a credible deterrent against excessive tariffs.

This regime could possibly achieve reasonable rates of return for DHCs (i.e. no overcompensation)—meeting ‘must’ criterion A. It is unlikely, however, to fully mitigate the market power of DHCs due to the uncertainty around the strict enforcement of ‘reasonable’ levels of rate of return by the regulator. As with option 1, this option does not provide the regulator with direct control over the tariffs set by the DHCs, which is necessary to protect small users given the lack of competition in/for the market. Due to the market power DHCs will have, a satisfactory quality of service to customers will not be assured. Hence, this option fails to meet ‘must’ criterion B.

The overall investment environment and the uncertainty introduced by ex post regulation are unlikely to facilitate the entry or expansion of new or existing firms respectively. Specifically, the regulator needs to be credible in enforcing a ‘reasonable’ rate of return. Provided that the regulator itself faces a level of uncertainty when determining the DHCs’ rate of return, the ACM may be hesitant to enforce rate of return adjustments—not meeting ‘must’ criterion C: in particular, the information available for setting the acceptable range of ex ante rates of return will differ from the information available for assessing ex post rates of return, leading to potential time inconsistency. For this reason, this option is not taken further.

3. **Revised gas reference price**: DHCs set prices subject to a national maximum price based on a revised gas reference price that reflects the currently enacted legislation (which is to be implemented by January 2020). This is using the gas reference price approach as it will be following the implementation of the changes outlined in section 4.1.4. It also involves profitability monitoring by the regulator and the introduction of respective regulatory accounting requirements.

   Role of DHCs: DHCs set prices according to the revised gas reference price. Further, they are obliged to report their costs and annual rates of return at a network level, according to the regulatory accounting requirements.

Role of regulator: the ACM sets and annually updates the revised gas reference price and is required to annually review the profitability of DHCs.

Option assessment

The revised gas reference price remains a maximum price that is based on the cost of natural gas which does not reflect the costs of DHCs. Therefore imposing a maximum price based on the revised gas reference methodology (in conjunction with the anticipated lack of effective competition and observation that DHCs currently price up or close to the cap) would not ensure against overcompensation of DHCs—therefore this option does not meet ‘must’ criterion A and is not considered further. Neither does it monitor or enforce a certain quality of service that DHCs need to provide to consumers—thus also not meeting ‘must’ criterion B.

4. **Alternative fuels reference price**: under this option, DHCs would have a national maximum price based on an alternative reference price that reflects the costs of other fuels used by DHCs: it is very similar to option 3 except that the reference price is based on fuels other than natural gas. It also involves profitability monitoring by the regulator and the introduction of respective regulatory accounting requirements.

   Role of DHCs: DHCs are obliged to report their annual rate of returns on a network level, according to the regulatory accounting requirements.

   Role of regulator: the ACM develops a new reference price based on fuels other than natural gas (and excluding a CO_2 tax). It further reviews the alternative reference price annually. It is also tasked with annually reviewing the profitability of DHCs.

   Option assessment

   As with option 3, this option would not prevent the overcompensation of DHCs because there are multiple costs involved in operating a DHN, of which cost of heat is only one (and one which can vary substantially across different networks depending on the heat source). Therefore, this option does not meet ‘must’ criterion A and is not considered further. Neither does it monitor or enforce a certain quality of service that DHCs need to provide to consumers—‘must’ criterion B.

   In addition, if the intention is for residual heat to become increasingly important and to be made available at zero cost to DHCs, then this would put downwards pressure on the overall maximum price index. As a result, investment incentives a damaged for DHCs that use sources other than residual heat. Hence, this option does not meet ‘must’ criterion C.

5. **DH cost-based reference price**: DHCs have a maximum price based on a reference price that is reflective of the actual costs of DHCs at a national level. An alternative way of expressing this is to say that maximum DH prices would be increased based on a DH cost index. It also involves profitability monitoring by the regulator (and potential adjustments to the index if industry-wide profitability is excessive) and the introduction of respective regulatory accounting requirements.

   Role of DHCs: DHCs are obliged to report their operating expenditure and capital costs incurred at a heat network level, in a format specified by the regulator. They also need to report their annual rates of return on a network level, according to the regulatory accounting requirements.

Role of regulator: the ACM processes the cost information for the different DHCs and sets the national DH cost-based reference price. This would be updated annually.

Option assessment

At an aggregate level, 'must' criterion A (no overcompensation) is likely to be met, since the reference price reflects the average cost developments for DHNs. There may be DHNs that are particularly efficient and/or have a particularly advantageous mix of heat sources or network distribution, such that these still earn a higher rate of return (i.e. are overcompensated). At the same time, some DHNs may receive too little revenues and would have an incentive to improve their efficiency.

This option would also: at an aggregate level provide incentives for DHCs to invest in service quality to meet the demands of customers and other stakeholders as the costs incurred in doing so would be included in the cap. However, for individual DHCs there is an incentive to not provide this service where it is practical to do so and therefore a service quality regime would be required,

Further, a DH cost-based reference price ensures a national, reasonable price cap that takes DHN-relevant cost development into consideration. This would provide a degree of certainty to DHCs that cost changes that affect the market as a whole would be incorporated into the price that can be charged to consumers, thus providing a more supportive environment than the status quo—meeting 'must' criterion C.

Implementing a DH cost-based reference price would be feasible (as it is a moderate adjustment to the current regulatory regime) and would result in a relatively low administrative burden for both regulator and DHCs—meeting 'must' criterion D.

This option creates incentives for DHCs to invest in sector coupling, efficiency and network integration where there are opportunities for these to reduce costs to those DHCs. This is because the DHCs are allowed to retain the reduced costs as increased profit: as the reference price is based on national costs, the DHCs, which have outperformed, will keep a portion of the cost reductions even after the reference price is rebased. This mechanism contributes to 'should' criteria E–G.

Overall, this option provides a substantial improvement compared with the current regulatory tariff regime in terms of preventing overcompensation and stimulating the roll-out of DHNs. Moreover, it does so at a relatively low administrative burden. However, while providing substantial improvements relative to the current regime, this option is not optimal in terms of the prevention of overcompensation and enabling roll-out of DHNs because there is still a national maximum price (which will be explained in more detail in section 6). As this option meets the criteria best of all the options with low administrative costs, it is considered further in the shortlist.

6. **Comparator-based regulation**: under this option, each network would have a maximum price established by reference to a benchmark. Benchmarks vary depending on a network's characteristics—maximum

prices are, however, not network-specific.[121] This benchmarking approach (also known as yardstick competition) is widely used in different markets, including in the regulation of the Dutch gas and electricity networks.[122] It does not require profitability monitoring by the regulator.

Role of DHCs: DHCs are obliged to report their operating expenditure and capital costs incurred, according to the regulatory accounting requirements.

Role of regulator: the ACM determines the benchmark by ranking the costs of all DHCs (after making adjustments using a statistical methodology for differences in density and scale of network, service quality and source of heat, etc.) and then sets the benchmark at the lowest quartile (or some other percentage) of costs. The benchmark then forms the maximum price that the DHC can charge. This needs to be reviewed for every regulatory period (between three and seven years).

Option assessment

To go from costs to allowed maximum price, further analytical work would need to be undertaken to determine a reasonable rate of return on costs.

This option creates competition between DHCs by ranking their costs, establishing a benchmark and evaluating their costs against this benchmark. This procedure therefore proxies competition and makes it likely that, over time, ‘must’ criterion A (no overcompensation) will be met. This requires that new DHNs will develop only if investors can, in expectation, recover their roll-out costs through regulated price. Generally, the approach introduces competition across networks and is intended to provide efficiency incentives for DHNs.

The potential for extra cost allowances depending on service quality (delivered by including service quality in the benchmarking) explicitly incentivises DHCs to provide such high service quality—meeting ‘must’ criterion B.

Comparator-based regulation invites more efficient firms to enter the DH market or expand respectively as DHCs performing better[123] than the benchmark can earn additional returns—meeting ‘must’ criterion C. Firms performing at the efficient level can earn reasonable returns (in expectation).

The regulatory burden of this option is significantly higher than the status quo as it requires the regulator to undertake additional analytical work and for the DHCs to provide detailed cost information in a way that complies with regulatory accounting requirements set out by the regulator. This would be particularly notable when initially setting up such a regulatory regime. The benchmarking exercise will continue to be a regulatory effort to be undertaken by the ACM during each tariff review. However, the costs of maintaining this model (unlike option 7) are likely to decline over time. Nevertheless, this is an approach that has been shown to deliver benefits[124]

[121] This approach could result in different maximum prices for DHNs that are owned by one DHC, if the DHC’s portfolio includes DHNs with very different network characteristics.
[122] ACM (2017), ‘Incentive regulation of the gas and electricity networks in the Netherlands’, May.
[123] This can refer to cost efficiency but also, among other things, the use of low-carbon heat sources.
[124] For example, over c. 20 years, electricity distribution charges have halved while transmission charges decreased by 41% under the incentive-based regulation in Great Britain. See Ofgem (2008), ‘Alistair Buchanan speech at SBQI’, 6 March. Ofgem’s ‘RPI at 20’ project’, p. 11.

and the additional administrative burden may be proportionate. Therefore, ‘must’ criterion D is met (at least, pending further development in section 6).

Ultimately, when assessed against criteria A–G, this option performs well. The trade-off is the additional administrative burden (compared with the status quo)—‘must’ criterion D. However, we still consider this option to be feasible in the long term.

7. **Engineering-economic ‘network reference model’**: under this option, DHNs are allowed to charge costs up to a specified, network-specific benchmark.

   Role of DHCs: this regulatory approach would not require any action from the DHCs.

   Role of regulator: the ACM would base the benchmark on a model based on economic/engineering principles that determines the costs of a hypothetical efficient network (in contrast to the comparator-based regulation, where the benchmark is determined with reference to other DHNs’ actual costs) and analytical work to determine the allowed return on those costs. This approach does not involve cost or engineering data from the DHCs. The benchmark then forms the maximum price that the DHC can charge. This needs to be reviewed for every regulatory period (between three and seven years).

   Option assessment

   Option 7 relies on engineering expertise to ensure against overcompensation—meeting ‘must’ criterion A. It is possible, in principle, to include cost items based on the quality of service in such models, although this is relatively unusual in our experience and including them would make the modelling exercise more complex. However, it seems plausible that ‘must’ criterion B could be met.

   However, the upfront and ongoing costs of developing and maintaining such a model would be significant, and dealing within the model with the wide range of heat sources and other types of variation within DHNs (such as scale and network structure) would seem likely to result in a lack of incentives to expand efficiently if the model does not accurately reflect the circumstances of the DHCs. This option therefore seems unlikely to meet the ‘must’ criteria C and D and is therefore not considered further.

   Unlike option 6, the costs of maintaining this model are unlikely to decline over time, as the model based on economic and engineering principles would require continuous updating for new heat sources, technological progress and other market developments in order to accurately reflect the reality that DHCs are facing. Option 6 will entail a lower continued administrative burden as the inputs to the model need to be updated but the model itself would remain more or less the same.

8. **Rate of return regulation**: DHCs (or DHNs) would be able to set prices[125] subject to the limitation of an imposed rate of return.[126] The regulator has the power to enforce this level on the rate of return through a legal regulatory instrument.

[125] Either network-specific or on a portfolio level
[126] The ACM would need to assess both the DHC’s internal rate of return/ROIC and provide the weighted average cost of capital as a benchmark.

Role of DHCs: DHCs are obliged to report their costs and annual rates of return on a network level, according to the regulatory accounting requirements.

Role of regulator: the ACM determines a reasonable level of rates of return in the beginning. It further needs to review the realised rates of return for each DHC (or DHN) annually.

Option assessment

Option 8 would avoid overcompensation of DHCs—meeting 'must' criterion A—while also providing a feasible regulatory option, involving a low administrative burden ('must' criterion D).

However, this type of rate of return regulation can set wrong incentives for companies. Firms have the incentive to significantly increase their costs, so that they can collect the set rate of return on these costs—achieving higher regulated total returns. Generally, this is considered to be 'gold-plating'.

Like option 2, this option offers a regulatory approach that either requires substantial upfront investment from the regulator and the DHCs (for example, in understanding the rate of return that would be considered 'reasonable' from an ex post perspective) or introduces significant regulatory uncertainty (if the DHCs do not know what would be considered 'reasonable'). When the regime is established, the ongoing administrative burden is likely to be relatively low but the uncertainty would remain.

Further, it does not meet 'must' criteria B and C (incentivising DHCs to deliver high-quality services and encouraging entry/expansion) for the same reasons as option 2. It is therefore not considered further.

DHCs option: some of the larger DHCs have provided an alternative suggestion for a regulatory tariff regime. We have considered and discussed this option extensively with the DHCs involved and have concluded that it is largely similar to rate of return regulation as described here. Hence, it also provides incentives for 'gold-plating' and does not meet 'must' criteria B and C. Therefore it is not considered further.

9. **Network-specific, incentive-based regulation**: DHNs would propose outputs (such as customer satisfaction scores) and cost reduction incentives as part of a business plan. This business plan would be reviewed and approved by stakeholders. The precise responsibility could sit with a number of parties (municipalities, the EZK, one of the EZK's supporting technical institutions) and has not been determined at this stage. This approach would result in a price cap per network based on network-specific costs.[127]

   Role of DHCs: DHCs would propose outputs and cost reduction incentives as part of a business plan on a network level.

[127] This option imposes a price cap, just like the other options. DHN operators would be able to price below the cap if they wished. However, since the price cap for each DHN is based on the costs (including a reasonable return) of that network, it is most likely that DHNs will price up to the cap. Hence, the price cap will serve more as an imposed price in practice. Throughout the rest of this report, it is assumed that the price cap under each of the tariff regulation options will be the price charged in practice.

Role of regulator: from precedent elsewhere,[128] it would be likely that the regulator would conduct benchmarking and cost of capital studies, similar to option 7, to test the evidence being put forward by the DHCs.

Option assessment

Option 9 is the most interventionist option from the wide spectrum of regulatory approaches. The price regulation based on the network-specific characteristics is likely to ensure against overcompensation of DHCs—meeting 'must' criterion A. It is also likely that 'must' criterion B is met, since the quality of service is part of the outputs considered by the stakeholders when setting the network-specific price cap.

This regulatory option also creates incentives for appropriate expansion as it provides clarity on the cost recovery mechanism and the reward for delivering certain pre-specified outputs, such as low-carbon heat sources—meeting 'must' criterion C.

However, the regulatory burden for this option would be relatively high compared with the other options as, not only would the regulator need to undertake the analytical work outlined for option 8, but the DHCs and stakeholders would need to engage on the company business plan. While any regulated business would be expected to engage with stakeholders on its business plan to a certain extent, this option envisages a formal role for those stakeholders in approving the business plan, which is clearly a more intensive process that would place a higher burden on the DHCs and those stakeholders. When balanced against the benefits of this option, however, it is not clear that the burden is unacceptable, at least not until further analysis is conducted in section 6. In terms of feasibility, while the DH sector has differences from other energy sectors in the Netherlands and the same sector in other countries, this approach is widely used for the price regulation of infrastructure assets and it is therefore likely to be feasible in the long term. For the purpose of this initial shift, 'must' criterion D is therefore considered to be met.

'Should' criteria E–F, providing incentives for innovation, network integration and sector coupling, are also likely to be met with this approach. For instance, sharing mechanisms as a cost-reduction incentive, can incentivise innovation that results in efficiency gains. The resulting additional profits in this scenario are shared between consumers and the respective DHCs, such that an incentive to constantly innovate remains ('should' criterion E).

Overall, when assessed against criteria A–G, option 9 performs well. The trade-off again is the additional administrative burden (compared with the status quo)—'must' criterion D. However, we still consider this option to be feasible in the long term.

5.4.1 Summary

Having assessed each of the longlisted regulatory options against criteria A–G, only option 5 ('DH cost-based reference price'), option 6 ('Comparator-based regulation') and option 9 ('Network-specific, cost-based regulation') will be considered in the shortlist in the next section.

[128] Incentive regulation is used to regulate a large number of German electricity and gas networks. See Bundesnetzagentur website, 'Anreizregulierung von Strom- und Gasnetzbetreibern', https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/Netzentgelte/Anreizregulierung/anreizregulierung-node.html.

6 Shortlisted alternatives to the gas reference price

After assessing the longlist against the criteria established in section 5.4 and concluding a shortlist of three options, this section explains these price-setting methodologies in more detail and adds complementary policies—forming three regulatory packages.

Any of these options could be implemented in a range of ways and there are many details that would need to be determined in due course. This section does not attempt to provide a comprehensive summary of these options, but rather to identify the key parameters that the regulatory design would need to consider, outline potential approaches that would be likely to achieve the EZK's policy objectives as outlined in section 5.2, and illustrate the practical details of each option. Other approaches could be adopted and would need to be considered as the Heat Act 2.0 is developed and the regulatory packages are implemented. The choice of a regulated tariff structure would be an additional regulatory measure that could be implemented independently in parallel to the price-setting methodology or the regulatory package.

Box 6.1 Tariff structure

The question of the tariff structure—such as the number and share of fixed and variable tariff components—can be addressed similarly for the three shortlisted options. Since DHCs need to finance the construction of large fixed assets (the DHNs), a large share of the tariff being fixed would reduce the risk that investors bear in financing such long-term investments. At the same time, consumers may prefer a larger share of variable costs reflecting their consumption so that they have greater control over their bills. More consumption-reflective DH pricing allows consumers to be demand-responsive to the current level of DH tariffs. For example, a largely flexible tariff structure would strongly incentivise (and perhaps excessively so) consumers to use alternative heat sources (e.g. from heat pumps) or reduce their use of heat. Such behaviour would reduce the utilisation of the DHNs and introduce risk for DHCs and their investors.

The EZK policy is to foster the accelerated roll-out of DHNs across the Netherlands to facilitate the decarbonisation of heat. Therefore, we consider that the decision on tariff structures could be left to DHCs (to give them the opportunity to reduce their risks), subject to some 'code of practice' (to make sure consumers understand the implications of the tariff structures, thus enhancing transparency and consumer acceptance).

In addition, much heat generation in DHNs is currently reliant on fossil fuel, and this heat generation and its associated costs can be adjusted to changes in the volume of DH heat demanded (and can therefore be considered a flexible costs component). However, the envisaged future development of DHNs will increasingly use residual heat and geothermal as heat sources, which are harder to flex with user volumes.

Another consideration, however, is that the resulting tariff structure (which is likely to largely rely on a fixed tariff component) reduces the volatility of DH tariffs over time compared with a purely variable component. This may also be perceived as beneficial to consumers.

The approach of cost type-reflective tariff regulation advocated in this report allows for different shares of fixed and variable tariff components across the Dutch networks.

Source: Oxera.

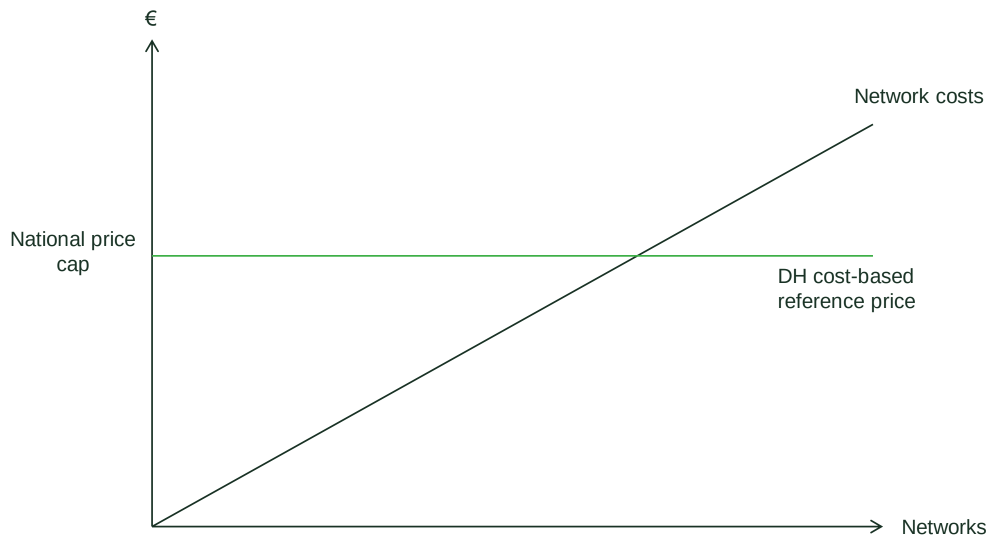
6.1 DH cost-based reference price

Under this option there is a national maximum price (i.e. one, single national price) for all DHCs calculated with respect to a base price established at a given point in time that is escalated according to a weighted index of DH costs. As a result, and compared with the status quo, the cost-based reference price would be expected to more closely (but not perfectly) reflect the efficient cost of delivering heat to consumers. In more detail:

- the base price would be based on the level of the gas reference price at the time the legislation enters into force for existing properties, or set at the time of connection for new properties;
- once per control period, the ACM could conduct a review to assess whether DHNs are earning 'excess returns'. This would provide information on whether the DH cost-based reference price provides the desired results;
- the index would be based on one or more price indices and weighted to reflect the costs of DHCs. It would be subject to review by the ACM every five years (or a different period);
- there would be no mechanisms by which efficiency incentives would be shared with customers.

The figure below illustrates how option 1 would function. Imagine all hypothetical networks are aligned in increasing order of cost (reflected by the 'network costs' line). The maximum price that any network can charge is set by the horizontal line (the 'national price cap'). Some networks therefore can have costs above the potential revenue line and some below.

Figure 6.1 Option 1 detail



Source: Oxera.

