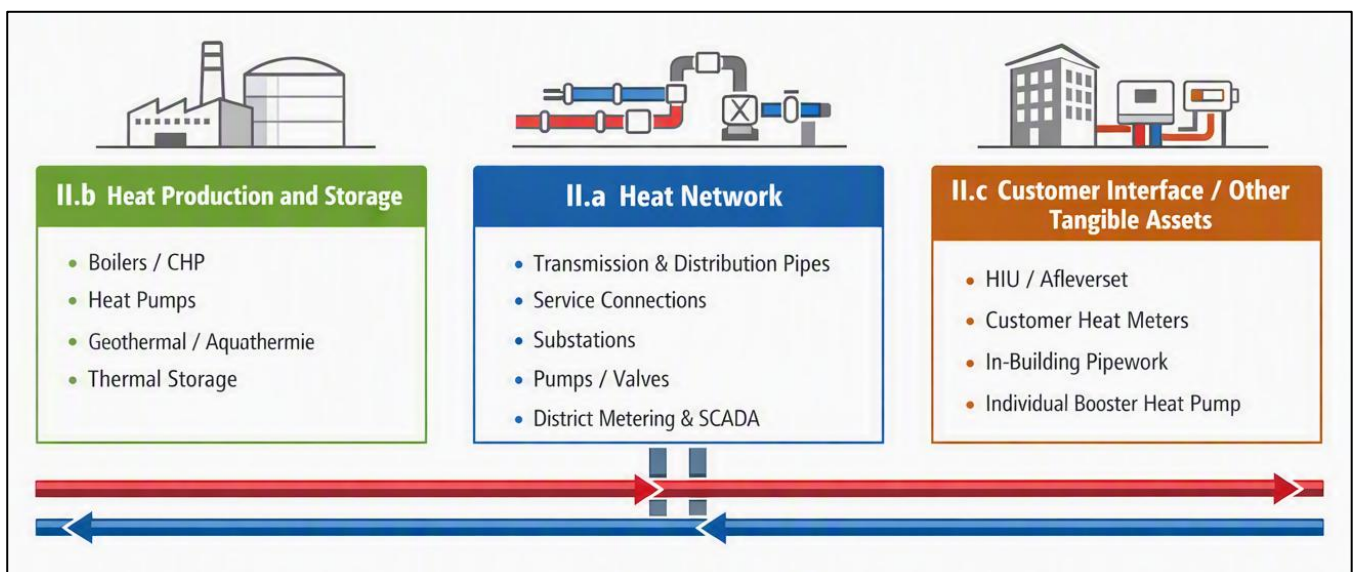


Levelization of Capital Costs of Cost-Based Regulated Dutch District Heating Companies

Phase 1 – Asset categorization and asset lifetime



30 September 2026

Frontpage picture:	Functional overview of a district heating system and corresponding RAR asset categories. Created with Copilot Premium.
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1 Introduction

The Dutch heat sector is transitioning to cost-based tariff regulation under the Collective Heat Act (Wet collectieve warmte, Wcw) and the associated Regulatory Accounting Rules (RAR). This Phase 1 report supports ACM's preparation by establishing the asset categories, boundary definitions and asset life methodology required for the future depreciation regime and the regulatory asset base (RAB). The report covers all designated heat companies (aangewezen warmtebedrijven). The asset categories and corresponding regulatory lifetimes for (WarmtelinQ Transmissie (WTS)) are not included in this report. These will be published separately.

1.1 Scope

Phase 1 covers five asset categories defined in the RAR, which are all classified with roman numerals: Category I (Intangible Fixed Assets), Category II.a (Heat Networks), Category II.b (Heat Production and Storage), Category II.c (Other Tangible Fixed Assets), and Category III (Third-party Contributions). For each category, the report establishes a proposed technical lifetime, proposed economic lifetime, and the methodological basis for each. The accompanying asset list (available in Appendix I of this report and as a separate interactive Excel sheet) contains the full per-category assessment with all underlying data, references and confidence indicators. This report describes and clarifies the structure, definitions and key findings; it does not go through the full row-by-row list in detail.

1.2 Definitions: Technical Lifetime versus Economic Lifetime

The distinction between technical and economic lifetime is central to the regulatory depreciation methodology. These terms are often used interchangeably in practice, but they represent different concepts with different implications for tariff design.