Under this option, some sort of socialisation or subsidies could be introduced to reach a higher level of DH roll-out. That is, for some networks, costs exceed the option 1 price. Hence, if these higher-cost networks still need to be established in order to meet certain roll-out targets, DHCs will need to receive some subsidy to make sure the business case for these networks is positive. Essentially, the BAK currently has this function. By introducing an explicit subsidy scheme—where DHCs would need to provide information on the cost level of certain networks to determine the required subsidy level—the BAK could be replaced by something more accurate, transparent and cost-reflective.

6.1.1 Calculation detail

The price cap for the DH cost-based reference price would develop in the following way:

Price cap = (price cap last year) x (index)

The initial price cap could be set with reference to the (revised) gas reference price at the time of transition, or a (revised) gas reference price that excludes energy taxation.

The index could be flexibly formed from a large number of factors driving costs. To illustrate:

index = a.[change in unit wage costs from previous year]

+ b.[change in input costs from previous year]

+ c.[change in economy wide inflation from previous year]

+ …

a, b, c, … are weights to be determined by the ACM with reference to average DHN costs. The more cost drivers that are included in the index, the more DH cost-reflective the escalation of the price cap will be.

Inflation indices can be obtained from CBS (or other sources), while additional data on the costs of DHNs would need to be sourced from the regulatory accounts of the DHCs.

Under this price-setting methodology it is particularly important to consider how long such a price cap is implemented for. The choice of the duration of the regulatory cycle affects the DHCs in several ways, including the incentives set to outperform against the determined price cap and the uncertainties the DHCs are facing.

Box 6.2 Pros and cons of different length regulatory cycles

There are a wide range of precedents for different length regulatory cycles:

- it is common for regulatory cycles to last for five years (also applied to Dutch electricity transmission and distribution);
- some examples of shorter cycles: Copenhagen Airport, Northern Ireland Water, Dutch telecoms and post;
- some examples of longer cycles: energy transmission and distribution in Great Britain, Gatwick Airport.

The table below summarises some of the **pros and cons of longer regulatory** cycles.

Pros	Cons
Greater certainty over prices	Greater forecasting uncertainty
Lower regulatory burden and administrative costs	Company may be exposed to greater risks associated with factors outside its control
Stronger incentives to make efficiencies if they are retained for longer	This may result in a higher cost of capital
Potential to incentivise a longer-term perspective (e.g. regarding investment decisions)	Risk of resulting in a greater administrative burden if mid-period reviews turn into full price review

Source: Oxera.

6.1.2 Treatment of sources

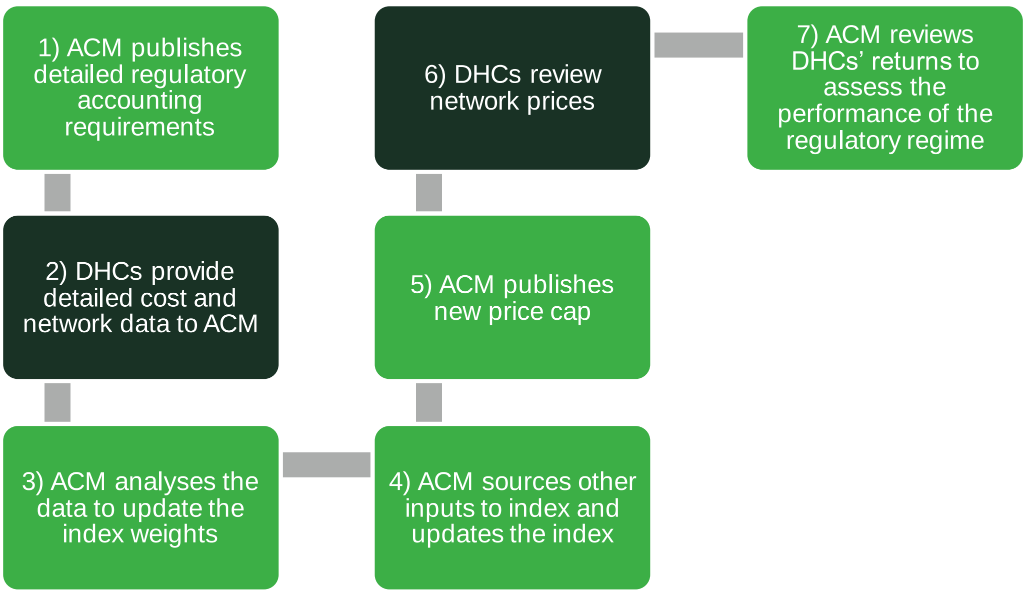
Under this option, the national evolution of the costs of different sources would be reflected in the development of the index (either through the prices charged to DHCs by independent generators, disclosed through the DHC regulatory accounts; or through the costs incurred by the DHC in the generation, also disclosed through the DHC regulatory accounts). So, for example, if a DHC purchases heat from an independent generator, the cost of those purchases would be disclosed through the regulatory accounts along with all the DHC's other costs. As these costs evolve, so can the weights in the cost index. For example, in the case that the cost of purchasing heat increases over time for all DHCs, then the cost of heat purchase would receive an increased weight in the cost index.

However, if a DHC generates its own heat then the costs incurred in that generation will also be disclosed through the regulatory accounts and a similar process can be followed. For example, if the price of source material becomes a more important component for all the DHCs then the weight that this receives in the cost index would increase.

6.1.3 Summary of price control process

Figure 6.2 illustrates the interactive process between the regulator and the DHCs under this regulatory option.

Figure 6.2 Illustrative process in a price control period under a DH cost-based reference price



Note: The process starts over again at the start of a new price control period, every few years.

Source: Oxera analysis.

As shown in Figure 6.2, this option provides for a relatively low administrative burden on both the ACM and the DHCs. Every control period, the ACM would be responsible for collating data submitted by the DHCs (provided through regulatory accounting requirements set by the ACM) and analysing that data. The ACM would identify relevant cost drivers, such as electricity prices, labour cost and inflation. It would then need to update the index weights: this would essentially consist of understanding the aggregate weights of the different cost drivers (which could either be relatively simple and use only a few cost drivers, or much more complex, depending on the desired trade-off between complexity and accuracy).

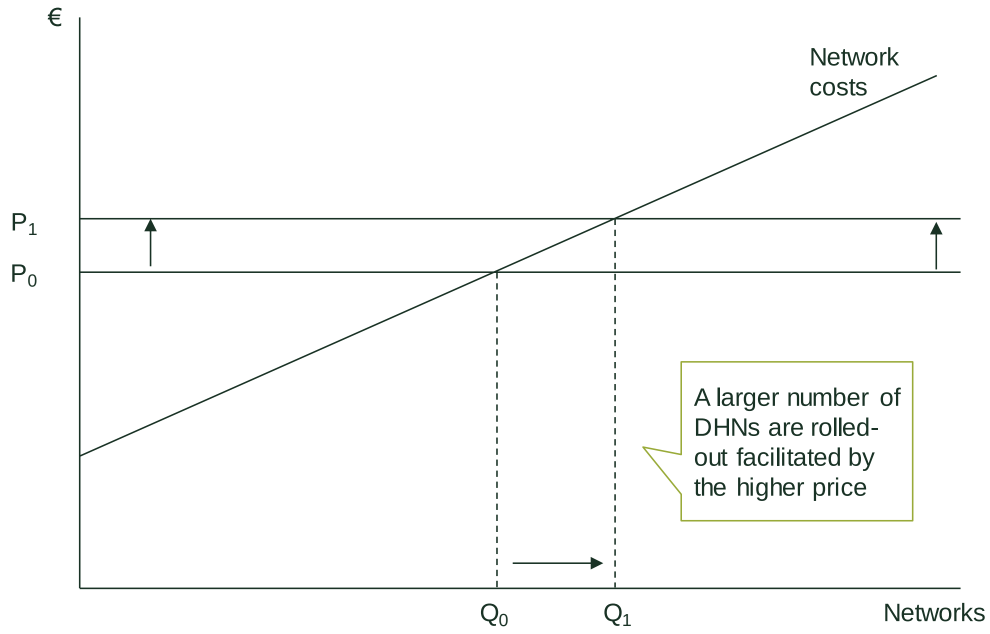
The ACM would then collate the necessary forecasts for the inputs to the index, publish the index and provide the national maximum tariff. The DHCs would review network prices accordingly.

6.1.4 Overall assessment

This option would provide a relatively low administrative burden and begin to address the risk of overcompensation. However, it cannot guarantee that no DHC receives overcompensation. The use of a single national price has the major drawback that it does not reveal the cost of DHN in a local region. Since it is likely that DHCs price up to the cap under option 1 (because they currently do so as well, see section 4.2.2), this has the following consequences:

- it does not provide transparency for customers on how their price is calculated (it is more transparent than the current regime because national prices are linked to national costs, but does not link the price in a smaller region to the costs in that region);
- it does not enable consumers and municipalities to take efficient decisions about whether a DHN is the right choice for them because prices do not reflect local conditions;
- it complicates the targeting of any government incentives to roll out DHNs because the high-cost networks cannot be readily identified.[129] This means that to facilitate the roll-out of additional networks, which may exhibit higher development costs, the overall, national price level will need to be increased, as illustrated in Figure 6.3 below.

Figure 6.3 Incentivising roll-out with national price



Source: Oxera analysis.

This figure provides an illustrative example: imagine that all the actual and potential DHNs are arranged in increasing order of cost (reflected in the increasing 'network costs' line). For any given price ('reference price (old)')

[129] The underlying assumption is that the reason why some DHNs are currently not yet rolled out, is that their development would be more costly. This may be due to features such as low connection density or unfavourable topography.

then a certain number of networks (‘networks (old)’) will be commercially viable.

If there is a single price then, for new networks to become feasible, the price charged across all the existing networks will also need to increase, making it hard for consumers and municipalities to take efficient decisions about which heat technology to invest in. Under this option, there is therefore a trade-off between the prevention of overcompensation and incentivising the roll-out of new networks.

6.2 Comparator-based regulation

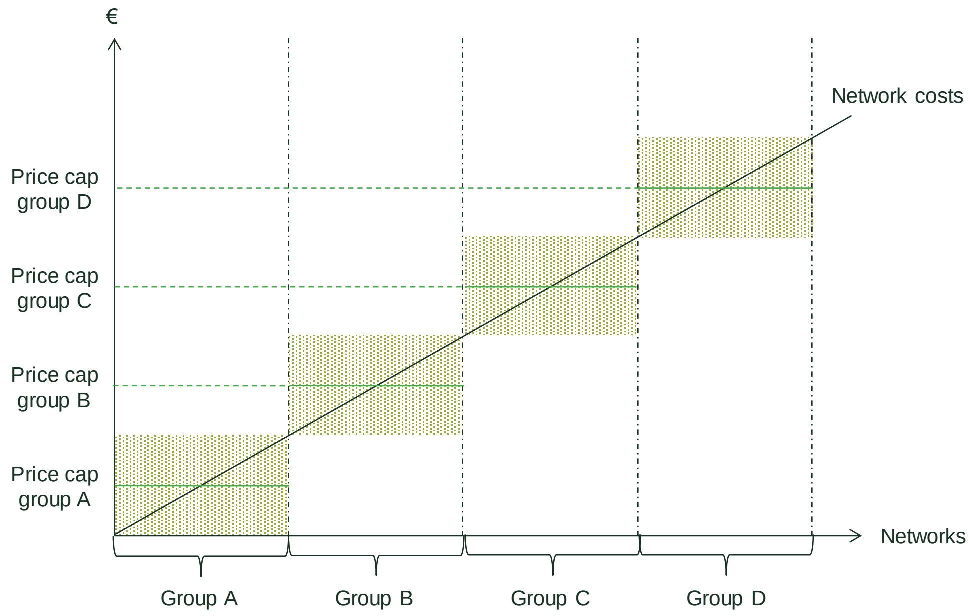
Under this option, DHCs are allowed to charge prices up to a maximum benchmark price. This benchmark would be set by ranking the costs of all Dutch DHCs and then setting the benchmark at the lowest quartile (or some other percentage) of costs plus an allowance for a reasonable rate of return. The methodology would need to allow for adjusted cost allowances due to differences in density and scale of network, service quality and source of heat, which can be done through the statistical modelling that determines the benchmark.[130] For comparator-based regulation to work effectively in practise, it is essential that there is enough good quality data available to perform such an exercise adequately. We expect the number of heat networks (and therefore the number of datapoints) to be sufficient to be able to do so.[131]

The figure below explains how this option would work visually: each network is grouped together with a number of comparable networks and the allowed prices set at a particular level within this group.

[130] The basis of this is a statistical model which explains costs as a function of explanatory variables (i.e. the cost drivers of DHNs identified by the ACM). Heat sources could constitute an explanatory variable which would allow for differences in costs incurred by DHCs. Among others, this option would require ACM to formulate regulatory accounting requirements, which allows it to gather the data from DHCs needed to conduct the benchmarking analysis in a standardised and consistent manner. There are a number of ways in which this approach could be implemented and this will need to be established by future studies.

[131] Currently, there are approximately 13 large and 6,900 small DHNs in the Netherlands (Climate Change (2018), ‘Lessons from European regulation and practice for Scottish district heating regulation’, p. 23). With the envisaged growth of the Dutch DH sector (Rijksoverheid (2019), ‘Climate Agreement’), the number of DHNs—and therefore the number of datapoints—is expected to increase in the upcoming years. This tools available for benchmarking are unchanged by a large number of networks.

Figure 6.4 Option 2 detail



Note: there are four groups presented for illustration only: the precise number of groups will be determined within the benchmarking analysis and are likely to be substantially more given the heterogeneity of the DHNs.

Source: Oxera.

This option:

- would require the development of a benchmarking methodology based on DH network cost driver information. In turn, this would require development of detailed and standardised regulatory accounting guidelines, with regulatory accounts compiled for each network;
- would impose a substantially increased administrative burden.[132] It would therefore be reasonable to exempt very small DH networks from this regime (‘de minimis’, in terms of scale), for example, networks with a single source of heat and serving fewer than 50 properties. A network qualifying for this de minimis exemption might only be required to file a simplified set of regulatory accounts; be a member of a ‘trusted trader’ scheme, which requires the network to sign up to a code of conduct; and publicise the contact details of the ACM for customers to complain to. The threat of regulatory enforcement might be sufficient to mitigate the risks of overcompensation for these very small networks. Of course, there would be substantial discretion available to the EZK and the ACM on the design of this exemption.

Analysis would determine to which group[133] a DHN is allocated, based on the physical characteristics of the network, the heat source, the quality of the service and other factors which are determined in the benchmarking analysis. Moreover, the benchmarking analysis consists of an assessment on the existence of outliers, along with determining whether any special cost

[132] The regulatory burden under this option largely consists of ex ante efforts.
[133] There are multiple ways in which the benchmarking exercise could be conducted in practise. Determining groups is only one of them, which is used as an illustrative example here.

allowances should be made due to the physical characteristics of those DHNs identified as outliers.

Municipalities and ACM have an important role in preventing strategic behaviour of DHCs. Such strategic behaviour could take the form of manipulating network configuration–or any other efforts that do not serve public interest–to fit into one benchmark category or another.

Under this option, being above the benchmark in terms of cost efficiency would result in greater financial performance. Hence, innovation to reduce costs is incentivised. Since prices reflect costs, these cost reductions are passed on to consumers at the next price control review. Product/service quality measurement can also be included in the benchmarking methodology—this would stimulate innovation to improve quality as the DHNs would receive a reasonable return on any costs incurred in improving product quality.

Because prices reflect costs, mitigating the risk for DHCs that they are not able to recover their costs, we consider there should be no need for an unregulated BAK under this option.

6.2.1 Calculation detail

The price cap under a comparator-based regulation would develop as follows:

Price cap = set based on a percentile of comparable networks' costs

+ a reasonable rate of return

To determine the distribution of comparable networks' costs, DHNs would supply detailed cost and network data to the ACM—in a format specified by the ACM according to specified regulatory account requirements set by the ACM. The ACM would then analyse this data using one or more statistical techniques (e.g. COLS, DEA, SFA—see box below) that attempt to account for key drivers of costs (such as network size, connection density, heat source) to determine the distribution of costs for comparable networks. The ACM would then set the percentile of allowed costs, which would determines the allowed cost for each network.

Box 6.3 Benchmarking approaches

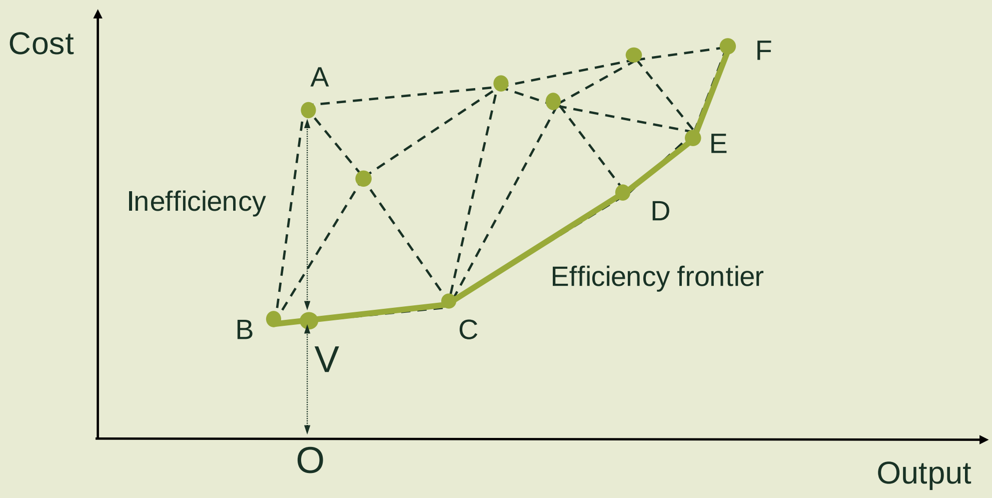
Data envelopment analysis (DEA)

A mathematical, non-parametric approach, DEA is one of the most widely used approaches internationally when benchmarking regulated companies. For example, the DEA approach is used to determine the price cap of Dutch–German electricity transmission company TenneT. DEA is a frontier-based approach, in that it measures efficiency by reference to an efficiency frontier, which is constructed as linear combinations of efficient companies—i.e. companies that produce the most output at the lowest cost levels.

In more detail, DEA assumes that two or more companies can be 'combined' to form a composite producer with composite costs and outputs—a 'virtual company'. These virtual and actual companies are then compared with each other. If the virtual company is better than the original, because it achieves the same output with fewer costs, the original company is judged to be inefficient. DEA selects the efficient observations and constructs a frontier from them, ignoring those observations that turn out to be inefficient (i.e. the frontier is defined by the efficient companies only).

In the example in the figure below, the DEA frontier is given by the line joining points B, C, D, E and F. The efficiency of company A is given by the distance from A to point V. Point V is a 'virtual company', made up of a weighted average of frontier companies C and D, such that V has the same quality level as A. Companies C and D are referred to as A's 'peers', with C clearly being given a much higher weighting than D.[1]

Graphical example of DEA



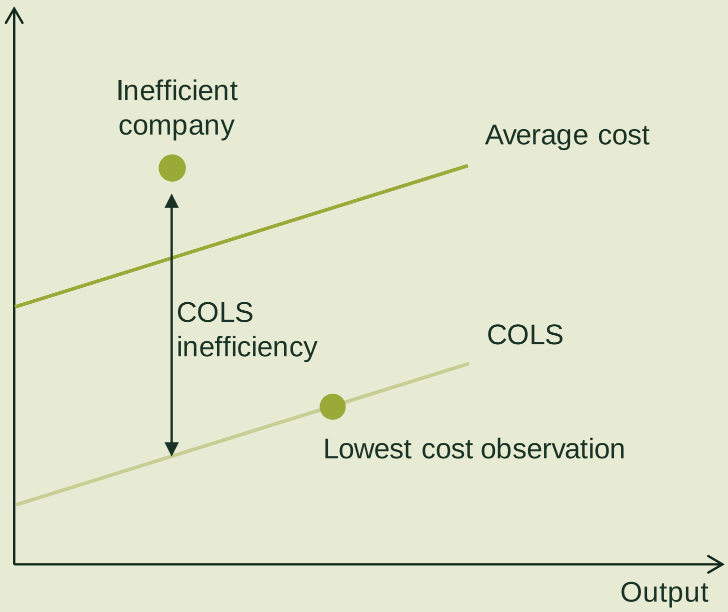
Source: Oxera.

DEA has been used in Finland, Norway and Germany, among other places and sectors.

Corrected ordinary least squares (COLS)

COLS is an econometric approach based on a simple regression model (i.e. ordinary least squares). Like DEA and SFA, it is a frontier-based approach; the frontier is derived by shifting the line of best fit from the estimated cost function[2] of the industry (itself derived by OLS), so that instead of representing the average cost of the industry, the line represents the efficiency frontier. This shift is based on either the maximum negative residual of the regression model, resulting in the pure COLS frontier; or a function of the residual sum of errors of the regression models, resulting in the modified OLS (MOLS) frontier. Alternatively, an ad hoc adjustment of either the COLS or MOLS frontiers may be applied (see the figure below).

COLS frontier and efficiency



Source: Oxera.