The technical lifetime used in this report follows the definition in the Energy Technology Catalogues (ETC) (Danish Energy Agency and Energinet, July 2026) (Danish Energy Agency and Energinet, December 2025) (Danish Energy Agency and Energinet, April 2026) (Danish Energy Agency and Energinet, April 2026) published by the Danish Energy Agency (DEA): the expected time for which an energy plant can be operated within, or acceptably close to, its original performance specifications, provided that normal operation and maintenance takes place. Key characteristics of this definition:

- Normal maintenance is assumed and included. This means routine component replacements — pump impellers, heat exchanger gaskets, control modules, valve actuators — are maintenance events, not lifetime-defining events. They are part of keeping the asset within specifications, not signs of approaching end-of-life.
- Technical end-of-life is reached when the cumulative effect of wear, degradation and increasing repair frequency leads to unacceptably low availability and/or operation and maintenance costs that can no longer be justified relative to the cost of replacement. This is a system-level assessment, not a single-component occurrence.
- The value is theoretical and based on experience. It is not the minimum/maximum observed lifetime — it represents a central expectation under typical operating conditions and maintenance practices. In the Netherlands, the usage of production technologies is estimated to approximately 4,000–5,000 full-load hours annually.

The economic lifetime is the period over which an asset is depreciated for regulatory purposes. It is not the same as the technical lifetime, and it should not automatically follow company bookkeeping practice. In practice, many district heating companies use shorter depreciation periods in their accounts than the true economic useful life of the asset — driven by financing incentives, grant conditions, tax rules or internal cash management strategies. For example, a pipe depreciated over 15 years may have an economic useful life of 45 years. Using the shorter lifetime in a regulatory context would front-load allowed revenues, inflating tariffs in early years and producing a fully-depreciated asset that still provides service — neither of which reflects economic reality. For regulatory purposes and to reduce intergenerational inequity between consumers, the economic lifetime should aim to reflect the period over which the asset genuinely delivers economic value to the system, anchored by the technical lifetime and adjusted for degradation and risk factors.

The economic lifetime proposed in this report is in most cases shorter than the technical lifetime, reflecting the Step 2 risk factors explained below: degradation risk (operation and maintenance costs escalating toward replacement economics before technical end-of-life) and policy or stranding risk (foreseeable early retirement due to regulation, technology shifts or demand change). For district heating network infrastructure with low risk on both factors, economic and technical lifetimes usually converge.

1.3 Lifetime Assessment

The lifetime assessment methodology developed in this phase and applied in the “Asset list DH companies” tab of the asset list (Appendix 1) is a two-step process. It is divided into the assessment of the technical lifetime (Step 1), followed by the economic lifetime (Step 2). Each step uses two key risk indicators to determine the associated risk level. An overview of all key indicators used in the process for determining the technical and economic lifetimes, stating their specific location in the Excel version of the asset list, is shown in Table 1. All columns in the accompanying Excel sheet (Appendix 1) present clarifying notes on the risk level categories.

Key indicator	Excel column	0 — Lowest risk	1 — Medium risk	2 — Highest risk
Asset Composition (Step 1)	H	Structural / civil dominated — ETC reliable as stated	Mixed: structural frame with some equipment	Equipment-dominated — component analysis required
ETC Confidence (Step 1)	I	Primary ETC data	Secondary reference or analogy	Engineering judgment only
Degradation Risk (Step 2)	N	O&M costs stable over full technical life	O&M costs escalate noticeably but remain manageable	O&M costs approach replacement cost well before technical end-of-life
Policy / Stranding Risk (Step 2)	O	No known regulatory or market risk	Foreseeable risk — policy direction likely but uncertain	Active policy or market risk — early retirement plausible

Table 1: Key indicators used in the two-stage assessment of technical and economic lifetimes.

Two examples of technologies at the opposite ends of the spectrum are:

- Individual booster heat pump (II.c.1.5), scoring medium or high on all indicators.
- Transmission pipes (II.a.1.1), scoring low on all indicators.

1.3.1 Step 1: Technical Lifetime Assessment

The technical lifetime assessment evaluates the baseline lifetime (column E in the accompanying Excel sheet) using two screening indicators. The first indicator is the asset composition (column H), assessing how much equipment and components there are in a certain asset (the more component-heavy, the higher the risk factor). The second indicator is the ETC compatibility (column I), evaluating how well the asset overlaps with a specific entry in the ETC (the less direct match, the higher risk). This two-step assessment is used to determine whether the baseline lifetime can be used directly, or whether a cost-weighted component analysis or experience-based engineering judgement is needed. The resulting technical lifetime (column M) should not be confused with an unadjusted technical lifetime: in most cases, it already reflects ordinary maintenance and routine component replacement under normal operating conditions.