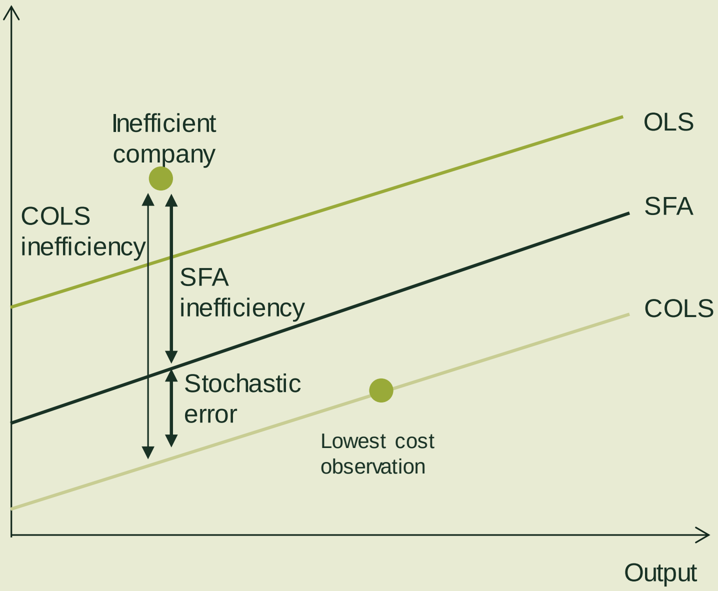
COLS has been used extensively in the UK.

Stochastic frontier analysis (SFA)

One of the main weaknesses of the COLS approach is that it assumes that any difference between a firm's observed costs and the regression line (i.e. the residual) represents inefficiency. It does not account for any stochastic error or noise in the model, such as measurement error, which affects the size of the residual. COLS may therefore impose harsh targets when the stochastic error element of the residual is large–this also means that the COLS method strongly relies on the availability of complete and detailed data.

SFA is an econometric technique that attempts to distinguish between random error and inefficiency in the model. By assuming a distribution for the inefficiency and the random error components of the residual,[3] SFA is able to decompose the residual term into inefficiency and noise, and thereby identify the relative inefficiency of each firm in the sample. SFA can also test for the presence of inefficiency.[4] The figure below illustrates the difference between the COLS and SFA techniques for estimating inefficiency.

Estimating inefficiency using COLS and SFA



Source: Oxera analysis.

SFA has been used in the UK and Finland.

Note: [1] For a more detailed discussion on DEA, see Thanassoulis, E. (2001), *Introduction to the Theory and Application of Data Envelopment Analysis: A Foundation Text with Integrated Software*, Springer. [2] Or, indeed, the production, revenue or profit function, depending on the goals of the analysis. [3] The stochastic error component of the residual is assumed to be normally distributed. The inefficiency component may be half-normal, truncated or exponentially distributed. [4] For a more detailed discussion on SFA, see Kumbhakar, S.C. and Lovell, C.A.K. (2003), *Stochastic frontier analysis*, Cambridge University Press.

Source: Oxera (2011), 'How can the NMa assess the efficiency of TenneT?', 16 June.

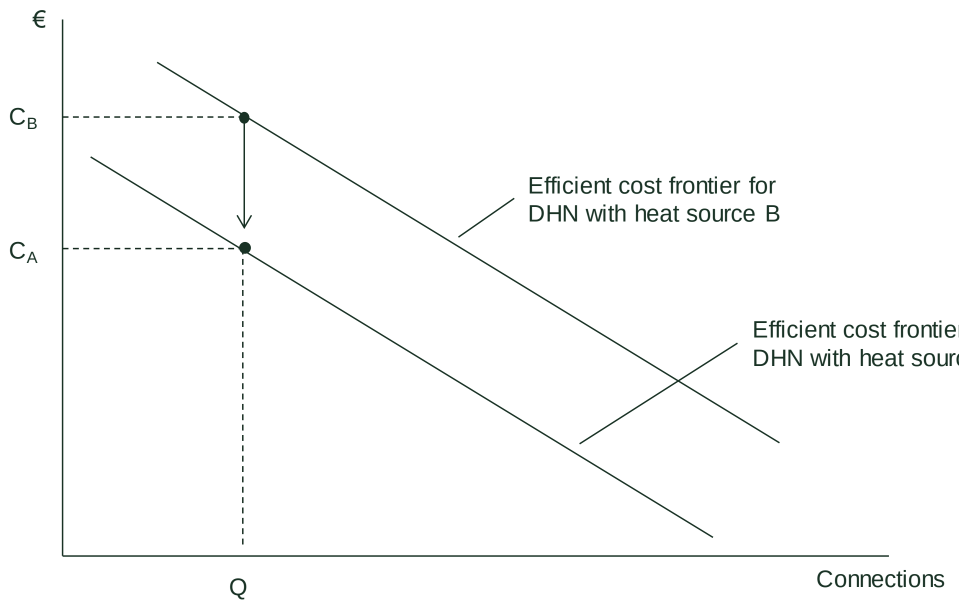
The allowed rate of return would be determined by the ACM, which would conduct a study on the cost of capital for the sector. It would then provide a determination on the allowed cost of capital for the sector, which could vary by network characteristics.

6.2.2 Treatment of sources

As each type of source would have a different cost, the benchmarking approach would incorporate the source of heat as a factor to allow for in determining the efficient costs of a DHN—i.e. a DHN with a high-cost source such as geothermal would not be disadvantaged compared with a DHN that used a low-cost source such as waste heat from an industrial plant. Similarly, where a DHN procures heat from an independent supplier, it could be compared with a DHN that produces its own heat to assess whether there is a systematic difference in costs that should be allowed for in the benchmarking.

Figure 6.5 illustrates this by comparing two DHNs with different heat sources. The regulatory methodology accounts for the different heat sources, such that the respective efficient cost frontier changes accordingly.

Figure 6.5 Adjusting cost allowances depending on heat sources



Source: Oxera analysis.

This approach is similar to the treatment of other characteristics of the DHN, for example changes in network temperature.

6.2.3 Impact on existing customers of network expansion

Since a DHN's prices are set with respect to the prices of other, similar, DHNs, under this option, the impact of a network expansion would depend on whether an allowance, based on the information derived from the RAR, is made within the benchmarking methodology for whether a network is expanding. To facilitate the deployment of new networks, it is likely that higher cost allowances would need to be made for network growth.[134] Alternatively, robust projections of the future costs and condition of the network could be used for the benchmarking. Therefore, the costs of a network expansion would be spread across existing customers: DHNs would need to consider the affordability of any tariff increases that arose from investment plans.

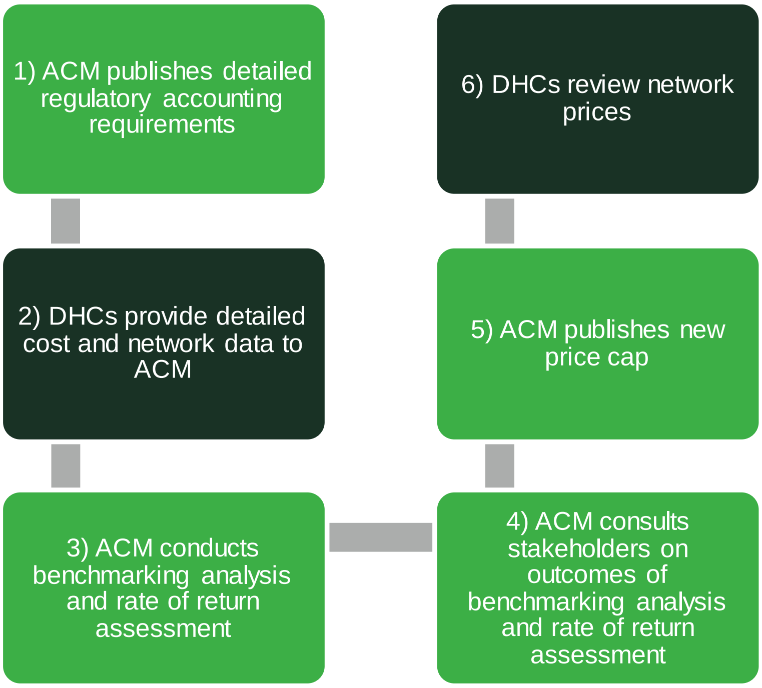
Should the number of connections to the network decrease (for example, due to consumers leaving the network), then this will be reflected in the treatment of that network within the benchmarking process.

6.2.4 Summary of price control process

Figure 6.6 illustrates the interactive process between the regulator and the DHCs under this regulatory option.

[134] Alternatively, the WACC, determined by the ACM, could reflect a higher reasonable rate of return for DHNs in the first 20 or 30 years to reflect the increased uncertainty that investors face.

Figure 6.6 Illustrative process in a price control period comparator-based regulation



Note: The process starts over again at the start of a new price control period, every few years.

Source: Oxera analysis.

As shown in Figure 6.6, this option implies a greater administrative burden than option 1. In particular:

- the ACM would need to specify regulatory accounting requirements; develop, maintain and apply a benchmarking methodology to determine the allowed level of costs; and determine the allowed rate of return;
- the DHCs would need to provide detailed accounting data and engage with a wider range of technical analysis from the ACM than what has historically been the case (although the types of studies are widely conducted in economic regulation in many jurisdictions, including that of the ACM).

Given the additional complexity and technicality of this approach, it is expected that the ACM would consult stakeholders to a greater degree than for option 1. While this would increase the administrative burden on both the ACM and the DHCs, it would be likely to improve the outcomes of the process significantly. The administrative burden would be likely to be greater for this option while the regime is being set up: when the technical studies and their inputs have been in operation for a period of time, it is likely that they would become more familiar to the ACM and DHCs and therefore impose a lower administrative burden.

6.2.5 Overall assessment

This option would provide an ongoing incentive for DHNs to increase their efficiency (and quality if that is accounted for in the benchmarking methodology), since beating the benchmark (e.g. by being above average in terms of cost efficiency) would result in greater financial performance. In the status quo and option 1, there is no comparable ongoing incentive to improve cost efficiency.

The efficiency incentive provides an incentive for networks to reduce their costs by other measures than cost efficiencies as well, for example by targeting further operational improvements and integration with adjacent networks. Given that network integration could help to achieve greater scale in terms of network development, as well as heat generation or purchasing, this would be a further benefit compared with the status quo.

Furthermore, since prices are cost-reflective to a large extent under this option, both small users and DHCs will benefit from efficiencies and cost reductions.

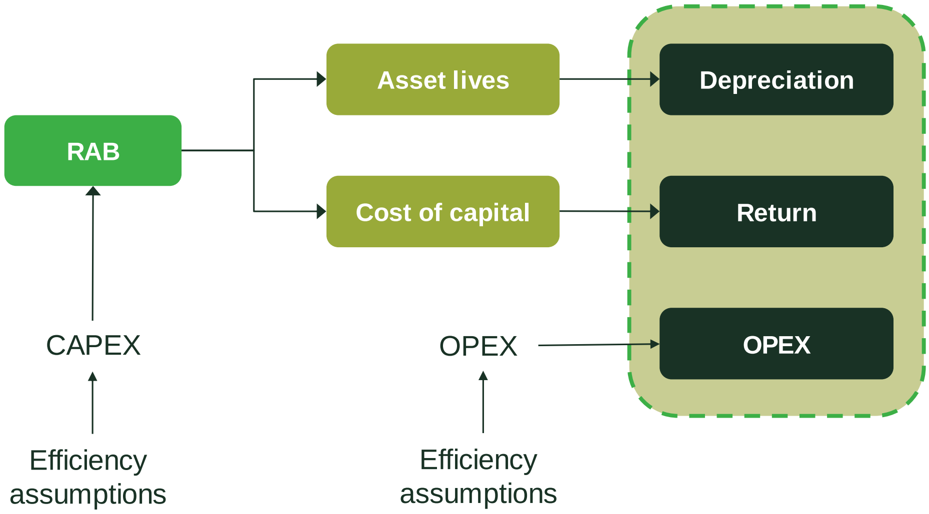
To the extent that smaller DHNs located in areas where the economic viability for DH is marginal, these DHNs would also have higher costs than the efficiency benchmark: although this would be mitigated by the benchmarking methodology, which should capture many measures of costs that are outside the DHCs control. It may be that the fully cost-reflective price would be considered ‘too high’ to be affordable, but this is outside the scope of this report. In any case, these networks would be clearly identified and support could be targeted at them if thought to be appropriate. For example, socialisation in the form of subsidies–and/or cross subsidies from low-cost DHNs–to high-cost networks could be introduced to keep prices to consumers at a level which is considered reasonable and mitigate undesired price differences.

6.3 Network-specific, incentive-based regulation

The network-specific, incentive-based regulation provides a DH price cap that accurately reflects the efficient costs of providing heat, while also providing incentives to deliver additional or incremental outputs that are valued by consumers or are otherwise aligned with policy objectives (output-based regulation). These alternative policy objectives could include accommodating low-grade, low-carbon heat sources in part by moving to low temperature DH networks, allowing new connections previously avoided by heat suppliers, network integration, sector coupling, etc.

Under this option, a DH price cap is established for each DHN based on the efficiently incurred costs of that network. In common with other network industries, investments in infrastructure would be remunerated using a RAB on which an allowed rate of return would be earned. As illustrated in Figure 6.7, the DHCs’ incomes would be based on the sum of operating costs (OPEX), depreciation, and a return on the RAB, subject to an assessment of efficient costs through benchmarking (as in option 2).

Figure 6.7 Allowed income of DHC in option 3

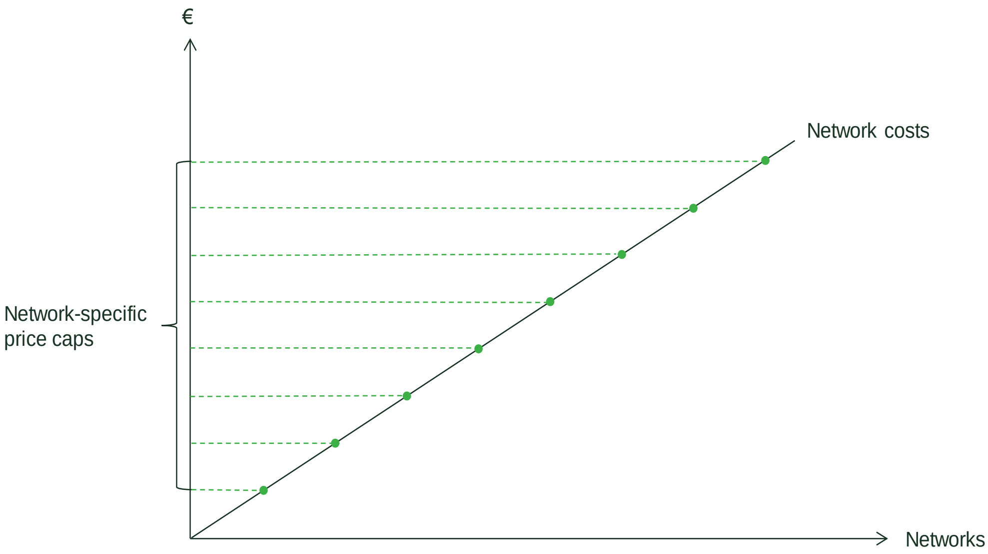


Source: Oxera.

This approach is likely to be significantly more resource-intensive than the other options because of the need for a business plan to be discussed and agreed between the DHNs and the appropriate regulatory authority (this regulatory authority could be the ACM, with appropriate support from the Netherlands Enterprise Agency (RVO), or it could be municipal/provincial/national governments with support from Expertise Centrum Warmte (ECW) or RVO.

The figure below illustrates how this approach would work.

Figure 6.8 Option 3 detail



Note: For illustration only.

Source: Oxera.

As can be seen from the figure above, each network has its own price cap.

This regulatory model would provide a number of important benefits:

- no overcompensation of DHCs as prices would be directly related to past expenditures and an appropriate risk-adjusted rate of return, or weighted average cost of capital (WACC);
- efficiency incentives would be provided through regular benchmarking of expenditures;
- raising financing for incremental investments would be facilitated by regulated RAB receiving a regulated return over the asset's full lifetime—which often spans several decades. This means that today's investments are partly remunerated through charges to future customers, whose opportunities to switch to alternative service providers are likely to be effectively curtailed by there being only one provider for an essential service;
- the use of a RAB makes it more straightforward to incorporate a profile adjustment for revenues to ensure that the retail prices of new DH networks are affordable;
- the network operator would propose output incentives as part of a business planning process that are agreed with a regulatory authority or municipality/provincial/national government, thus facilitating innovation that is agreed between the DHN and its customers/stakeholders. Any outperformance against the targets would then be shared between the operator and consumers. It would be important that there is a clear valuation of the incremental outputs (e.g. in welfare terms) that could then be shared in some proportion between customers and the network operator. This approach provides a mechanism for other stakeholders to directly influence the outputs being delivered by the DHNs;

In principle, this approach could be adopted by all networks. It may, however, be necessary to exempt small DH networks from this regime (de minimis, in terms of scale) given the expected regulatory costs to the network operators and the respective DHCs. For example, similarly as in section 6.2, a network qualifying for this de minimis exemption may only be required to file a simplified set of regulatory accounts; be a member of a 'trusted trader' scheme, which requires the network to sign up to a code of conduct; and publicise the contact details of the ACM for customers to complain to: the threat of regulatory enforcement may be sufficient to mitigate the risks of overcompensation for these very small networks. Of course, there is substantial discretion available to the EZK and the ACM on the design of this exemption.

6.3.1 Outline of calculation of price cap

The price cap under a network-specific, incentive-based regulation would develop in the following way (as illustrated in Figure 6.7):

Price cap = (RAB x allowed rate of return) + OPEX allowance + depreciation allowance

RAB this year = RAB last year + allowed CAPEX from this year

The allowed rate of return would be determined by the ACM. It would conduct a study on the cost of capital for the sector and provide a determination on the allowed cost of capital for the sector. This could vary by network characteristics.

The OPEX and CAPEX allowances would be determined by the regulator after reviewing the business plans disclosed by the DHCs. OPEX and CAPEX included in the business plan to achieve the agreed objectives would be considered by the regulator, considered against efficient levels and would require the regulator's approval. Such efficient OPEX and CAPEX levels would be determined through a cost benchmarking exercise as described for the comparator-based regulatory option (see section 6.2.1).

The initial RAB would be determined differently for existing and developing networks. For existing networks, this could be set based on an assessment by the regulator of the value of assets of the network; for new networks, the starting RAB would be zero.

6.3.2 Treatment of sources

The costs of sources would be reimbursed through the OPEX allowance (if heat is procured from a third-party source) or through the OPEX and CAPEX allowances (where OPEX and CAPEX are incurred in generating the heat) if the source is within the network. The DHN's (forecast) efficient costs are counted towards the DHN's allowances for OPEX or CAPEX set by the ACM.

Given the importance of heat sources in achieving the decarbonisation of heat, it will be important for parties with new, low-carbon heat sources, to be able to provide heat if that is beneficial to society.

6.3.3 Impact on existing customers of network expansion

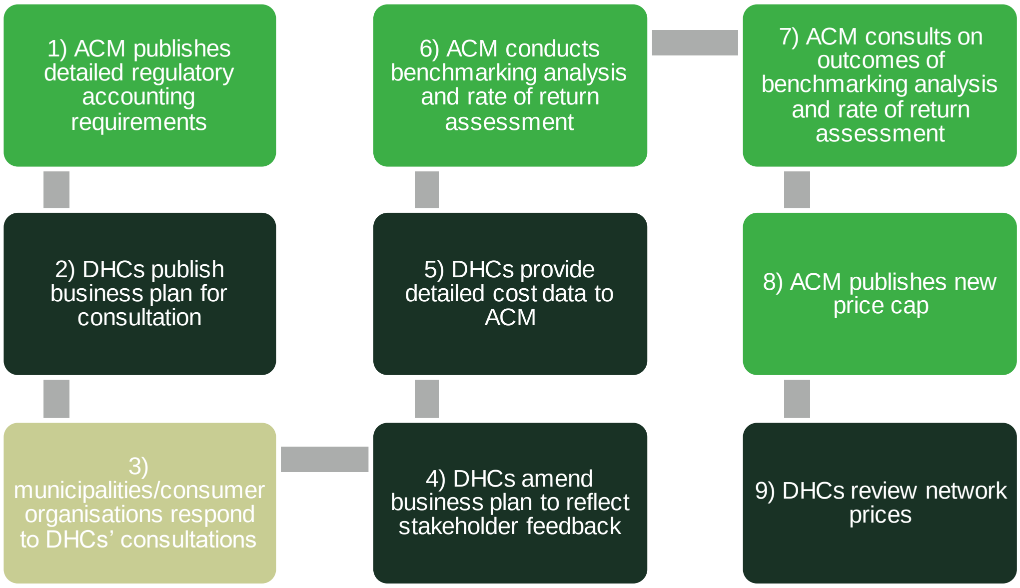
As the network is backed by a RAB, there is an opportunity to use the security provided by the RAB to profile the repayment of the capital costs over time to make the network expansion more affordable. The potential price shocks this might cause can be mitigated by smoothing cost shocks within and over a period. Again, as with all the options, the price charged is consistent across all customers within a network, i.e. the costs of network expansion would be spread across all customers on the network. Whether this results in an increase or decrease in the price charged to existing customers will depend on whether the incremental costs of the new customers are more or less than the reduction in the share of the costs of the existing network allocated to those existing customers.

Unlike with the comparator-based regulatory approach (see section 6.2), this approach would include the costs (subject to an efficiency assessment) of the individual DHN rather than using costs of multiple DHNs in a benchmark. Hence, tariffs vary more across connections in this option compared with option 2.

6.3.4 Summary of price control process

Figure 6.9 illustrates the interactive process between the regulator, the DHCs and the municipalities under this regulatory option.

Figure 6.9 Illustrative process in a price control period under network-specific, incentive-based regulation



Note: The process starts over again at the start of a new price control period, every few years.

Source: Oxera analysis.

As shown in Figure 6.9, the price control process would be relatively complex. In particular:

- the ACM would need to specify regulatory accounting requirements; develop, maintain and apply a benchmarking methodology to determine the allowed level of costs; and determine the allowed rate of return;
- the DHCs would need to produce detailed business plans and consult with stakeholders on those business plans; provide detailed accounting data and engage with a wider range of technical analysis from the ACM than has historically been the case (although the types of studies are widely conducted in economic regulation in many jurisdictions, including the ACM's);
- stakeholders (customer organisations and municipalities) would need to engage with DHCs in a more detailed way than has been the case in the past to agree the business plan.