Where either asset composition or ETC confidence indicators are at 1 or 2, a component assessment is performed, if available. The tab “Component Assessment” in the accompanying Excel sheet contains data for a broad array of assets based on PlanEnergi/BPC’s experience, which are broken down into the different components they consist of. These can be changed by the user of the sheet in column C. Column G shows a standard cost allocation index, where all chosen components are weighted equally. The cost allocation of the components is then corrected, if necessary, in column H. The components from column H are included in the calculation of the weighted average lifetime for each asset, carried out in column C, as follows:

$$T_{corrected} = \frac{\sum_i c_i t_i}{\sum_i c_i}$$

where c_i is the relative replacement-cost weight of the component (column H), and t_i is its corrected technical lifetime (column F). The corrected cost allocations are based on typical market-observed replacement costs at the time of installation and are documented in the sheet. They can be adjusted by the user of the asset list, to account for different cost distribution in a specific case, which would change the average weighted lifetime of the asset (column C).

Standard parameters in the component assessment can be changed by the user under “Data input – component level” (Line 552), while average weighted lifetimes for the different assets are collated under “Lookup and datalists” (Line 643) and connected to the tab “Asset list DH companies”.

An important constraint on component analysis follows from the ETC lifetime definition: components that are replaced as normal maintenance do not define the technical lifetime of the overall asset. Component analysis should therefore only introduce shorter component lifetimes where the replacement event constitutes a major capital renovation rather than routine maintenance. The distinction between 'normal maintenance' and 'major renovation' is a judgment call that is calibrated carefully for each asset type in this report. Where no ETC value is available, nor it is possible to perform a component analysis, the technical lifetime is estimated based on engineering judgement along with desk research.

1.3.2 Step 2: Economic Lifetime Assessment

Having established the technical lifetime, the economic lifetime is derived by assessing two risk factors on the same 0–2 scale. Both factors can shorten the economic lifetime relative to the technical; neither

can lengthen it. As mentioned before, if both factors score 0, the economic lifetime equals the technical in most cases.

Degradation risk (column N in tab “Asset list DH companies”) captures the magnitude of operation and maintenance cost relative to technical end-of-life. A score of 0 means operation and maintenance costs are stable, and the asset remains cost-effective through its full technical life. A score of 2 means operation and maintenance costs approach replacement economics significantly before the technical end-of-life, making early replacement the rational choice.

Policy / stranding risk (column O) captures foreseeable external factors that could force early technological decommissioning. A score of 0 means no known risk. A score of 2 means an active policy trajectory or market development (e.g. more efficient technologies) makes early decommissioning within the technical lifetime a plausible outcome (examples: gas phase-out for gas boilers; building-level heat pump adoption for heat interface units (HIUs) in low-rise buildings; regulatory change for specific asset types).

The economic lifetime, given in column Q, is set per category as a single value appropriate for use in annual RAB recalculation, rather than a range. The value for economic lifetime is estimated using judgment rather than calculated. It uses the technical lifetime (column M) and factors the risk level associated with the abovementioned two key economic indicators - Degradation Risk (Column N) and Policy/Stranding Risk (Column O) – to estimate the final value for each asset. Relevant remarks regarding a certain asset, where necessary, are given in Column W.

1.3.3 Key Findings

The key findings from this report are summarized below:

- **Asset classification:** The RAR boundary definitions are clear and confirmed with ACM. Afleversets and warmtemeters belong in II.c, not II.a; in pandig leidingstelsel belongs in II.c; service connections are placed in secondary distribution (II.a) by RAR convention. Survey respondents categorised these assets differently; taxonomy in this report harmonises to the RAR definitions.
- **Technical lifetimes:** Well documented for core district heating infrastructure by ETC data and engineering experience. ETC compatibility is high (score 0 or 1) for most categories. Engineering judgment is applied only where no direct ETC reference exists (service connections, low temperature ambient loop pipes, some valve types, etc.).
- **Economic lifetimes:** Divergence from technical lifetimes occurs mostly for fossil-fuel production assets (high policy risk), software (functional obsolescence) and commercial heat pumps / HIUs (degradation). For long-lived network assets, technical and economic lifetimes converge.
- **Bcw residual value:** The proposed 30-year cap creates a necessity for calculation of residual value for all long-lived infrastructure (pipes, civil works, in-building pipework, low temperature ambient loop pipes, etc.) with the purpose of supporting district heating projects’ feasibility.
- **International benchmarking:** The benchmarking of ETC values along with Danish engineering experience to data from Germany and Sweden confirms the validity of the lifetime estimation approach used in Denmark.