6.3.5 Overall assessment

This option provides the investment climate necessary to achieve the desired roll-out of DHNs. This comes at the cost of variable tariffs across user groups. That is, in order to ensure efficient network development over the long term, while also allowing new DHNs time to build the customer base to achieve long-term commercial viability, it would be necessary to allow for greater flexibility to defer remuneration of network development costs. Also, it would be necessary to facilitate innovation (including sector coupling, network integration) and other output incentives to align with wider policy objectives. This could be achieved through a network development planning process that requires coordination with, and approval by, the regulator and local authorities.

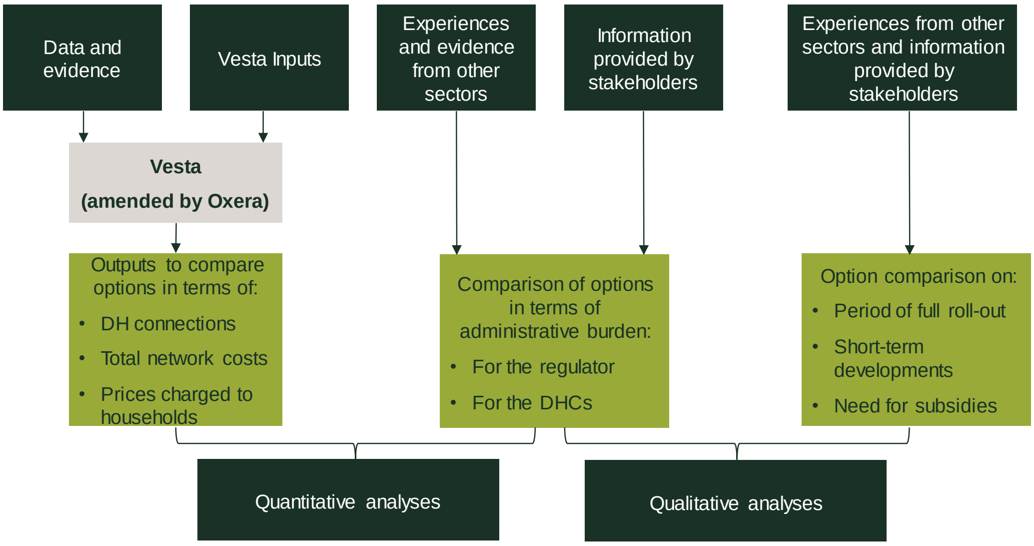
This option prevents overcompensation, since maximum prices are directly linked to the costs of each DHN.

7 Impact assessment of shortlisted regulatory reform options

Having outlined the three shortlisted options, the next step is to consider the quantitative and qualitative impacts of those three options to inform an assessment of their impacts and which should be preferred. Our approach to this impact assessment is outlined in the figure below.

For readers who are interested in the results and implications of this impact assessment, please go to section 7.2. More detail is provided in Appendices A5–A8.

Figure 7.1 Overview of the impact assessment methodology



Note: Vesta is a model that simulates scenarios for the development heating networks and heating supply choices in the Netherlands, developed by PBL.

Source: Oxera.

We assess the impacts of the three shortlisted options relative to a baseline (which represents a scenario in which the gas reference price regulation as at January 2020 continues to be the regulatory regime) to inform our recommendation for a price regulation approach. The purpose is to compare the shortlisted options in terms of their ability to meet the policy objectives and criteria outlined in section 5.

In this assessment we quantitatively examine the long-term impacts for 2040—by then, it is likely that the chosen regulatory regime will have been fully rolled out and the impacts of each of the shortlisted options will have become apparent.

For our quantitative analysis, we use the Vesta MAIS spatial energy model (Vesta). Vesta is a geospatial economic-engineering model developed by ‘Planbureau voor de Leefomgeving’ (PBL), the official Dutch research institute concerned with the consequences for energy supply and the environmental impacts of spatial planning and development. With the model, different scenarios for the future development of heating networks and heating supply choices in the Netherlands can be simulated.

We consider the following quantitative metrics:

- **discount rates**—the expected (annual) return DHCs require to be willing to invest in a DHN, which increases as DHCs are exposed to more risks;
- **cost-efficiencies**—the expected (annual) reductions in costs DHCs realise, based on the incentives each option provides to do so;
- **DH adoption level**—the number of DH connections established by 2040;[135]
- **DH network costs**—the costs of investing in and operating a DHN;
- **DH prices for households**—the average price households pay for DH;
- **cost variability across connections**—the difference in costs of establishing and operating different DH connections;
- **DHCs' overcompensation**—the excess return DHCs receive on top of network costs and a reasonable return; and
- **administrative burden**—the costs associated with the regulatory regime that the regulator (ACM) and DHCs incur (for example, information gathering and compliance with accounting requirements respectively).

Furthermore, we consider the impacts on CO_2 emissions in Appendix A7. As the Climate Agreement targets for DH are set in terms of connections rather than emissions, and emissions for DH are substantially affected by the heat sources (which are not influenced by the tariff regulation) and other interventions in the built environment, we focus our modelling approach on DH connections not CO_2 emissions.

The DH market is growing rapidly, the policies surrounding it are not fully developed yet and the development of the built environment is difficult to forecast. Therefore, the purpose of this section is to assess the impacts of each of the three shortlisted options compared to the baseline. Hence, exact values of these metrics should not be interpreted as predictions of the future—instead, the focus should be on the relative impacts of the regulatory regimes considered.

In addition, we consider several qualitative factors to inform our assessment of the trade-offs between different options, as follows:

- how quickly each of the regimes could be implemented;
- the short- and medium-term effects;
- the potential risks; and
- the need for subsidies or other stimulating measures.

Some of these considerations are discussed further in section 8.

7.1 Assumptions for quantitative modelling

A wide range of inputs are already included in Vesta. These include (among others) information on the built environment, heat sources, policy measures such as subsidies/taxes and costs that are associated with rolling out a

[135] As the target number of connections set in the Climate Agreement is for year 2030 (see section 4.1.2) but our quantitative results are calculated for 2040, we will be adjusting the Climate Agreement target in order not to exclude the development of DH networks between 2030 and 2040. This is discussed in more detail in section 7.2.

DHN.[136] We mostly use the default settings. However, we also make some amendments to better capture what we want to compare between options 1–3 and the baseline. The most important amendments are outlined in this section. For a more detailed description on how we used and amended Vesta, please refer to Appendix A5.

7.1.1 Reference price

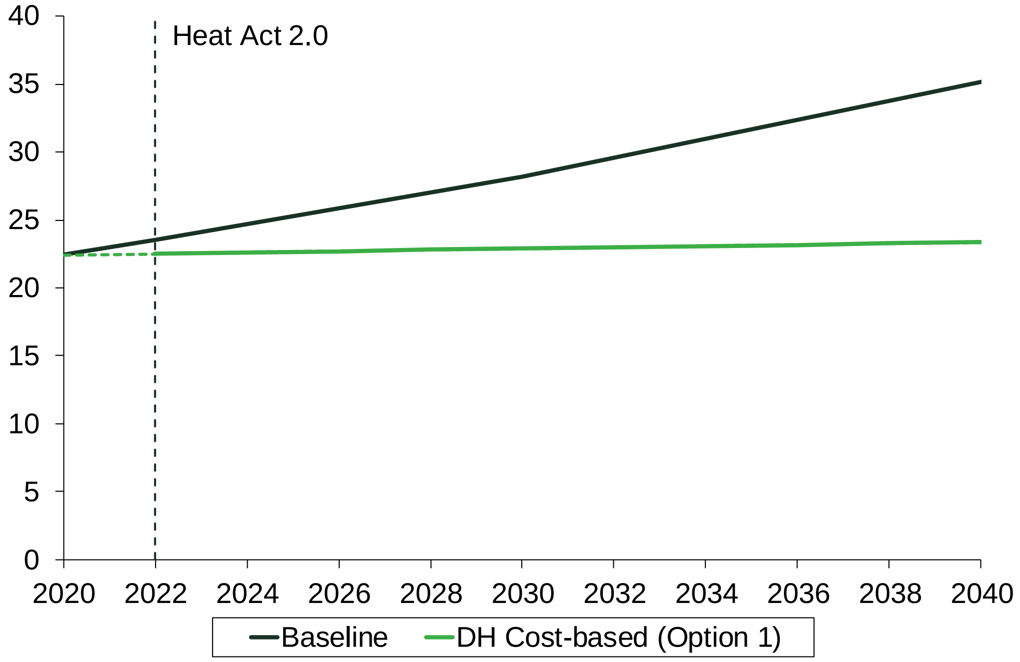
The baseline and option 1 use a single national reference (maximum) price. In the baseline (which serves as a comparison point for the other options), prices will continue to be regulated by the revised gas reference price (as at January 2020). For option 1, we use a reference price based on the costs of DH. The predicted gas reference price as of January 2020 is taken as a base and adjusted over time according to an index of the cost components of DHNs:

- the costs of building the network and connecting individual buildings to it;
- the costs of input energy;
- the costs of repairing and maintaining the network;
- the administrative costs.

Further details of the baseline and option 1 prices are discussed in Appendix A6. Figure 7.2 illustrates the projected evolution of the baseline price and the DH cost-based reference price (option 1). The projected development of the option 1 price is based on the historical trend in the components of the index outlined above.[137] Based on the historical data, this index is expected to remain essentially flat (with 0.1% annual growth in real terms). If future evolution of the price under option 1 follows this historical trend, the price for small users under option 1 will grow at a lower rate than in the baseline, where the maximum price for DH is tied to the natural gas price.

[136] More information on the workings and inputs of Vesta can be found in PBL's description of the model: PBL (2017), 'Het Vesta ruimtelijk energiemodel voor de gebouwde omgeving'.
[137] We use the historical trend to proxy future developments of the index since no long-term forecasts of the components were easily available.

Figure 7.2 Maximum price in the baseline scenario and option 1 (€/GJ)



Note: Excluding VAT and BAK. 2010 prices.

Source: Oxera, gas reference price based on Vesta input data, originally from WLO/PBL (2016), 'Toekomstverkenning Welvaart en Leefomgeving. Achtergronddocument – Klimaat en energie', with additional calculations by Oxera.

In options 2 and 3, there would not be a single national reference price, as prices vary across DHNs, reflecting the DHN costs (see section 6). The modelling approach used for these options is further discussed in Appendix A5.

7.1.2 Discount rates

The shortlisted options expose DHNs to different degrees of risk.[138] The difference in risks implies a difference in the cost of capital of DHNs.[139] We reflect this by using different discount rates for investors' decision making on whether to roll out a network in a particular location.

The risks associated with each of the shortlisted options will depend on their exact specification (for example, whether the regime has cost pass-through elements, how long the price control period is (i.e. how long prices are fixed for, or what the lag is between the costs that are incurred and those that are recovered)). Therefore, the cost of capital estimates that we use in this impact assessment should be considered as broad orders of magnitude.

The main difference between the DHNs' risks under the shortlisted options is the degree of cost-reflectivity in prices: the more cost-reflective the regime is, the lower the cost risks of DHNs. In particular, where prices are allowed to change with costs, DHNs are less exposed to profit variations, and hence returns to investors are more secure.[140] The cost-reflectivity of prices under

[138] See section 6 for further discussion on the shortlisted options.
[139] On the equity side, investors can mitigate some risks by diversifying their investment portfolios. They do not need to be compensated for these risks and, therefore, these risks do not affect the cost of equity of the investments. Where the risks cannot be diversified, they affect the cost of equity and hence the cost of capital of the investment. Even if the risk is diversifiable, it can arguably affect the cost of debt.
[140] In the academic literature this is referred to as a 'buffering effect'. The more cost-oriented the regime, the stronger the effect. See Pedell, B. (2006), *Regulatory Risk and the Cost of Capital*, Springer, p. 36. Cost-

option 1 is slightly higher than in the baseline, because the reference price in option 1 is indexed to DH costs rather than the price of natural gas. However, since the price is still nationwide, the difference is small. Under option 3, the prices are set individually for each DHN, implying substantial cost-reflectivity at the network level. Under option 2, the prices could be the same within similar groups of DHNs, hence the cost-reflectivity is between options 1 and 3, but likely to be closer to option 3.[141]

Therefore, we consider the following differences between the DHNs' cost of capital across the shortlisted options to be appropriate:[142]

- in option 1, to be similar to that in the baseline due to the similar cost-reflectivity characteristics of the two options;
- in option 3, to be lower and close to that of other energy networks operating under price or revenue caps;[143]
- in option 2, to be between those in options 1 and 2.

The allocation of volume risk to DHCs does not depend on the choice between the options to the same extent as the allocation of cost risk, but rather depends on the details of the option implementation. In particular, under each of the options, the volume risk can be allocated between DHCs and customers to varying degrees.

Table 7.1 outlines the cost of capital assumptions used in our impact assessment and the basis on which the estimates have been chosen. As with the other aspects of the impact assessment, it is the relationships between the options that are important rather than the absolute level.

Table 7.1 DHNs' discount rate assumptions[1]

Option	Discount rate assumption[2]	Based on:
Baseline	5%	the ACM's current view on DHCs' cost of capital, expressed in real terms[2]
Option 1	5%	the ACM's current view on DHCs' cost of capital, expressed in real terms
Option 2	4%	midway between options 1 and 3, reflecting middle risks allocation
Option 3	3%	energy networks' rate of return allowance[3]

Note: [1] Including generators, transporters, distributors, and end-user suppliers. [1] Based on pre-tax, real cost of capital estimates. As noted earlier, the important aspect is a comparison of these options rather than their absolute magnitude. [2] The ACM reports a range for DHCs' cost of capital from 5.2% to 6.6% on a nominal, pre-tax basis, where a midpoint of the range is 5.9%. The ACM's inflation assumption used with the 5.2% estimate is 0.77%. Bringing these together,

reflectivity is also one of the factors in the Moody's rating methodology for regulated electric and gas utilities. The factor is referred to as timeliness of recovery of operating and capital costs. It has a weight of 12.5%. See Moody's (2017), 'Rating methodology. Regulated electric and gas utilities', 23 June.

[141] Although the extent of this depends on the details of the benchmarking.

[142] It may also be argued that a regulatory reform will cause an increase in the cost of capital in the shortlisted options compared with the baseline due to the increased uncertainty in the future regulation of the sector. This is sometimes referred to as regulatory risk. The more predictable and stable the regime is, the lower the regulatory risk and, therefore, the lower the required rate of return. For example, a Consistency and Predictability of Regulation factor has a 12.5% weight in the Moody's rating methodology for regulated electric and gas utilities. See Moody's (2017), 'Rating methodology. Regulated electric and gas utilities', 23 June. However, if the regulator commits to a predictable and stable regime, this effect may be minimised after the transitional period.

[143] Depending on the regime specification (e.g. energy costs pass-through), the generation business segments of DHCs may not be exposed to the risks additional to those of the regulated networks: for the purpose of this assessment, we assume that the heat generation activities would have the same risk profile as the networks.

we consider 5% a reasonable assumption for the DHCs' discount rate estimate in the baseline and option 1 scenarios. [3] The ACM's rate of return allowance to energy networks for 2021 was set at 2.8% in 2016.

Source: Oxera assumptions choice based on estimates from the ACM's publications. [1] PBL (2017), 'Het Vesta ruimtelijk energiemodel voor de gebouwde omgeving', section 2.9, p. 23. [2] CE Delft (2019), 'Rendementsmonitor warmteleveranciers 2017 en 2018', September, p. 13; Autoriteit Consument & Markt (2016), 'Zaaknr. ACM/18/033721 / Documentnr. ACM/UIT/505475', p. 27. [3] Autoriteit Consument & Markt (2016), 'Zaaknr. ACM/18/033721 / Documentnr. ACM/UIT/505475', p. 27.

7.1.3 Cost-efficiency multipliers

As discussed in section 6, options 2 and 3 imply higher cost-efficiency incentives for DHNs than the baseline and option 1. The distinction within the two groups—i.e. the baseline and options 1; and options 2 and 3, respectively—is less definitive. We reflect the incentives for cost-efficiency under options 2 and 3 by modelling a cost reduction in real terms over the years when the regimes may be in place.

To inform our assumption of any cost reductions arising from efficiency incentives, we have looked at the historical efficiency improvements for networks operating under incentive-based regulation—i.e. regimes for which efficiency incentives are similar to options 2 and 3. Table 7.2 summarises historical information for Great Britain and Northern Ireland, where incentive-based regulation has been in place for a number of decades. As the findings reported here are not from the Netherlands, there is a risk that they will not reflect the Dutch context. However, given that evidence from the Netherlands could not be sourced, the figures reported in Table 7.2 are the best evidence that we have been able to find. In our analysis, we therefore assume that the price reductions in the Netherlands will be similar in size, but due to the uncertainty involved in the estimates we take the lower end of the range.

Table 7.2 Historical price reductions under incentive-based regulatory regimes in Great Britain and Northern Ireland

Sector	Annual real-terms reduction estimate	Time period
GB ED[1]	3.8%	1990–2008
GB ET[1]	2.9%	1990–2008
NI ET&D[2]	2.8%	1992–2012
Range	**2.8–3.8%**	n.a.

Note: ET, electricity transmission; ED, electricity distribution; NI, Northern Ireland.

Sources: Oxera calculations based on data from various sources. [1] Ofgem (2008), 'Alistair Buchanan speech at SBQI', 6 March. Ofgem's 'RPI at 20' project', p. 11. [2] Northern Ireland Electricity Limited (2013), 'Transmission and Distribution RP5 Price Control. Statement of Case to the Competition Commission', 10 May, para. 1.9.

The range of annual price reductions based on the identified evidence is 2.8–3.8%. Since this is the change in prices rather than costs, it could be affected by factors other than cost efficiency—for example, financing costs are potentially significant factors (although financing costs have not changed materially over this period).[144] To account for these factors, we use an assumption of 3%, which is closer to the lower end of the range.

[144] In the GB transmission price control review in 1996, consistent with the previous price control period, the cost of capital allowance was 7% (pre-tax, real). In the GB transmission price control review in 2006, Ofgem allowed 6.25% (pre-tax, real). See Offer (1996), 'The transmission price control review of the National Grid Company: Proposals', October, p. 2; Ofgem (2006), 'Transmission Price Control Review: Final Proposals', p. 55.

We consider our approach to be reasonable because:

- we take an assumption towards the lower end of the range of available evidence;
- while there are some incentives for efficiency under the baseline (depending on the management structure: municipality-owned DHNs have less cost reduction incentives under option 1 and the baseline compared to privately owned networks), they are likely to be stronger across the industry under options 2 and 3. The relative differences in cost-reduction assumptions reflect this.
- we assume no cost-efficiency savings until 2030 and an annual cost reduction from 2030 to 2040, when the regime will be fully rolled out;
- at the 10–year time horizon, the quality of service is expected to improve relatively more under options 2 and 3 compared with the baseline and option 1 because we expect that options 2 and 3 would include a service quality regime that incentivises DHN operators to improve their service quality over time.

7.2 Results of quantitative modelling

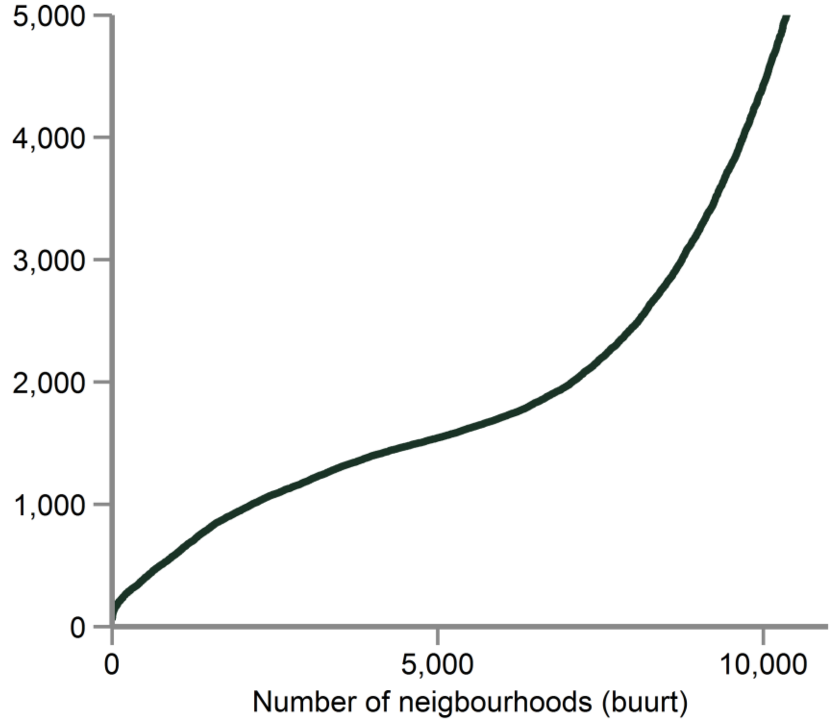
In this section, we outline the results of our impact assessment of the three shortlisted options by assessment parameter. We summarise these in the next section.

7.2.1 Variability of network costs

One of the key characteristics of the DH sector is the variation in costs between DHNs. Figure 7.3 illustrates the differences in cost per connection across the Netherlands.[145] If this cost variation is reflected in the prices charged to small users, there will also be significant variation in these prices charged to small users. The extent to which this is acceptable will be an important determinant of any requirement for subsidies to fund the roll-out of DHNs in high-cost areas.

[145] This figure reflects the costs of all technically feasible networks (according to Vesta) and does not impose any commercial thresholds on what price would be acceptable to users.