2 Regulatory Framework and Asset Boundaries

2.1 RAR Asset Categories

As mentioned in section 1.1, the RAR for district heating companies defines five fixed-asset categories. Correct classification is a prerequisite for RAB composition and depreciation methodology. Heat Networks (II.a) are further subdivided by the RAR into transmission, primary distribution and secondary distribution, each with its own sub-accounting treatment.

2.1.1 Confirmed Boundary Definitions

Several asset types at or near the consumer interface are explicitly excluded from the warmtenet definition (Wcw art. 1.1) but appear in the RAB of the district heating companies. Their correct classification has regulatory significance. Table 2 summarises the confirmed classifications.

Dutch Term	English	RAR Category	Notes
Afleverzet	Delivery set / HIU	II.c (RAR §58)	Includes warmtemeter per RAR §66. Company-owned only. Multiple survey respondents classified HIUs under II.a — this report harmonises to II.c.
Warmtemeter	Heat meter	II.c via afleverzet (RAR §66)	Not a standalone II.a item. Consumer metering is part of afleverzet, but is a standalone entry under II.c. District-level metering remains II.a.
Inpandig leidingstelsel	In-building collective pipework	II.c (RAR §65)	Collective riser and distribution inside multi-unit buildings. Excluded from warmtenet definition. In RAB only if company owned.
Leveringsaansluiting	Service / house connection	II.a by convention	Technically excluded from warmtenet (Wcw art. 1.1) but RAR places it under secundair distributienet (II.a) because first-installation costs cannot be separated. Treated as a separate subcategory.

Table 2: Component classification of specific asset types.

In practice, survey respondents categorized these assets inconsistently: several companies placed afleverzet under II.a and recorded warmtemeters as separate II.a line items. This report harmonises to comply with the RAR definitions. Companies that have historically categorised these assets differently will need to reclassify for RAB purposes.

Third-party contributions (III.) are considered as non-depreciable assets, since they are in practice different types of incomes for the district heating network operator. These incomes reduce the RAB, thereby the depreciable sum, and should be subtracted from the RAB before it is depreciated.

3 Technical System Overview

Dutch district heating systems vary in scale, temperature level and production technology. For asset categorization, they are grouped by functional building block: heat production and storage (II.b), transport and distribution (II.a), and the consumer interface (II.c). Four principal system types are relevant:

- **High and medium temperature:** Long-distance transmission, high-temperature substations, combined heat and power (CHP) or boiler-based production. Longest pipe lifetimes; lower equipment intensity in the network.
- **Lower temperature electrified:** Large-scale heat pumps as primary source, thermal storage for flexibility, lower delta-T substations. Higher equipment intensity in production.
- **Low temperature ambient loop:** Very-low-temperature network supplying heating and cooling via building-level heat pumps. Pipe lifetimes are very long (75 years); the depreciation structure is dominated by building-level equipment.
- **Aquifer thermal energy storage (ATES/WKO) systems:** Widely used in the Netherlands, open ATES/WKO systems require component-level treatment (componentenbenadering). The WKO bron (boring, well casings and groundwater system) has a technical lifetime of 30 years — consistent with all primary Dutch sources (Koster, November 2022) (Nationaal Programma Lokale Warmtetransitie (NPLW)) (Cardose, June 2022) (de Fockert, May 2021). Well pumps have a 15-year replacement cycle and are capitalized as a new asset at year 15. Heat pumps are assessed separately under II.b.3. TEO and TEA aquathermy source installations are assessed at 30 years. See section 4.1.3 for the full component treatment and reinvestment discussion.

All system types share the same functional block structure and can be assessed using the same asset taxonomy. Figure 1 illustrates the principal division into production, distribution and consumption and gives an overview of the corresponding RAR categories within a typical district heating system.