Figure 7.3 Variation of average DH costs per connection (€/year)



Note: The figure represents the total network costs in each neighbourhood (buurt), divided by the number of DH connections in the neighbourhood.

Source: Oxera analysis, using Vesta.

This variability in the underlying costs is an important theme that is returned to in various places below.

7.2.2 DH adoption

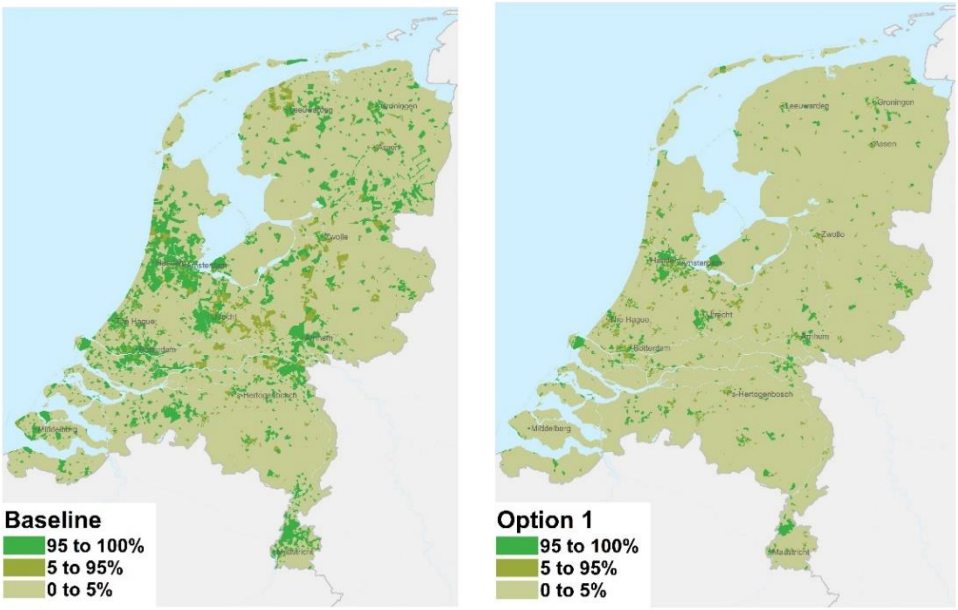
This section compares option 1 with the baseline in terms of adoption rate and the popularity of different heat sources.

As seen in Map 7.1, there is a significant roll-out of DHNs in the baseline as of 2040, especially around larger cities.[146] The key driver of this result is the predicted growth in the gas reference price, which increases incentives to invest in DH networks. The modelling suggests that the number of connections will gradually increase up to 2040, as there would be no sudden or abrupt changes in the reference price. In Map 7.2, we see that the choice of heat source has some regional variation, with residual heat being the most popular option.

Under option 1, due to the lower price compared with the baseline, the extent of DHNs would be lower than in the baseline, and the Climate agreement target would be not met.

[146] Based on our sensitivity analysis, this also remains true if 2030 is used in our simulation.

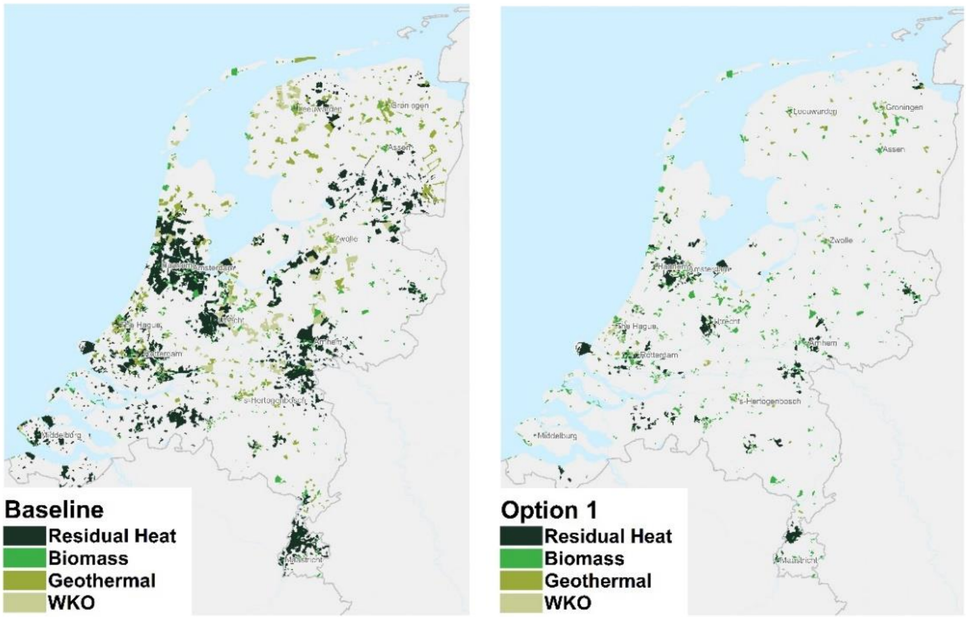
Map 7.1 The share of DH connections by neighbourhood (buurt) in the baseline scenario (left) and option 1 (right) in 2040



Baseline scenario **Option 1**

Source: Oxera, using Vesta and MapInfo.

Map 7.2 The most popular DHN heat source by neighbourhood in the baseline scenario (left) and option 1 (right) in 2040



Baseline scenario **Option 1**

Note: For each neighbourhood, the most popular DH option is shown, unless the total share of all DH types is less than 10%. In Vesta, if two separate DH options (e.g. residual heat and biomass) would both be profitable in the same area, the choice between the two is made according to a ranking of the options specified by the Vesta user. Therefore, the choice between any two DH options is very sensitive to modelling assumptions, so the map should be interpreted with caution.

Source: Oxera, using Vesta and MapInfo.

Table 7.3 shows the estimated number of connections for existing and newly built houses to compare the connection levels with the Climate Agreement target (which focusses solely on existing houses). The table shows that in the baseline, the connection level of existing houses for 2040 is much higher than the Climate Agreement target,[147] due to the relatively high maximum price. Under option 1, the Climate Agreement target would not be met due to the lower price, DHC risks and lack of cost reduction incentives. Therefore, additional subsidies for high-cost areas would be needed to meet the target in option 1.[148]

Table 7.3 District heating connections (households) in 2040

Scenario	Number of existing houses connected to a DHN	Number of new houses connected to a DHN	Total houses connected to a DHN
Climate Agreement target 2040 (for modelling purposes)[1]	2.0m	–	–
Baseline	4.0m	1.7m	5.7m
Option 1	1.3m	0.7m	2.0m

Note: [1] Currently, 450,000 houses are connected to a DHN. In the Climate Agreement, the expectation is formulated that 750,000 additional existing houses will be connected to a DHN by 2030. Moreover, an increase in the number of houses connected to a DHN of 80,000 per year between 2025 and 2030 is targeted in the Climate Agreement. To extrapolate the 2030 Climate Agreement target to 2040, we assume the same annual growth target for the period 2030-2040. By putting together these information points, the target for existing houses connected to a DHN amounts to 2m in 2040.

Sources: Oxera, using Vesta [1] Climate Agreement 2019, with additional calculations by Oxera using Vesta.

On the other hand, comparing the development of the baseline reference price with the DH cost-based reference price in option 1, it seems likely that the price in the baseline will grow at a rate that is not reflective of the actual costs of building and operating the DHNs, resulting in overcompensation.

The number of connections under options 2 and 3 is to a large extent a policy choice that depends on factors such as affordability and the public acceptance of the variation in prices across networks or the willingness to subsidise higher cost networks, either through a direct subsidy or cross-subsidies between users.

7.2.3 DHNs' costs

As discussed in section 7.2.2, the DH adoption rate (i.e. the heat sector 'market share' of DH) under options 2 and 3 is more strongly driven by policy choices rather than being purely a market-driven. Therefore, we compare network costs under the assumption that the adoption rate of DH among currently existing houses is equal to the target adoption rate of the Climate

[147] The Climate Agreement targets for DH are set for 2030, while the impact assessment of this report focusses on 2040. Therefore, we extrapolate the Climate Agreement target for 2030 to 2040. Currently, approximately 450,000 houses are connected to a DHN. In the Climate Agreement, the expectation is that 750,000 additional existing houses will be connected to a DHN by 2030. Moreover, the targeted increase in the number of houses connected to a DHN amounts to 80,000 per year between 2025 and 2030. To extrapolate the 2030 Climate Agreement target to 2040, we assume the same annual growth target for the period 2030–40. Taken together, the target for existing houses connected to a DHN amounts to 2m in 2040.
[148] Given that a BAK is already included in these calculations using the default implementation in Vesta (a fixed fee of €2,700 per connection), the result that option 1 does not meet the Climate Agreement target suggests that the BAK alone (at the levels assumed in Vesta) is not enough to bridge this gap, so additional measures would be necessary.

Agreement, and assume that the most profitable networks are built first up to the point that the target is reached. This allows us to compare costs under each option and the baseline on a consistent basis.[149]

As the Climate Agreement target only refers to existing houses, the total number of connections in each scenario is not fixed.[150] In particular, there is substantial variation in the amount of newly built houses that are connected to DH networks in each option.

Table 7.4 presents the network costs under different options. These costs represent all the costs of building, maintaining and operating the network, irrespective of which party pays them.[151]

Table 7.4 Average DHN costs assuming the Climate Agreement target is just met, 2040

Scenario	Average DH network costs per connection (€/year)[1]	Number of households (existing and new) connected to DH networks
Baseline / Option 1[2]	955	3.0m
Option 2	964	4.0m
Option 3	944	4.0m

Notes: For 2040, we are considering the target to be that 2 m existing houses should be connected to a DH network (see 7.2.2 for further discussion). In order to reach the target for option 1 (where the target is missed under the projected price), we use an alternative modelling price that is higher than the projected price to ensure the target is met. [1] DH network costs are expressed as the sum of investment costs and yearly operating costs in 2010 prices. Investment costs are converted to annual levels at the DHCs' discount rate, thereby including a 'reasonable profit' for DHCs. These figures do not include any other payments from end-users or any subsidies. This number is calculated over the costs on all connections, including both households and other connections. As a large proportion of the network costs are fixed (i.e. they do not depend on the number of connections in the network), the allocation of network costs between households and non-households can vary greatly, and therefore we have calculated the costs across all connection types. [2] As we are using the same target number of existing households in all of the scenarios, and given that in the baseline and in option 1 the costs of capital and efficiency incentives are assumed to be the same, the network costs and the total number of connections are equal in this calculation as well.

Source: Oxera, using Vesta.

Table 7.4 shows that the average network costs per connection under options 1-3 show limited variation.[152] The average cost per connection under option 2 is 1% higher than under option 3. Connecting a given building type is less expensive under options 2 and 3 relative to the baseline and option 1 due to the assumed efficiency incentives and the lower risks to DHCs. As a result, options 2 and 3 bring forth additional connections compared to the baseline and option 1, thereby potentially providing an additional contribution to meeting

[149] This section focuses on the costs of the networks, not the costs of the networks to small users, as Vesta does not enable the allocation of network costs between different types of connection.
[150] In Vesta, it is not possible to keep fixed at the same time both the number of total connections and the number of existing household connections. In our modelling approach, we have chosen to fix the number of existing household connections in order to align the scenarios more closely with the Climate Agreement target.
[151] For example through the BAK or other specific charges.
[152] The cost variation is also sensitive to the modelling choices made in Vesta. As a sensitivity check, we excluded WKO (which on per connection base is one of the costlier alternatives), and found that especially in options 2 and 3 a more expensive heating source is sometimes chosen even if a cheaper option is available, which drives up the costs. This is a limitation of Vesta which does not optimise over heat sources but uses a user defined order to choose heat sources from.

the carbon emission reduction target for the built environment at roughly the same costs per connection.[153]

7.2.4 Prices charged to households

As outlined in section 5.2, a key policy objective of the EZK is to protect consumers from paying excessively high prices and, hence, prevent overcompensation to DHN operators. In this section, still assuming the Climate Agreement target is just met under each option, we look at the prices of DH to households[154] and overcompensation to DHN operators.

The level of DH prices charged to households

In the baseline and option 1, the maximum prices charged to households are determined by the reference prices, which are either based on the gas price or on the alternative criteria outlined in section 6. The DH cost-based reference price (option 1) and the baseline reference price have the same starting point, but then diverge with different growth rates. Hence, the differences in households' costs between option 1 and the baseline depend on the differences in the growth rates of these two prices. As shown in Figure 7.2, the projection of the price to small users for option 1 grows at a lower rate than the price in the baseline. Therefore, household prices in option 1 are likely to be lower than in the baseline if the future developments of the index follow its historical trend.[155]

Under options 2 and 3, there would not be a single maximum consumer price as prices would reflect network costs. It is important to note that a reasonable profit for DHCs is included in the DH network costs. Therefore, cost-reflective pricing under options 2 and 3 does not imply that DHCs are not able to earn a return on their investments.

Table 7.5 Average prices charged to households, 2040

Scenario	Average price per household connection (€/year)[1]
Baseline	1,331
Option 1	1,296
Option 2[2]	610
Option 3[2]	600

Note: [1] The average price are calculated as the average revenue per household connection, assuming the Climate Agreement target is just met. For options 2 and 3 we have first calculated the average price using a fixed nationwide price as in the baseline and option 1, and then deducted the total overcompensation from the prices, using a modelling assumption that the prices under options 2 and 3 are perfectly cost-reflective and overcompensation is fully passed through to households. If the prices were less cost-reflective or the recovered overcompensation would not be fully returned to households (e.g. due to the limitations of the regulatory regime), the resulting prices would be higher. Prices expressed at 2010 levels. Also note that these figures refer to the prices paid by household users, whereas Table 7.4 refers to the costs of the DHCs, so the numbers should not be directly compared. [2] For options 2 and 3, it is worth noting

[153] The Climate Agreement includes a separate target for carbon emission reductions for the built environment amounting to 3.4Mt by 2030 (Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 3). While the roll-out of DH could contribute to meeting this target, the desired emission reductions in the built environment will be achieved through a range of policy instruments.
[154] In this section, the scope of the analysis is limited to households instead of small users: small users include some non-household connections but it is not feasible to isolate non-household small users from larger commercial users within Vesta, and therefore the next section of the report focuses on household connections to provide a clear explanation of the implications of the options for small users.
[155] Importantly, the predicted increases in the energy tax are no longer reflected in the maximum price DHCs can charge to small users for DH under any of the shortlisted options.

that the price reflects a nationwide average, and significant regional price variation could exist because of the flexibility allowed under these options.

Source: Oxera, using Vesta.

From Table 7.5, we can see that under the scenario that the Climate Agreement target is just met, the costs for households are on average lower under options 2 and 3 compared to the baseline and option 1. There are two main reasons for this:

- under options 2 and 3, we expect the DH networks' cost efficiency to be higher and the required rate of return to be lower, which are reflected in lower prices;
- under options 2 and 3, the increased flexibility allows the prices to be lower in the areas where implementing DH is cheaper. Under a fixed reference price (i.e. the baseline and option 1), the price level has to be relatively high for all households, if the aim is to reach a high DH connectivity rate (as explained in section 6.1.4), which is likely to result in significant overcompensation.

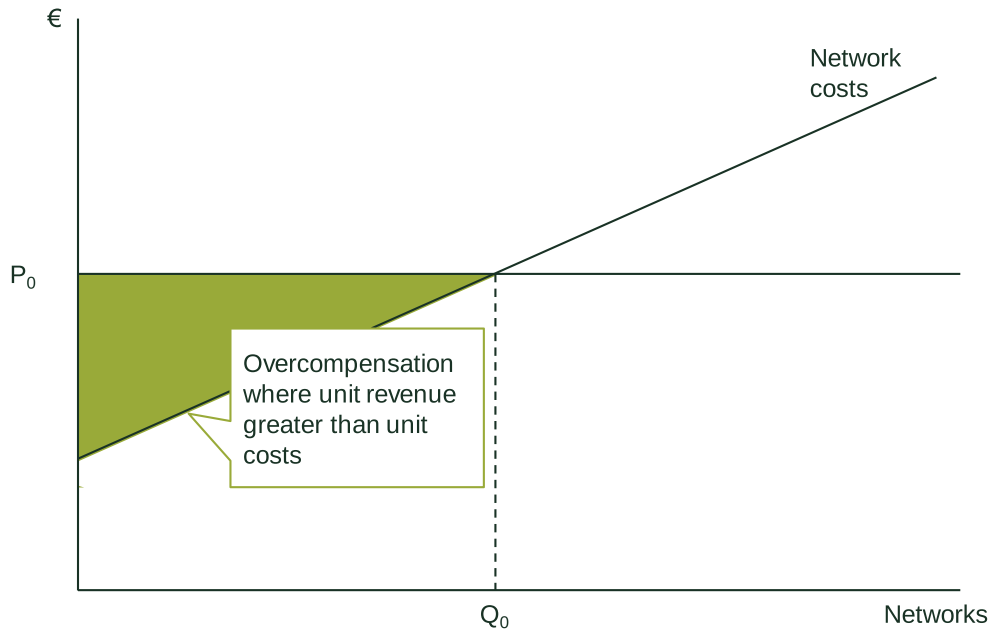
It is important to note that the numbers from Table 7.4 and Table 7.5 are not directly comparable. For options 2 and 3, it seems the average prices charged to households are below network costs (presented in Table 7.4). However, the prices presented in Table 7.5 are calculated for household connections only. On the other hand, the average DH network costs depicted in Table 7.4 refer to all users, and therefore also include the non-household connections in the network. On average, these non-household connections have a higher connection capacity and therefore can be more costly to provide than for typical household connections. For this reason, household prices never drop below efficient costs (including a reasonable return) under options 2 and 3.

Overcompensation

As discussed earlier, an important criterion in assessing the regulatory regime options is their ability to prevent overcompensation to DHCs. Overcompensation can be defined as a situation where a DHC makes a return that is greater than its cost of capital, as illustrated by the green box in the figure below.[156]

[156] It is also worth noting that overcompensation may occur even if the DHCs are operating efficiently, if the DHCs are allowed to charge users high prices compared with their costs (taking into account a reasonable rate of return). Therefore, ensuring that DHCs operate efficiently is not enough to guarantee that overcompensation would not happen.

Figure 7.4 Overcompensation (illustrative)



Note: The line representing network costs includes a 'reasonable profit' for DHCs.

Source: Oxera.

Table 7.6 presents the calculated total overcompensation for the baseline and option 1. The national reference prices of both the baseline and option 1 enable a considerable amount of overcompensation to DHCs. Since the reference price under option 1 is slightly more cost-reflective than that of the baseline, overcompensation is lower under option 1. Options 2 and 3 have the potential to reduce overcompensation significantly because prices are linked to costs at the network level. The extent to which overcompensation can be prevented in practice depends on how the options will be implemented. We expect that overcompensation can be prevented marginally more under option 3 than option 2, because prices are slightly more cost-reflective in option 3 compared to option 2.

Table 7.6 Overcompensation

Scenario	Total overcompensation (€bn/year)[1]
Baseline	2.63
Option 1	2.52
Option 2[2]	close to 0
Option 3[2]	close to 0

Note: [1] Overcompensation numbers are computed as the difference between discounted yearly DH revenues and discounted yearly DH network costs, assuming that the Climate Agreement target for currently existing households is just met. [2] Overcompensation for options 2 and 3 will largely depend on the details of the implemented policy, and therefore the overcompensation for these options has not been quantified.

Source: Oxera, using Vesta.

The results presented in Table 7.6 illustrate the importance of cost-reflective prices. It was shown in Figure 7.3 that costs vary strongly across networks. Therefore, in any potential regulatory option where the price does not vary with the costs of the network, there is a risk of overcompensation in areas where the costs of implementing and operating DHNs are relatively low, as the networks in these areas would have the same (or similar) prices as everywhere else even though their costs are lower. In options 2 and 3, this risk would be lower, as the network-specific prices can be adjusted to take into account the cost differences across networks.

Overall, we would summarise the extent of overcompensation in each of the options as follows:

- in option 1, overcompensation is expected to be lower than in the baseline, but since the reference price is the same across the country, overcompensation could still be significant;
- in option 3, overcompensation is the lowest, as prices are expected to be very cost-reflective;
- In option 2, overcompensation might be slightly more compared to option 3, because prices are marginally less cost-reflective under this option.

7.2.5 Summary of quantitative modelling

The quantitative modelling illustrates that options 2 and 3 are likely to enable meeting of the Climate Agreement target at lower prices charged to households than either the baseline or option 1. This arises because of the reduction in the overcompensation. The lower cost of capital (in turn driven by the lower risk of DHNs under these options) and incentives for cost efficiency under these options would result in more new connections being economically feasible.

However, these benefits come at the cost of greater variation in prices across networks than is the case under the baseline or option 1. The extent of this variation would be governed, in practice, by the willingness of consumers to accept such variation and the willingness/ability of the government to provide a subsidy and/or a cross-subsidy from other users.

7.3 Administrative costs

Another criterion outlined in section 5 is that the administrative burden associated with the regime should be reasonable. Both the regulator and the regulated companies would be confronted with an increase in administrative burden from all options.

Administrative costs incurred by the regulator mostly include information gathering and monitoring,[157] specifying the parameters of the regulatory regime, and undertaking a dialogue with the industry in these respects. There would be both set-up costs for the regime and ongoing costs.

Administrative costs faced by the regulated company consist of the costs of meeting regulator-specific reporting requirements that may differ from statutory accounting standards. Depending on the regulatory regime, the company may have to disclose different amounts of information at different levels of detail—for example, it may need to disclose only historical costs or business plan forecasts; or only company-level total expenditure or expenditure allocated by business units or products. The regulated company may also need to engage with stakeholders to a greater extent than it would otherwise have to.

[157] Berg, S.V. (1998), 'Introduction to the fundamentals of incentive regulation. Infrastructure regulation and market reform', Public Utility Research Center, University of Florida, p. 40.

The magnitude of administrative costs is different for the different shortlisted options. In general, price cap regulatory regimes (such as options 2 and 3) are information-intensive with relatively high administrative costs, with the exception of national tariffs for a limited number of services (such as option 1).[158] Hence, options 2 and 3 are expected to impose a higher administrative burden on both the regulator and regulated companies than option 1 or the baseline.

Since under option 3, more elements of the regime have to be designed, and more metrics have to be reported by the DHCs, the administrative burden is expected to be higher under option 3 than under option 2.

As a comparison, the operating costs of four utility regulators in the UK—which all apply price controls comparable to option 3—annually increased approximately 10% in the first decade after their foundation (see Table 7.7). In financial year 2018/19, Ofgem's operating costs were £33.8m, and they were relatively stable compared to the rapidly increasing costs in the 1990s.[159]

Table 7.7 Operating cost increases of UK utility regulators

	Average annual increase in operating costs (in real terms)	Total operating costs in 2000/01 (£m)	Sector
Ofgem	10.5%	36.8	Energy
Oftel	6.8%	13.9	Telecoms
Ofwat	7.4%	10.9	Water and sewerage
ORR	14.4%	13.8	Rail and highways
Weighted average	**10.1%**		

Note: The average annual increases of operating costs are based on data from fiscal year 1990/91 (ORR: 1996/97) to 2000/01. The weight assigned to each regulator's average cost increase in calculating the weighted average is based on that regulator's amount of operating costs in 2000/01, relative to the other regulators' operating costs in 2000/01.

Source: WS Atkins Management Consultant and Oxera (2001), 'External Efficiency Review of Utility Regulators'.

In 2018, the ACM, passed on €0.48m of operating costs to the heat supply industry.[160] Assuming the same pattern for the ACM's operating costs on heat supply as for the UK utility regulators, these would rise to €1.25m in 2040 after the introduction of option 3.

These costs are significant and may be even more significant if ACM's operating costs increase faster than the costs of the UK utility regulators; however, these costs need to be considered against the benefits of each option. As discussed in section 7.2.4, we expect that overcompensation will be significantly lower under options 2 and 3 compared with option 1 and the baseline. We can also see from 7.2.4 that for options 2 and 3, the potential yearly savings per connection compared to the baseline could be almost €700 per connection per year (or a total of €1,400m savings across the 2m households needed to achieve the Climate Agreement target), so the ACM's operating costs of €1.25m per year would be low when compared with the

[158] Agrell, P.J. (2015), 'Incentive Regulation of Networks. Concepts, definitions and models', Reflets et perspectives de la vie économique, **54**:1, p. 113.
[159] Ofgem (2019), '2018–19. Office of Gas and Electricity Markets (Ofgem). Annual Report and Accounts', p. 75.
[160] Refers to the share of the budget passed on to regulated DHCs. Additional state financing is received. If the same proportion is applied to the state financing as to the market financing, the total budget of regulating the DH sector can be estimated at c. €2m. ACM (2019), '2018 ACM Annual Report', p. 43.

potential cost savings under these options even if €1.25m per year appears to be a conservative estimate.

As for the DHCs, their administrative burden could also be expected to be higher under options 2 and 3 compared with option 1 and the baseline. Higher regulatory costs may increase barriers to entry and slow down the DH uptake. One of the main reasons for this is that these regulatory schemes require more cost reporting information from the DHCs for benchmarking (see Appendix A2 on the regulatory accounting requirements). This information is typically more detailed than that reported under statutory accounting standards—for example, the regulatory reporting would include breakdowns of costs by network and by category. In addition, the details behind statutory accounting may be inconsistent across DHNs—regulatory reporting will help to increase consistency, which is important for enabling an accurate benchmarking analysis to be undertaken. The burden is likely to be higher at the beginning when the regulatory reporting process is being set up, but going forward, the incremental burden of the regulatory reporting would be comparable to disclosing more information in DHCs' annual reports.

Comparing options 2 and 3, the costs of regulation are likely to be higher under option, owing to the need to prepare business plan forecasts for each price control and enter into a dialogue with stakeholders on these plans. These additional needs of option 3 regime make the DHCs' regulatory burden significantly higher under option 3 than under option 2.

Overall, we consider that the baseline and option 1 are characterised by the lowest regulatory burden and option 3 by the highest. Option 3 would have a substantially higher burden than option 2 due to the need for companies to prepare and for stakeholders to challenge the business plans.

7.4 Qualitative assessment

In addition to the quantitative results of our impact assessment and the magnitude of the administrative costs, in this section we consider some of the qualitative characteristics of the different options. In particular, (i) how quickly an option can be rolled out; (ii) how the option is likely to perform in the short to medium term; and (iii) whether additional support in the form of subsidies is likely to be required.

Period of full roll-out

Option 1 is the option that is most similar to the baseline and requires relatively small changes to the regimes. Therefore, we consider it possible for this regulatory regime to be fully implemented within a few years.

Options 2 and 3 would require more preparation for both the regulator and the DHCs. The regulator would need to ensure that it satisfies the needs of the corresponding option; decide the details of the regime (e.g. the length of the price control period, the cost pass-through allowance, the formula for calculating revenue allowance); and develop the regulatory accounting requirements. Furthermore, the benchmarking, required for both options 2 and 3, is only possible when sufficient data is available—the data according to the newly introduced regulatory accounting requirements. Overall, we consider a realistic assessment to be that options 2 and 3 could be fully rolled out after the transition period of 5–10 years (see section 9 for the details on the transition period).

Short- to medium-term developments

In the short to medium term, option 1 would imply a much more stable investment environment than options 2 and 3, as the changes in option 1 are limited and straightforward for DHCs to understand. It is also likely that in option 1 an increase in overcompensation could be limited quite quickly, as the direct connection of DH prices to gas prices would be removed.

If implemented immediately, options 2 and 3 may be associated with an initial period of lower DH investment due to the higher uncertainty and a more significant change in the regulatory system during the implementation phase. It will take time for the regime to be established and for investors to fully understand the impact of the new regime. Moreover, investors may be reluctant to invest in DH before the details of the new regulatory regime are specified. Therefore, the DH uptake might be lower for options 2 and 3 in the short to medium term. This could be mitigated by the ACM and EZK sharing a transition plan and providing an update to stakeholders against that transition plan regularly.

Once the transition is fully completed, however, in the long term, the investment environment would be more favourable than in the baseline and option 1 due to the higher cost-reflectivity of prices. Hence, this would contribute to achieving the target DH uptake. In particular, in options 2 and 3, subject to the benchmarking regime performing correctly, investors can expect to recover all efficiently spent costs over the useful life of the assets, whereas in the baseline and option 1, the recovery of costs is more uncertain (it would depend on unpredictable external factors affecting the reference price).

The necessity of subsidies

As mentioned above, option 1 by itself (using a DH cost-based index that reflects historical changes in costs) is unlikely to trigger sufficient investments required to meet the Climate Agreement target. Therefore, significant subsidies to DHCs would be required in order to reach the target.

Under options 2 and 3, the Climate Agreement target is more likely to be achieved without additional financial support to DHCs. However, the higher the DH adoption rate achieved, the wider the roll-out of higher-cost networks, and the more areas that would exhibit high DH prices. In some areas, DH services may become unaffordable, so that the state or local governments may choose to intervene. It could choose to financially support either small users in those high-cost areas (i.e. in the form of subsidies), or DHNs in the same areas so that they could recover part of their costs externally instead of through the consumers connected.

7.5 Summary of the impact assessment results

In the impact assessment, we have compared the three shortlisted options against a baseline (of the revised gas reference price as it is since 1 January 2020) to inform our recommendation for a price regulation approach.

The results of our impact assessment suggest that, under options 2 and 3 compared to the baseline and option 1, the target formulated in the Climate Agreement can be achieved at (i) lower prices charged to households and (ii) more newly built houses being connected to DHNs at roughly the same network cost. There are two main reasons for this. First, under options 2 and 3, the network-specific prices allow prices to be lower for those DHNs with lower costs and higher for those DHNs with higher costs. Hence, overcompensation is prevented and a lower average price is needed to achieve a certain level of DH roll-out. Second, under options 2 and 3, we expect the DHNs' cost efficiency to be higher and risks for DHCs to be lower than in the baseline and option 1—which means that the required rate of return for DHCs would be lower.

The impact assessment demonstrates that, in the baseline and option 1, consumer prices are found to be higher than DHN costs, and therefore DHCs would receive substantial overcompensation. Options 2 and 3 have the potential to significantly prevent overcompensation. In the baseline and option 1, there are no incentives to pass on any cost reductions to consumers—passing on cost reductions to consumers occurs by design in options 2 and 3. These results are in line with our theoretical assessment of options 1–3 in section 6.

The main benefits of option 1 are simplicity and a relatively small increase in the regulatory burden. However, as the revised reference price for option 1 is projected to remain broadly flat in real terms (if the future development of the index components is in line with their historical trend), it is unlikely that the roll-out of DHN will increase significantly, and therefore it is unlikely that the Climate Agreement target will be met unless subsidies or other policy measures are implemented. Furthermore, as mentioned above, overcompensation is likely to be considerable under option 1, while this is minimised by construction in options 2 and 3. These factors mean that we do not consider option 1 to be suitable as a long-term solution.

While options 2 and 3 are able to prevent overcompensation and bring forth relatively low prices charged to households compared to option 1 and the baseline, they would lead to price variation across networks. Since prices reflect costs under options 2 and 3, prices charged to households are higher in these higher cost areas. Therefore, if either option 2 or 3 is implemented, careful consideration could be given to a policy of subsidy and/or cross subsidy for these neighbourhoods to enable the costs for consumers to be reasonable in the high-cost areas and to mitigate undesirable price differences across user groups.

As options 2 and 3 are more complex than the baseline, the administrative burden is likely to be higher as well. We estimate that the administrative costs could increase up to €1.25m in option 3, and slightly lower in option 2. These costs are substantial, but they are relatively small when compared to the other benefits of these options.

Compared to option 1, which could be implemented relatively quickly given its similarity to the current gas reference price, a full implementation of option 2 or 3 is not likely to be feasible without a longer transition period (see section 9 for details). It is also likely that in options 2 and 3 DH investments will slow down in the short term before the chosen option is fully implemented because of the increased uncertainty and the time needed to adapt to the new regulatory regime. However, these effect would be only temporary, as in the medium and long term the investment incentives would be higher when compared to option 1 or the baseline. The effect of this uncertainty could be mitigated by the EZK and ACM clearly explaining to stakeholders what the transition plan is and communicating around that to enable DHCs to plan their investments with as much certainty as possible.

Comparing options 2 and 3 with one another, the benefits of option 3 can to a large extent be achieved with option 2 at lower administrative cost. The investment climate would be better under option 3, as this approach would provide greater protection against cost risks to DHCs. Since option 3 only performs slightly better on these points than option 2, it seems unlikely that the marginal benefit of option 3 compared to option 2 would be outweighed by the increased regulatory burden.

The table below summarises the key results from this section.

Table 7.8 Summary of the impact assessment results

	Baseline	Option 1	Option 2	Option 3
Results				
Average price per household connection (€/year)[1]	1,331	1,296	610	600
Risk of overcompensation	High	Medium–high	Low	Low
Administrative burden	Low	Low–medium	Medium–high	High

Notes: [1] Quantitative metrics are specified for 2040 estimations in 2010 prices. Prices charged to households are based on the revenue collected from the end users, and adjusted by removing the potential overcompensation for options 2 and 3. All prices are calculated for a scenario where the number of DH connections for currently existing households is enough to just meet the Climate Agreement target for DH roll-out.

Source: Oxera.

However, as cost-reflective price regulation would be a large change for the DH sector, it would need to be implemented over an extended period of time. This could involve making the current gas reference price more cost-reflective at a national level in the short term, and then progressively implementing the key building blocks required for cost-based regulation at the network level (regulatory accounting requirements, designing the benchmarking and allowed rate of return methodology, etc.). To smooth the transition to the new regime, which would result in higher prices for some networks and lower prices for others, the new tariffs could be phased in over a period of 5–10 years.

8 Other suggested policy options

In addition to deciding on a price-setting methodology, a regulatory package needs to include other policies, such as:

- creating incentives for DHCs to develop or contract low- or zero-carbon heat sources that are more cost-efficient than the ones they currently use;
- designating an operator of last resort or a special administration regime (in combination with measures to prevent the necessity of it as much as possible);
- introducing robust regulatory accounting requirements;
- providing a mechanism for the socialisation of risk and associated funding;
- a consumer protection regime, including a dispute resolution procedure;
- providing a mechanism to subsidise high-cost networks (if desired).

These are important issues for the success of the DH sector, but are beyond the scope of this study. Therefore, they are briefly raised here for completeness but are not considered in detail.

8.1.1 Incentives for DHCs to contract external low- or zero-carbon heat sources

DHNs are simply a mechanism through which to achieve the reduction in carbon emissions from heat. Our understanding is that there are already plans to require DHNs to decarbonise heat sources; therefore, it will be important for an additional policy to be put in place to create incentives for DHCs to develop or contract low- or zero-carbon heat sources if this is more economical than developing sustainable heat generation themselves.

It is important that such a policy provides a route to market for renewable or low-carbon heat sources. These may be supported through other schemes (e.g. SDE++) that subsidise the development of renewable energy. Hence, the regulation of the DH industry should be aligned with existing regulation and enable access to the DHNs for external heat sources—providing a route to market. This may potentially require the development of a ‘balancing test’, which weighs the benefits to society against the costs to a DHN or independent generator of having potentially valuable generation assets displaced.

8.1.2 Operator of last resort or special administration regime

As DHCs become local monopolies under the new market design and provide an important product to consumers, it will be necessary to plan for what would happen in the event that a DHC experiences financial distress or is unable to operate for other reasons.

Such procedures are common in many network industries and can include either retention by the government of an ‘operator of last resort’, which can be mobilised to take over a failing DHC until the issues can be resolved, or a special administration regime that enables an entity that would normally be required to cease supplying and distributing heat to continue doing so under close supervision by the regulator or government.

8.1.3 Socialisation of risk

One risk of developing a DHN is the uncertainty of its utilisation—i.e. the number of connections that will ultimately finance the project and the extent of heat that those connections will demand (volume risk). Since consumers are not required to connect, 'locked into the DH service', or required to use a certain volume of heat, this risk is difficult for DHCs to tackle. It could, however, be shared with the government (municipal/provincial/national) to make investment in DHNs more attractive.

This type of risk-sharing approach would be likely to reduce the required rate of return for investment in DHNs. It would also align the interest of public, local authorities (e.g. municipalities) with the interest held by DHN investors. Both would strive to ultimately mitigate this risk, with the authorities potentially able to mitigate the volume risk by using different tools from the companies.

8.1.4 A consumer protection and service quality regime

Another standard component of regulatory regimes is a consumer protection and service quality regime. These elements aim to ensure that the incentives on the regulated companies to be efficient and reduce costs are balanced with incentives to provide a high-quality service—i.e. that the cost reductions do not come at the expense of service quality.

Such regimes can include both minimum standards (where delivering less than those minimum standards can result in fines, adverse publicity or loss of an operating licence) and incentives to provide service quality that is higher than the minimum standards. A dispute resolution mechanism could also be established to give customers an opportunity to raise grievances stemming from service failures and to have these investigated.

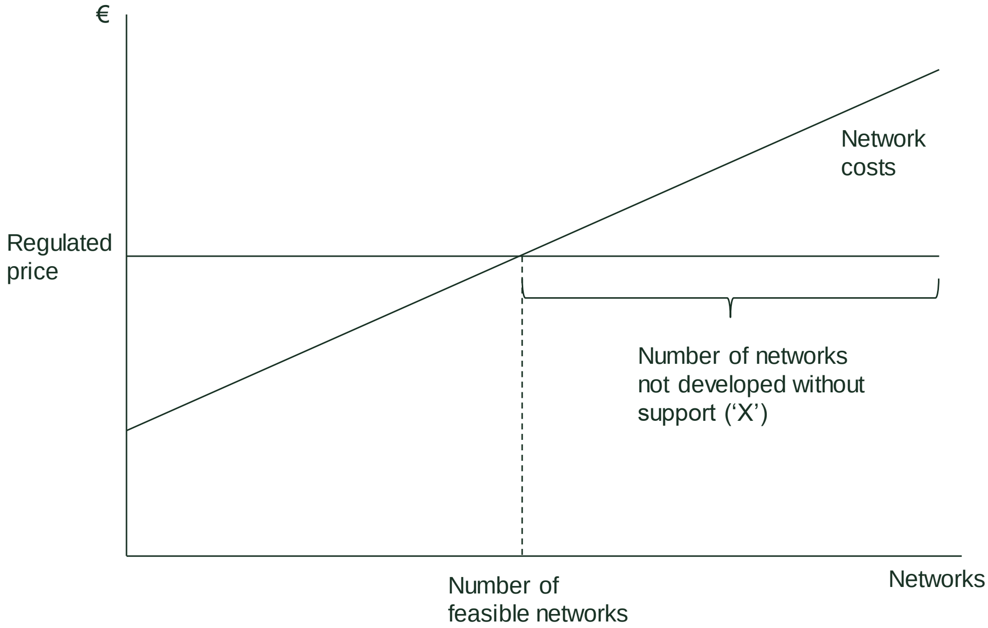
8.1.5 Cross-subsidisation of high-cost networks

While the proposed forms of tariff regulation would contribute to cost-reflectivity of tariffs, they cannot by themselves ensure affordability. In some areas the roll-out of DHNs may be costly, however, they are still considered the most cost-effective alternative gas heating by municipalities. To further progress the development of such DHNs, cross-subsidisation between networks could be considered as a solution to progress and accelerate the roll-out of DHNs.

As illustrated in the stylised example presented in Figure 8.1, imagine that all the actual and potential DHNs are arranged in increasing order of cost (reflected in the increasing 'network costs' line). For a given regulated price, there is a corresponding number of feasible networks, whose development is commercially viable.

Under the baseline and option 1, there is a non-network-specific regulated price, such that networks with high development costs are likely not to be rolled out. 'The range 'X'' refers to the number of DHNs, where network costs are higher than the regulated price, such that the roll-out would be infeasible. An important consideration in this regard is whether meeting the Climate Agreement targets would require DHNs within 'X' being constructed: if the Climate Agreement targets can be met from DHNs that are not in 'X' then there would be no direct requirement for cross-subsidy: we return to this question in section 7.

Figure 8.1 Illustration of cost and roll-out of networks



Source: Oxera.

The nationwide regulated price may challenge the rapid roll-out of DH networks envisaged by the EZK. However, there are two options to address this problem:

- cross-subsidisation across networks:
  - this approach would increase the price to DH consumers connected to lower-cost DHNs, while enabling lower prices to DH consumers connected to higher-cost DHNs. In an extreme setting (which would be difficult to implement in practice), this mechanism could level prices across the country to offer one single national price to consumers, while DHCs are covering their individual costs;
- external subsidy:
  - this approach would subsidise the development of higher-cost DHNs through other funds provided by (local) government.

For both approaches, it is critical to clearly communicate these financial transfers to consumers to provide transparency in the DH tariff structure.

Under option 3—despite the ability to delay compensation for costs incurred in expanding or enhancing a network to a greater extent than under other options—there may still be some networks for which the costs are not affordable. The same two options as described above are available to address the problem of affordability.

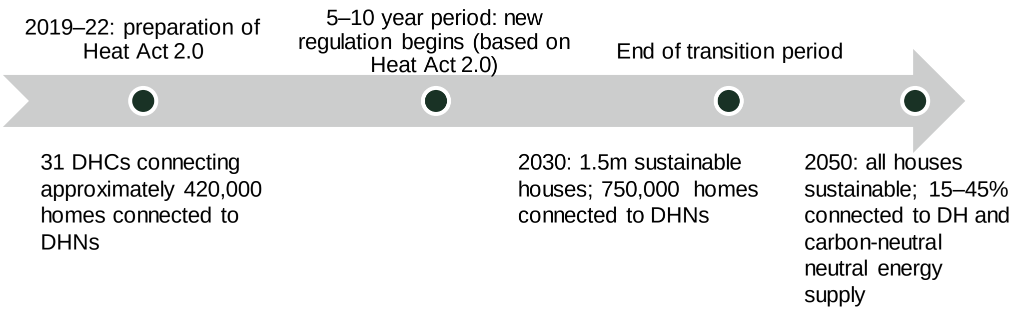
9 Transition to recommended regulatory regime

9.1 Need for a transition period

As cost-reflective price regulation (such as option 2) would be a large change for the DH sector, it would need to be implemented over an extended period of time. This could involve making the current gas reference price more cost-reflective at a national level in the short term, and then progressively implementing the key building blocks required for cost-based regulation at the network level (regulatory accounting requirements, designing the benchmarking and allowed rate of return methodology, etc.). To smooth the transition to the new regime, which would result in higher prices for some networks and lower prices for others, the new tariffs could be phased in over a period of 5–10 years.

Oxera's understanding of the indicative timeline for the introduction of new DH regulation is shown in the figure below.

Figure 9.1 Timeline for the introduction of new DH regulation



Source: Oxera.

Figure 9.1 shows that the introduction of the Heat Act 2.0 is expected within a relatively short time, such that a transition to a new regulatory regime is likely not to be feasible. This suggests that there may need to be a transitional regime for a 5–10-year period that would allow for only limited reform of the revised gas reference price (which itself was only implemented on 1 January 2020). Although the transitional regime may not be sufficient to achieve all of the desired policy objectives, it would nevertheless allow for thorough preparations to be made for the introduction of a more ambitious regime after the end of the transition period.

It is important to note that the transition period will result in uncertainty for DHCs and may reduce the attractiveness of investing in DHNs during this transition period. Thus, to achieve the desired roll-out of DHNs, the transition period should be prevented from covering an excessively long period, the envisioned regulatory regime at the end of the transition period should—ex ante—be communicated transparently and key stakeholders updated regularly by the EZK and ACM on the progress in transitioning to the new regulatory regime. In addition, stakeholders should be consulted carefully on the transition plan and detail of the regulatory regime before and during the transition period. However, it is important that when the new regulatory regime is introduced, that the necessary components are in place: for example, that the ACM has access to robust data (through regulatory accounting requirements) and that the benchmarking approach is well developed and tested. Putting these components in place will take time and so the length of the transition period will need to be balanced between these competing elements.

9.2 Implementation of the transition towards new regulation

As set out in earlier sections, it is envisaged that the introduction of a successor regime to the revised gas reference price would require several new features to be introduced to the DH sector in the Netherlands:

- revised DH licences, including a 'de minimis' regime for small suppliers;
- more robust regulatory accounting requirements;
- a mechanism for the socialisation of risk and associated funding;
- incentives to provide third-party generators with access where this is socially beneficial;
- a consumer protection regime, including a dispute resolution procedure.

This is a substantial programme of work, which is crucial for reaching the desired outcomes in the DH sector. On this basis, the shortlisted option 1 is the most suitable approach for implementation during the transitional period. This is because the administrative burden is the lowest of the three shortlisted options, something that would imply that this approach could be implemented more quickly than the others. The risk of overcompensation would then be mitigated (although not eliminated) during the transition period.

The transition period could then be used to implement the other reforms outlined above. Meanwhile, the DH cost-related reference price would also be flexible enough to allow it to be adjusted periodically (via the base price) to be responsive to the findings of future profitability monitoring reports.

9.3 Consequences of recommended transition

A consequence of the move from the revised gas reference price (since 1 January 2020), to a DH cost-related reference price (from 2022), and then to either a comparator-based regime or network-specific incentive-based regulation (from 2027-2032 onwards) is that individual consumers could experience significant changes in the level of prices for DH services at these points unless some way of 'smoothing' prices at these times is found. This follows from the fact that these transitions would involve: (i) moving from a gas-price-based to a DH cost-based reference price; (ii) moving from a national price to a network-specific price; and (iii) 'unwinding' of existing (and potentially large) cross-subsidies or overcompensation maintained by DHCs within their portfolios of (very heterogeneous) DHNs and customers.

Although there are many ways in which the transition between two different pricing regimes could be managed, one simple and generally applicable option would be to continue to calculate prices under both regimes for a defined period (say, five years) and then gradually change the weighting factor in the calculation of the average of both prices from 0% to 100%.[161] For example, in year 1 of the transition period the weighted average price would be entirely based on the 'old' price (i.e. 0% weight given to the 'new' price), then a 25%

[161] This approach could also be made more gradual for customers that face larger price 'shocks' between the old and the new pricing regimes.

weight to the new price would apply in year 2, and so on until, by year 5, the weight given to the new price would be 100%.

In the event that domestic DH customers face very large price 'shocks' between the old and the new pricing regimes (for example, when the new price would result in a household being classed as 'energy poor'[162]) then it may be necessary to spread these costs in some way (to other consumers or taxpayers).

Another consequence of the move from the revised gas reference price (since 1 January 2020), to a DH cost-related reference price (from 2022) is that some DHCs that have entered into long-term contracts for the purchase of heat at prices linked to the natural gas price may face a growing mismatch between their heat purchase costs and the (new) end-user price cap. Although, this issue would seemingly only arise as a result of the commercial decisions of the DHCs involved, the inability to renegotiate the terms of these contracts could put additional strain on the financial viability of certain DHCs. In this case, it would be important to ensure that a special administration regime is in place and that a supplier of last resort can be designated for any DHN to ensure continuity in DH supply.[163]

More generally, another possibility is that DHCs may try to recover the costs caused by changes to pricing regulations by increasing prices to 'contestable' customers (i.e. those that are not covered by the price cap regulations). While these customers are generally larger and may have long-term contracts that shield them from price risk, additional monitoring or dispute resolution mechanisms may need to be implemented to mitigate the adverse consequences on these customers.

The details of the transition period will need to be developed considerably, but from our experience, a transition period of 5–10 years would seem to be realistic. This period could start with reform of the current gas-reference price to make it more cost reflective while at the same time putting the key building blocks of Option 2 in place: regulatory accounting requirements, setting out the rate of return and benchmarking methodology, etc; running the regimes in parallel for a few years; and then gradually transitioning customers to the new tariffs.

[162] Energy poverty is often defined as when a domestic customer is unable to keep their home adequately warm. While the operational definition of this varies greatly across the EU it is often measured as a threshold value for affordability, such as energy costs as a percentage of household income. Some member states have no official definition for this term. See Eurostat website, 'EU statistics on income and living conditions (EU-SILC) methodology - economic strain', https://ec.europa.eu/eurostat/statistics-explained/index.php/EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_-_economic_strain.
[163] In principle, this would also apply to any other change in regulation that inadvertently resulted in certain commercial arrangements being uneconomic and threaten the financial viability of a DHC or DHN.

10 Conclusions

The DH market is complex and evolving. Partly as a result of this complexity, it can lack transparency to customers, DHCs and the government. This means that customers may find it difficult to understand how their bills are calculated (and particularly what the BAK is paying for and how that is calculated); DHCs do not necessarily understand the profitability of different customers or networks; and the government cannot target policies to achieve desired policy outcomes.

The DH market is also highly variable, with different networks having different sources of heat, different technical characteristics (such as the operating temperature of the network), and different density of connections.

Despite this complexity, the government sees a substantial increase in the number and scale of DHNs as an important component of decarbonising the provision of heat. This increase is not an end in itself, but rather a method by which very low- or zero-carbon heat sources can be connected to properties to decarbonise the supply of heat. The EZK is therefore developing a market design that will result in the appointment of a DHC for each local area.

Tariffs for DH are regulated by linking the cost of DH to the costs of heat from natural gas. This is because DHCs experience little or no effective competition, and therefore small consumers are considered to be in need of protection against the monopolistic power of DHCs, especially since heat is a merit good in the Netherlands. The linking of the costs of DH to the natural gas price results in a perception of unfairness and in counterintuitive outcomes: as the price of natural gas increases, so does the price of DH, regardless of the underlying costs of DH. This does not increase the attractiveness of DH as an alternative to natural gas.

New price regulation therefore needs to be developed that enables the EZK to achieve its policy objectives in the DH sector. This price regulation must work with the complexity and continued evolution of this sector.

There are a wide range of potential approaches to price regulation, but relatively few meet the EZK policy objectives of preventing the overcompensation of DHCs (which will be local monopolists once they are appointed); providing a supportive investment climate so that DHCs are prepared to continue investing in DHNs; and supporting customer acceptance of DH as a technology through the provision of transparent and relatively stable prices.

In order to meet all of these objectives, some form of cost-based pricing at the local level is necessary. As some networks are higher-cost than others (either because of higher upfront investments, higher operation costs or higher costs of heating sources), if there were a single national price then encouraging the roll-out of new networks would require either a subsidy or an increase in the national price to make new networks commercially viable. In a system with one national price, it is not possible to reveal the high-cost networks. However, increasing the price across all networks to support the roll-out of the new DHNs/the expansion of existing DHNs by making them more commercially appealing (which would be the effect of increasing a single national price) is likely to result in overcompensation and/or inefficiency from the existing (lower-cost) networks, and a lack of consumer acceptance and (potentially) affordability, because the relationship between costs and prices is unclear.

However, this cost-reflectivity cannot be unlimited: in terms of either changes in costs over time (volatile prices year on year are unlikely to be acceptable to customers), or across regions.

Within such a cost-based price regulation framework there would be two main options: a benchmark option, where DHNs have their costs set on the basis of the costs of other DHNs that are broadly similar; and an incentive-based option, which is similar to the benchmark option but where DHNs can propose additional incentives to deliver outputs that stakeholders want in exchange for additional revenue, so that the benefits of delivering those outputs are shared between the DHN and the stakeholders.

The administrative burden is higher for the incentive-based regulation than for the benchmarking approach on its own. To arrive at a choice between the two, the relative costs and benefits should be considered: there is no unique answer and different parties may draw different conclusions about how to weight the factors. Based on our assessment of these different aspects, we consider that a benchmarking approach (referred to as option 2 in the shortlist in the body of the report) provides a better balance between administrative costs and the benefits from reduced risks and efficiency incentives.

Price regulation, and regulatory regimes more generally, are complex and evolve over time. It is therefore possible that option 2 could be implemented and elements of option 3 be added over time in response to particular aspects of the market if needed or desirable. In any case, given the detail required to implement any price regulation, there remain many decisions to be taken on the detail of any of the options identified in this report.

However, as cost-reflective price regulation would be a large change for the DH sector, it would need to be implemented over an extended period of time. This could involve making the current gas reference price more cost-reflective at a national level in the short term, then progressively implementing the key building blocks required for cost-based regulation at the network level (regulatory accounting requirements, designing the benchmarking and allowed rate of return methodology, etc.). To smooth the transition to the new regime, which would result in higher prices for some networks and lower prices for others, the new tariffs could be phased in over a period of 5–10 years.

A long transition period increases the risks DHCs face, thereby reducing the attractiveness in investing in DHNs. However, some time should be devoted to implement the regime properly, considering its complexity and significant long-term benefits.

A1 Rate of return and financeability

One of the typical objectives of networks regulation is to protect consumers from being overcharged by companies. For this reason, regulators often cap the allowed revenues and prices. However, the allowance has to be high enough for regulated companies to recover their costs and earn sufficient profit.

Investors invest in an opportunity only when they expect the return to be in line with or above the cost of capital of that opportunity.[164] In a regulatory context, this is sometimes referred to as the 'fair bet' principle.[165] If the return that DHCs are allowed to earn is not sufficiently high, they will experience difficulties with raising financing for their operations. If the allowances appear to be insufficient for DHCs to service their debt obligations, in a worst-case scenario they may be forced to enter into a bankruptcy procedure.

Potential consequences of insufficient profit allowances are:

- underinvestment in the quality of consumer service (e.g. a lack of network maintenance investment);
- low supply-side uptake of DH, and therefore challenges in achieving Climate Agreement targets;[166]
- in the worst-case scenario, the closure of DHNs, which creates a risk for the security of heat supply.

The importance of sufficient compensation to DHCs is also recognised in the Heat Act 2.0.[167]

A1.1 Rate of return

In network regulation, companies' profitability is typically measured with the return on capital. The corresponding profit allowance is then estimated with reference to the cost of capital. Other options to measure profitability are also available—for example, profit margins may be used in more asset-light industries.

The cost of capital is the cost at which a company can raise finance from investors—for example, to support its new investment. At the same time, the cost of capital is the rate of return required by investors to make a given investment, rather than investing in other opportunities.

There are two main reasons why investors require a return on their investments. First, they require compensation for the time value of money: a euro today is typically considered more valuable than a euro tomorrow.[168] Second, investors require compensation for the risks that they bear. Therefore, the more risk is allocated to the regulated companies, the higher the allowed return should be.

[164] In order for this to hold, the upside and downside risks should be symmetrical. If the upside is capped but the downside risk is unlimited, the distribution of the expected returns changes, as does the mean return. This should be taken into account when setting DHCs' regulatory allowances.
[165] See Ofcom (2011), 'Proposals for WBA charge control', 20 January, p. 181.
[166] Rijksoverheid (2019), 'Climate Agreement – C Arrangements in sectors – C1 Built environment', p. 37.
[167] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3., pp. 10–11.
[168] The time value of money refers to the real value of money—i.e. inflation would need to be compensated separately. This principle is at odds with the current negative interest rate environment of some countries.

The cost of capital should reflect the cost of both equity and debt financing if both are used by the companies in the market. These are then weighted using the appropriate proportions, reflecting the companies' capital structure. To estimate the regulatory allowances for the cost of equity and the cost of debt, regulators typically refer to asset pricing models (such as the capital asset pricing model, CAPM, for the cost of equity) and the market data.

A1.2 Financeability

In addition to assessing the cost of capital for regulated companies, some regulators undertake additional tests of whether companies are able to raise financing on reasonable terms.

The ACM does not have an explicit finance duty to ensure that, under the chosen regulatory regime, DHCs are able to finance their operations on reasonable terms. Neither is this explicitly mentioned in the Heat Act 2.0. However, given the policy objective to increase the uptake of DH, it would be important for the ACM to consider financeability issues at least upon request—i.e. where concerns are identified.

The following methods can be considered in order to mitigate the DHCs' exposure to the financeability risks associated with the regulatory regime.

- Allow a sufficient rate of return to ensure the DHCs' long-term sustainability (see the previous subsection).
- Undertake financeability assessments to check whether, under the chosen regulatory framework, efficiently operated regulated companies are able to finance their operations on reasonable terms. In practice, this may be interpreted as achieving an investment-grade credit rating. To ensure that inefficiency is not rewarded, the ACM may consider undertaking the assessment on a notional level—i.e. using assumptions of an efficiently operated DHC. The financeability assessment does not have to be undertaken for all DHCs, but can be looked into upon request.
- Introduce additional provisions within the regulatory framework, such as ring-fencing or special administration. Ring-fencing conditions restrict the extent of the claims that can be written on regulated cash flows and assets. The special administration condition provides customers with a degree of protection from the interruption of the essential services.
- Transfer cash flows' risk to customers. As with the opportunity to share the volume risk with customers (or fully allocate it on them), other tools are available to a regulator under more flexible regulatory regimes (such as the shortlisted options 2 and 3). These include the risk-sharing mechanisms, pass-through cost allowances, price control re-openers, and the choice of the length of the price control.
- Be predictable. The more stable and predictable the regulatory regime is, the lower the regulatory risk. Where investors cannot rely on the regulator to be reasonable, the ability to raise finance on reasonable terms will necessarily deteriorate.
- Limit the leveraging of DHCs. This can be achieved by reducing DHCs' incentives to rely on debt financing and increasing their incentives to issue equity. Alternatively, a regulator can recommend or prescribe an appropriate proportion of debt financing.

Given the number of DHCs and (especially) DHNs in the market, it is important for these measures to be proportionate in terms of the associated administrative burden on DHCs and the ACM.

A2 Regulatory accounting requirements

Regulated companies are often required to prepare and report their regulatory accounts to the regulator, in addition to the statutory accounts that all companies, whether regulated or not, must report. Regulatory accounts are consistent across the industry and may include specific metrics not included in the statutory accounts. Therefore, the two types of accounts may or may not diverge from each other, depending on what is dictated by the regulatory regime.

The regulatory accounts typically serve the following purposes.

- **Monitoring companies' performance**—e.g. profitability, which may be used to assess the potential extent of investors' overcompensation or financial health. This information shows how well the market is functioning, and therefore how well the regulatory regime is performing. Monitoring companies' performance is beneficial for any regulatory regime, and hence for any shortlisted option considered in this report.

- **Informing revenue allowances**, including avoiding double-counting in costs remuneration. In cost-reflective regimes, revenue or price allowances are informed by companies' actual or forecast financial information, which must be prepared in a consistent and transparent manner. It is also important to ensure that the accounting requirements are consistent with the elements of the regulatory regime and that no costs are counted twice when revenue allowances are estimated.[169] This purpose is specific to cost-reflective regulatory regimes—for example, it would be relevant for the comparator-based regulation (shortlisted option 2) and network-specific incentive-based regulation (shortlisted option 3) proposed in this report.

- **Benchmarking companies' financials across the industry**. It would not be appropriate to benchmark companies' costs if accounting treatment or principles of common costs allocation were not consistent across the DHNs and over time. In the context of our recommendations to the DH sector, consistency is essential for shortlisted options 2 and 3.

- **Improving transparency**. Statutory accounting standards typically do not require companies to disclose segmental financials. For example, they will not contain financials of individual DHNs owned by a large DHC. Neither will they separate heat generation from distribution and retail. Finally, if DHCs are involved in non-regulated activities, regulatory accounts will typically strip them out.[170]

To achieve these purposes, the ACM may need to issue the regulatory accounting guidelines (RAGs), in which it would specify critical principles for the DHCs to follow.

However, the administrative cost of issuing the RAGs and complying with them should be considered. Given the number of market players, the ACM (or individual municipalities) will not be able to verify each submission individually. Therefore, it is important that the guidance is very clear and precise, and that the process is highly automated. The ACM may require external parties, such

[169] For example, asset valuation should be consistent with the rate of return estimate: if the value of the assets is regularly increased by inflation, no additional inflation allowance is needed within the rate of return allowance.
[170] Although in option 1 regulatory accounts would not be required for benchmarking or informing revenue allowances, they would still be important in improving transparency.

as auditors, to verify the regulatory accounts. However, in doing so, the ACM would have to be mindful of the increasing reporting burden for DHCs.

On the other hand, a large number of DHNs in the market increases the statistical significance of any benchmarking analysis. Therefore, the reporting consistency becomes less critical than it would be with a limited number of market players.

A2.1 RAG elements to consider

For the recommended comparator-based regulatory regime, the ACM would need to require DHCs to report financials at the DHN level. This, however, would not mean that the three financial statements would have to be prepared for each of the networks—instead, only the elements needed to achieve the regulatory purposes would be required. For example, if DHNs do not raise financing at the network level, asking DHCs to report the interest payments by DHN is unlikely to be informative.

If DHCs are involved in any non-regulated activities, accounts for the regulated part of the business will have to be separated from the non-regulated part of the business. Moreover, the ACM may request accounting separation of DHCs' activities across the value chain—i.e. the accounts for heat production would need to be separated from those for distribution and retail. However, to minimise the administrative burden, this should be requested only if needed for the regime—i.e. if the costs of different activities are required for benchmarking, or if they are expected to be remunerated differently.

Below, we list a number of specific areas that the ACM may need to consider and specify in the RAGs.

A2.1.1 Costs and assets allocation principles

Given that segmented accounts are likely to be required (at a minimum, segmentation by a network), the guidelines should specify the principles of allocating costs and assets between the segments.

In general, the costs may be classified into the following categories.

- Direct costs, which are directly associated with a particular segment of the business. These should be allocated to the corresponding business segment.
- Indirect costs with identifiable cost drivers. These costs are not directly associated with any of the segments, although it is possible to find a cost driver for them. For example, HR costs could be allocated to business segments in proportion to the corresponding FTE numbers.
- Indirect costs with no identifiable cost drivers. The RAGs will have to specify the methodology for allocating these costs. For example, they may be allocated in proportion to the direct costs and allocated indirect costs.

A2.1.2 Cost categories

The guidelines should specify the level of costs categorisation required for benchmarking. Immaterial cost categories should be grouped together where possible to reduce the reporting burden for companies. However, this is likely to be more detailed than in the statutory accounts.

A2.1.3 Asset base considerations

If the asset base is used for determining the revenues allowance, the asset valuation principles should be discussed in the RAGs. Examples of the issues to consider are as follows:

- asset life assumptions;
- depreciation method;
- capitalisation principles;
- the choice between historical cost accounting and current cost accounting.[171]

It is important to ensure that these principles are consistent with the treatment of costs under the chosen regulatory regime.

A2.1.4 Transfer pricing

To increase the consistency and transparency of the reporting, the RAGs should also specify and/or require disclosure of the principles of pricing mechanisms used for internal and external transactions with related parties. To make this requirement proportionate for the ACM and the DHCs, it may be worth requesting the disclosure only upon request—e.g. following a complaint.

[171] This has to be consistent with the the rate of return estimate: if historical cost accounting is used, the rate of return estimate should be specified in nominal terms. If current cost accounting is used, the rate of return estimate should be specified in real terms.

A3 Tariff design

A3.1 Principles of tariff design

After determining the price-setting methodology for DH tariffs, a potential next step is to determine how this should be converted into DH retail tariffs. The tariff design (i.e. the structure of DH tariffs) may be specified by the regulator or the regulated company.

Principles of tariff design have been discussed in the academic literature.[172] Potential objectives for the structure of tariffs can include:

- yielding total revenue requirements;
- achieving fairness in allocating the total cost of service among different customers;
- discouraging wasteful use of the service;
- ensuring revenue stability and predictability;
- ensuring tariff stability and predictability;
- promoting simplicity, comprehensibility, public acceptability and feasibility of tariffs.

A3.2 Tariff structure options

Based on the principles of tariff design described above, we consider four main options for structuring tariffs:

- **peak tariffs**—which involves pricing energy consumption differently during well-defined times of high demand and/or low supply;
- **two-part tariffs—**comprising both a fixed charge and a per-unit charge;
- **three-part tariffs**—similar to two-part tariffs, but with the addition of a capacity (or demand) charge that is charged on the basis of customers having high-intensity demand for energy at any point in time;
- **block tariffs—**where per-unit charges depend on the actual consumption.

These options are not mutually exclusive and, in practice, are often used in conjunction.

A3.2.1 Peak tariffs

Peak pricing involves pricing energy consumption differently during well-defined times of high demand and/or low supply. Such tariffs are readily justified for customers whose demands for electricity vary greatly by the day, hour, week, month or season, and thus impose extra costs on various parts of the electricity supply system.

With peak pricing, users are charged a higher per-unit charge for access during the peak period (e.g. during winter). There are two main objectives of such a scheme:

[172] Bonbright, J. (1961), *Principles of Public Utility Rates,* New York, Columbia University Press.

- cost reflection—to ensure that customers, at specified times, are charged for the impact of their high-intensity demand on system costs;
- generating incentives to smoothen demand—to provide customers with high-intensity demand with an incentive to reduce their peak consumption.

Peak pricing is, therefore, a form of marginal cost pricing: the per-unit charge levied during the peak times should reflect the costs of heat supply incurred in these time periods. As a result, peak pricing promotes cost-related fairness, since those users who require heating during peak times (thereby imposing higher costs on the system) are charged higher tariffs for this usage.

A3.2.2 Two-part tariffs

Two-part tariffs are commonly used for customer electricity pricing. They are known as 'two-part' because these tariffs comprise a fixed charge and a per-unit charge. This tariff structure could also be applied to the DH sector.

The fixed charge (or 'standing charge') component is typically intended to capture a customer's share of the fixed costs involved in supplying their electricity, including the costs of transmission and distribution. By charging a fixed cost, the tariff is better able to recover allowed revenues while the incentive benefits of marginal cost pricing are retained. The per-unit charge typically consists of a per-unit (kWh) charge for energy, intended in some way to reflect the marginal cost of extra units of energy (however, there is some flexibility here—see 'block tariffs' below).

From the point of view of cost recovery, a two-part tariff aims to approximately recover the costs that each customer imposes on the energy infrastructure in terms of their share of both the fixed and variable costs of electricity consumption. An appealing property of these tariffs is that they ensure that, regardless of usage, a customer pays their share of the fixed costs incurred by the producer. In addition, they ensure some revenue stability for the producer.

Two-part tariffs can, however, lead to concerns about distributional fairness, particularly for residential customers. High fixed charges, which are applied irrespective of energy usage, may result in significantly higher bills for customers who do not actually use much electricity (perhaps due to self-rationing) and would otherwise face a low bill. A partial solution to this issue of distributional fairness is to vary the fixed charge based on customers' total usage over a defined period. It may be considered fair that customers who use a larger total amount of electricity over a given period pay a higher fixed charge, reflecting their overall more extensive use of the system-wide assets.

A3.2.3 Three-part tariffs

Three-part tariffs are essentially two-part tariffs but with the addition of a capacity (or demand) charge that is charged on the basis of customers having high-intensity demand for energy at any point in time. While capacity charges are fixed charges levied on customers, in contrast to the standard fixed charge in the two-part tariff setting, they are dependent on the maximum instantaneous usage that a particular customer requires. Moreover, capacity charges differ from peak charges (as above), since capacity charges are based on the customer's own peak heat usage, whenever that peak occurs, as opposed to being based on periods of high overall system demand. Equivalently, peak charges are intended to incentivise heat use at the margin at specific times, whereas capacity charges aim to incentivise the efficient conservation of energy on a continuous basis.

Both capacity and peak charges, however, aim to cover the cost of providing a network large enough to cope with peak demand, and the running of the network at peak times. Capacity charges also deliver a degree of revenue certainty for the company. However, through levying capacity charges, the company gains better information to forecast investment requirements. In addition, capacity charges provide customers with an incentive to forecast their demand more effectively.

A3.2.4 Block tariff

A final option for DH pricing is to price heat usage in inclining or declining blocks. Under this scheme, the first units of heat consumption in terms of kWh (the first 'block') are charged at a certain price, followed by a second category for higher usage charged at a higher price (for inclining blocks) or a lower price (for declining blocks), and so on.

The use of inclining blocks can be justified on both distributional and conservational grounds.[173] In terms of distributional concerns, low-income households are more likely to consume heat at low-tier rates, and high-income households at high-tier rates, redistributing the revenue burden to the wealthiest households.[174] In terms of conservational concerns, by charging additional heat usage at increasing per-unit costs, price-sensitive customers will be incentivised to keep their heat consumption down, thereby promoting energy efficiency. However, while appropriate for some customer classes, inclining blocks can penalise those who require more heating, particularly for commercial reasons; in some cases, declining block tariffs may be preferred on the basis that they offer an effective volume discount.

With inclining or declining block tariffs, the two major control levers are the level that the tariffs are set at, and the rate of change between the tariff blocks. A particularly steep ascent from one block to the next may incentivise greater energy conservation, but may also have equity implications, since this is likely to have the greatest impact on the most price-inelastic customers. Conversely, tariff blocks that incline less aggressively provide less incentive to conserve energy consumption.

173 Borenstein, S. (2016), 'The economics of fixed cost recovery by utilities', *The Electricity Journal*, **29**:7, p. 9.
174 Ibid., p. 9.

A4 Consumer protection

Consumer protection is one of the typical objectives of network regulation and one of the primary duties of regulators in most countries with well-established regulatory frameworks. It is considered necessary because network companies usually have a certain degree of monopoly power over consumers. This means that network companies can (to some extent) raise prices or reduce quality without consequences, because consumers have no alternatives and depend on the company of interest.

Among other things, consumer protection involves the prevention of excessive prices. Other elements of consumer protection include ensuring security of supply and preventing price volatility or large one-off price increases.

In the Dutch DH sector, consumer protection is addressed by the Heat Act.[175] In the Netherlands, heat is a merit good, which means that security of supply and affordability of heat are a primary duty of the government. DH consumers are considered in need of protection, since DHCs have a degree of monopoly power.[176]

A4.1 Maximum prices

Protection against excessive prices and price volatility are addressed by the Heat Act through maximum prices. The ACM sets maximum tariffs for the following price components:[177]

- variable tariffs that consumers pay per GJ (this is discussed in further detail in the appendix on tariff structures);
- annual fixed payments from consumers to the DHC;
- tariffs for measuring a customer's heat consumption;
- prices charged for disconnection from DHNs;
- tariffs for the use of delivery sets (a delivery set is the link between the heating network, heaters and the hot water tap). This tariff is regulated since 1 January 2020, when the amendment to the Heat Act will be fully in force.[178]

These maximum tariffs apply to all connections up to 100kW. The maximum prices are set annually by the ACM. Except for the variable tariffs per GJ, the maximum prices equal costs.

A4.2 Other protective measures

In addition to maximum tariffs, the Heat Act looks to protect consumers with the following measures.[179]

[175] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, p. 9.
[176] Ibid., pp. 9–10.
[177] ACM Consuwijzer, 'Stadsverwarming en blokverwarming – Welke kosten staan er op de warmtenota?', https://www.consuwijzer.nl/stadsverwarming-en-blokverwarming/de-warmtenota.
[178] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, pp. 19–20.
[179] ACM, 'Levering van warmte', https://www.acm.nl/nl/onderwerpen/energie/energieleveranciers/levering-van-warmte/.

- DHCs cannot turn off heat supply or deliver heat below a certain temperature (the minimum being set by the ACM).[180] In case of failure to supply, DHCs are obliged to compensate consumers through a monetary payment (set by the ACM).
- DHCs can disconnect consumers from the DHN only if:
  - the consumer asks to be disconnected;
  - the consumer commits fraud;
  - the installation is not safe;
  - the supply agreement expires;
  - payables are not met by the consumer.
- There is a committee that consumers can make an appeal to if they have a dispute with their supplier.[181]

A4.3 Consumer engagement

An important aspect of consumer protection is consumer engagement, both ex post and ex ante. In the Netherlands, ministries can choose to publish draft legislation for public consultation—to which both consumers and companies can respond.[182] This was also the case with the amendment to the Heat Act.[183] Moreover, as also with the Heat Act 2.0, consumer organisations are closely involved in discussions on what the new legislation should look like.

A4.4 Exceptions

An amendment to the Heat Act was made in early 2019.[184] The amendment introduces the following exceptions regarding the obligations on suppliers.

- The obligations that the Heat Act imposes on suppliers no longer apply to agents that simultaneously act as heat suppliers and landlords. The reasoning behind this is that tenants are already protected by tenancy law. The prices that these households pay for their heat consumption are prescribed to be cost-reflective at the household level.

  The dispensation from supplier obligations imposed by the Heat Act also applies to owner associations that supply heat to their members. It is reasoned that agents who consume heat from an association of which they are a member do not need extra protection from the Heat Act—i.e. they have influence on that association's policy.

[180] ACM Consuwijzer, 'Stadsverwarming en blokverwarming – Welke kosten staan er op de warmtenota?', https://www.consuwijzer.nl/stadsverwarming-en-blokverwarming/de-warmtenota.
[181] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, p. 7.
[182] Rijksoverheid, 'Internetconsultatie nieuwe wet- en regelgeving', https://www.rijksoverheid.nl/onderwerpen/wetgeving/internetconsultatie-nieuwe-wet--en-regelgeving.
[183] Parlementaire Monitor (2017), 'Memorie van toelichting - Wijziging van de Warmtewet (wijzigingen naar aanleiding van de evaluatie van de Warmtewet)', Kamerstuk 34723, nr. 3, pp. 29–30.
[184] *Staatsblad van het Koninkrijk der Nederlanden* (2019), 'Besluit van 26 maart 2019 tot wijziging van het Warmtebesluit (wijzigingen ter uitvoering van de wet tot wijziging van de Warmtewet naar aanleiding van de evaluatie van de Warmtewet)', **133**, 26 March.

A5 Use of the Vesta model in impact assessment

For the quantitative part of the impact assessment, we use the Vesta spatial energy model (Vesta) to simulate the different regulatory options and compare them with a baseline. Vesta is a geospatial economic-engineering model developed by the Netherlands Environmental Assessment Agency (PBL),[185] which simulates the heating networks and heating supply choices in the Netherlands at both the national and the local level. Vesta was released as an open source model in 2017 in order to promote wider usage among municipalities, energy companies, and other users.[186]

From the point of view of this impact assessment, Vesta's main feature of interest is that it combines detailed technical and economic calculation rules with detailed household-level data, and uses this combination to provide insight into the following output measures:

- the DH adoption rate;
- CO_2 emissions;
- costs to the network companies;
- cost variability across heating networks;
- costs to customers;
- avoided gas heating costs.

As the results produced by Vesta are highly dependent on input parameters and the future values of these parameters are very uncertain (such as future energy prices and the development of the Dutch housing stock), the exact numbers presented in our calculations should not be interpreted as precise and definitive predictions of the future. This is because there is a considerable degree of uncertainty surrounding the results. Instead, the most relevant information is the relative differences between outcomes for the different policy options. For this type of analysis, Vesta is a good source of evidence to inform us about the trade-offs across the options.

When modelling the three options and the baseline, we assume that no other policy changes occur at the same time. The only exception being the energy tariffs discussed in Appendix A6.

Box A5.1 provides some technical details about the modelling.

[185] CE Delft (2017), 'Functioneel ontwerp Vesta 3.0', commissioned by Planbureau voor de Leefomgeving, December, p. 6.
[186] PBL website, 'Vesta: ruimtelijk energiemodel voor de gebouwde omgeving', https://www.pbl.nl/vesta.

Box A5.1 Vesta technical specifications

From a technical point of view, each of the three options and the baseline are implemented as separate Vesta runfiles, and run using Vesta version 3.4. In general, we use the Vesta default settings for all of the runs, except for those changes that are explicitly mentioned. However, the following technical changes are made to the model for all scenarios.[1]

- **Exclusion of low-temperature DH**. Although implemented in Vesta 3.4, this option is still under development and therefore PBL recommends not using it for policy analysis.[2]

- **Exclusion of household-level alternatives to gas heating (e.g. electric heating pumps)**. In order to facilitate comparisons between individual gas heating and DH, we do not include other alternative heating options in our simulations. In our sensitivity analysis, the adoption rates of household-level non-gas heating options remained below 1%, suggesting that their adoption on a large scale does not appear as a likely alternative in Vesta.

Change of social discount rate. Since one of the key differences between the policy options and the baseline is the DHCs' discount rate, we set the social discount rate equal to the investors' discount rate. This simplifies the analysis but does affect the results that we use from Vesta, which all use the DHCs' discount rate. We do not use outputs involving the social discount rate and so this change simplifies the analysis but does not change our results.

Note: [1] Part of the modelling assumptions have been checked and validated by Ecorys, which found the approach taken by us to be reasonable. We are grateful to Ecorys for its support.

Source: Oxera. [2] Vesta 3.4 release notes, https://github.com/RuudvandenWijngaart/VestaDV/blob/master/20190619_Releasenotes_3.4.pdf

A5.1 Price setting for options

We have made a number of amendments to the standard Vesta pricing as outlined below:

- for the baseline, the price is based on our current understanding of what the regulatory framework will be in January 2020, the latest available gas reference price (2019), and projections of future gas prices and energy taxes;

- for options 2 and 3, a similarly straightforward approach is not feasible, as the specification of prices at a network level is not possible in Vesta. This is due to the fact that the reference price is always set at the national level in Vesta, and varying prices regionally or at the network level is not possible without making significant changes to the model. Therefore we use a single national price for calculating the results in Vesta and conduct additional analysis outside Vesta to remove the overcompensation that results from using a single national price.

In order to make the results more comparable, we calculate the DH costs separately for each scenario in a case with only the number of connections to achieve the climate target. With this approach, we can roughly estimate the total and average costs for 'just meeting the target' for each option in a comparable way.

A6 Reference prices for baseline and option 1, technical details

A6.1 Baseline

In the baseline, we assume that the regulatory framework for the gas reference price in January 2020 is kept in place, and that the DH price is therefore kept linked to gas prices.

The price levels are based on the October 2019 price, and the energy price forecasts used in Vesta.[187] We also assume that the taxes on gas and electricity (energiebelasting) increase at roughly the same rate as they did during 2013–19 (following the discussion of the policy context in section 4).

A6.2 Option 1

For the purposes of the impact assessment of option 1, we form a model version[188] of the DH cost-based reference price, based on the gas reference price and currently available cost information.

The reference price in Vesta consists of the following components.

- **Base price**: the 2020 revised reference price is set equal to the predicted gas reference price in 2020.[189]
- **Cost index**: this represents a type of index that could be used by a regulator under option 1.

The cost index used for modelling contains four subcomponents:

- **the costs of building the network and connecting individual buildings to it** (50%): these are represented by a price index of civil engineering works in the Netherlands, provided by Statistics Netherlands (CBS);[190]
- **the costs of input energy prices** (20%): these are represented by the development of electricity wholesale prices at the Amsterdam Power Exchange (APX);[191]
- **the costs of repairing and maintaining the networks** (15%): these are represented by a price index of repairs and installations of machinery in the Netherlands, provided by CBS;[192]

[187] Originally from WLO/PBL (2016), 'Toekomstverkenning Welvaart en Leefomgeving. Achtergronddocument – Klimaat en energie'.
[188] Therefore, the subcomponents of the model price and their weights should not be interpreted as the final formulation of the revised price if option 1 were implemented. In particular, it would be beneficial to investigate the cost components of the current heating networks in more detail and possibly adjust the component weights accordingly.
[189] In order to keep the Vesta simulations comparable and consistent across the scenarios using 2010 prices, the modelled 2020 reference price is somewhat lower than the actual gas reference price in 2019.
[190] CBS, 'Civil engineering works; Input price index 2010 = 100', https://opendata.cbs.nl/statline/#/CBS/en/dataset/82261ENG/table?ts=1571823813732, accessed 23 October 2019.
[191] Source: Refinitiv. Other, non-electricity energy sources are excluded from the impact assessment for simplicity. In the actual regulatory regime, the inclusion of other energy sources (according to their relative weights) should be considered as well.
[192] CBS, 'Producer Price Index (PPI); output and importprices by product, 2015=100', https://opendata.cbs.nl/statline/#/CBS/en/dataset/83935ENG/table?ts=1571824163691, accessed 23 October 2019.

- **administrative costs** (15%): these are represented by a price index of Accounting and Legal service costs in the Netherlands, provided by CBS.[193]

The weight of each component approximately corresponds to the component's share of total DH costs in a Vesta simulation, where DH has been adopted on a large scale. In their study on the transition to decarbonised heating of the built environment, DNV GL and its partners also assume that the price of DH will be largely determined by the investment costs.[194] The large share of the investment costs is also consistent with findings from the UK Department of Energy & Climate Change,[195] which found that the investment costs of heat networks are generally large compared with the operating costs, but are often omitted or undervalued in pricing schemes.[196]

To extrapolate the development of the cost index for option 1, we calculate the historical growth rate of each component using all the data available (ranging from seven to 19 years depending on the component), and extrapolating the weighted average of these rates for years 2020–50. This approach assumes that the future will resemble the past. Independent forecasts of the components of the index were not available within the scope of the study.

Since the model is set in real prices, we adjust the cost index for inflation, using historical values of the harmonised consumer price index (HICP) in the Netherlands.[197]

Based on this analysis, we assume a reference price growth rate of c. 0.2% (in real terms) for the whole period.

[193] CBS, 'Services producer price index (SPPI); index 2015=100', https://opendata.cbs.nl/statline/#/CBS/en/dataset/83760ENG/table?ts=1571824450031, accessed 23 October 2019.
[194] DNV GL, Thermaflex, TU Eindhoven, Visser & Smit Hanab and IF Technology (2018), 'Slim van het gas af met lage temperatuur warmte in de bestaande bouw', TKI WINMST, pp. 5–6.
[195] Now part of the Department for Business, Energy & Industrial Strategy.
[196] Department of Energy & Climate Change (2015), 'Assessment of the Costs, Performance, and Characteristics of UK Heat Networks', p. 41.
[197] We use data from 2000–18 in line with the longest time series of the index components. CBS (2019), 'Annual rate of change HICP; The Netherlands, Euro area and Europe, 2015=100', 8 October.

A7 CO_2 emissions

This appendix describes the total carbon emissions calculated for each of the options using Vesta.

The table below shows annual CO_2 emissions and their corresponding monetary values, as estimated for 2040.

Table A7.1 Yearly CO_2 emissions in 2040

Scenario	Carbon emissions (million tonnes/year) [1]	Annual cost of total emissions (€m at €23/tonne)[2]
Baseline / Option 1	80.01	1,840
Option 2	78.82	1,813
Option 3	78.77	1,812

Note: All results calculated for a scenario, where the Climate Agreement target for existing households is just met. [1] Includes emissions from both DH and non-DH connections. [2] Value based on the European Emissions Allowance price at 11 October 2019.

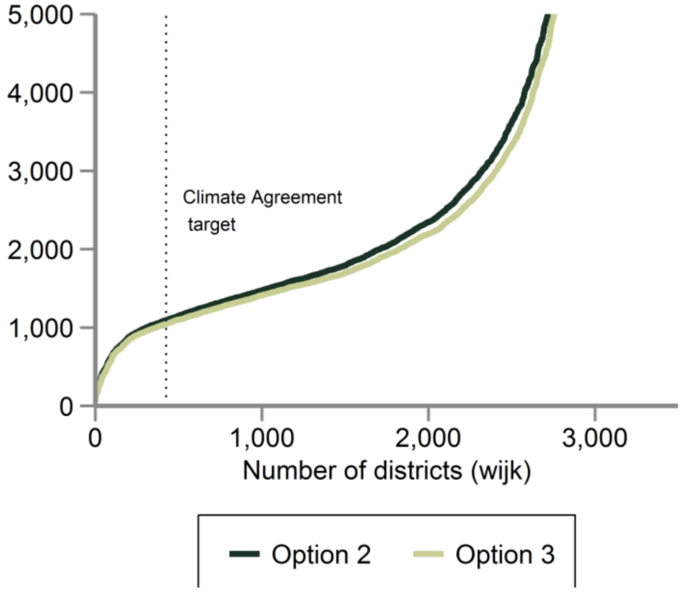
Source: Oxera, using Vesta. [2] Markets Insider website, 'CO2 EUROPEAN EMISSION ALLOWANCES', https://markets.businessinsider.com/commodities/co2-european-emission-allowances, accessed 11 October 2019.

As can be seen from the table, there is very limited differences in the total CO_2 emissions: this arises because of the assumption that there are similar numbers of connections under the different options.

A8 Additional results

The figure below shows the variation in average costs per connection at the district level.

Figure A8.1 Variation of average DH costs per connection, calculated at the district level (€/year)



Note: The figure represents the costs associated with a single DH connection, calculated at the district (wijk) level.

Source: Oxera analysis, using Vesta model.

Map A8.1 shows the distribution of total connections for options 2 and 3, under the modelling assumption that the adoption rate will be close to 100%.

Map A8.1 The most popular DH type by neighbourhood in options 2 and 3 in 2040

Source: Oxera, using Vesta and MapInfo.

The table below provides results with and without WKO enabled for option 2.

Table A8.1 Network costs, number of connections and total emissions, with and without WKO

Scenario	Average DH network costs per connection (€/year)	Number of households (existing and new) connected to DH networks	Carbon emissions (million tonnes/year)
Option 2	964	4.0m	78.82
Option 2—no WKO	877	2.8m	80.20

Note: All results calculated for a case where the Climate Agreement target for existing households is just met. The results for the 'Option 2—no WKO' row have been obtained using a Vesta simulation where WKO is not available as a heating source.

Source: Oxera, using Vesta.

This table shows that the average DH network costs under option 2 are lower (but CO_2 emissions are higher) in case WKO is not included as a source option for DH. The main reason for the observed cost reduction is the way the choice of a heating source is modelled in Vesta. As Vesta is not an economic optimisation model, the choice of a heating source is dependent on a ranking of the options chosen by the Vesta user if more than one source would be economically feasible. Therefore, as the network costs are lower in options 2 and 3, a more expensive heating source is sometimes chosen over a cheaper alternative (in particular, WKO is chosen over residual heat), which drives up the average costs for options 2 and 3. These numbers also suggest that, since options 2 and 3 have relatively more WKO-based connections, these options might actually bring forth lower average DH network costs if sources are allocated efficiently–the latter is not the case in Vesta, but is likely to happen in reality under the Neighbourhood Oriented Approach.

A9 List of stakeholder organisations invited to take part in stakeholder engagement exercise

Alliander

Consumentenbond

Eigenhuis

Eneco

Engie

Ennatuurlijk

Eteck

GasUnie

Kelvin

HVC Groep

SVP

Woonbond

Vaanster

Vattenfall

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