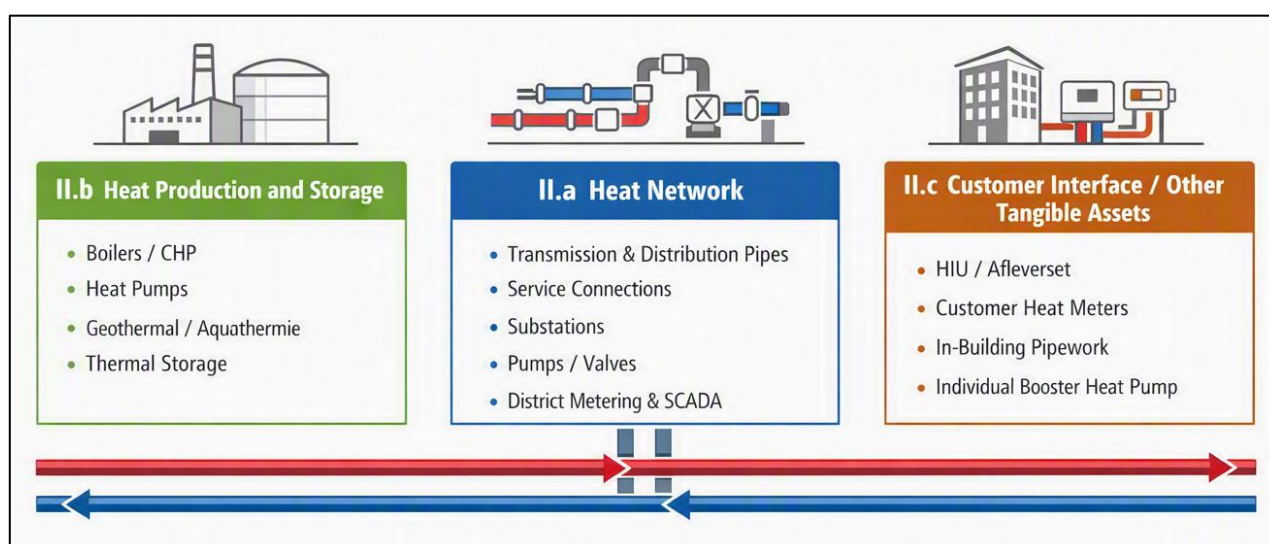


Figure 1: Functional overview of a district heating system and corresponding RAR asset categories.

4 Asset Taxonomy and Lifetimes

Table 3 provides a summary overview of all asset categories assessed in this report. The list shows the asset categories and groups, with proposed technical and economic lifetimes along with a brief note on the key driver or methodological choice. Full per-category documentation — including component breakdowns, ETC source references, benchmark comparisons and confidence assessments — can be found in the asset list (Appendix 1).

Asset	Categories and groups	Technical Lifetime [years]	Economic Lifetime [years]	Notes
I. Intangible Fixed Assets				
I.1.1	Enterprise Resource Planning (ERP) / operations management	8	5	Limited by vendor support and obsolescence.
I.1.2	GIS and asset management software	10	8	Data migration extends useful life.
I.1.3	Capitalised development costs	—	—	Follows the resulting asset where applicable.
II.a. Heat Networks				
II.a.1.1	Transmission pipes	45	45	Insulation degradation is the main constraint.
II.a.1.2	Primary distribution pipes	45	45	Same lifetime basis as transmission pipes.
II.a.1.3	Secondary distribution pipes	45	45	Same pipe lifetime rationale.
II.a.1.4	Service connections / house connections	30	25	Shorter life and consumer-side risk.
II.a.1.5	Low temperature ambient loop pipes	75	60	Low-stress plastic pipework.
II.a.2.1	Area substation / heat transfer station	26	20	Pumps and controls drive replacement.
II.a.3.1	Main network circulation pumping station	25	20	Pump-dominated asset.
II.a.3.2	Booster pump station	20	20	Same as main pumping station.
II.a.4.1	Isolation and control valves	25	20	Actuators shorten combined life.
II.a.4.2	Pressure regulation equipment	20	15	Dynamic loading and wear.
II.a.5.1	District-level metering and instrumentation	18	15	Electronics and calibration limit life.
II.a.5.2	SCADA and network control system	12	10	IT obsolescence and cybersecurity.
II.a.6.1	Utility and Equipment Buildings	40	35	Linked to shorter-lived equipment.
II.a.6.2	Operations and Administration Building	50	45	Long-lived civil asset.
II.a.6.3	Civil works – excavation, reinstatement and crossings	45	45	Follows corresponding asset life.
II.b. Heat Production and Storage				
II.b.1.1	Gas boilers (peak/backup)	25	20	Gas phase-out risk.
II.b.1.2	Electric boilers (peak/backup)	23	20	Low technical and policy risk.
II.b.1.3	Wood chip boiler – standalone production unit	25	20	Maintenance and biomass policy risk.
II.b.2.1	Gas engine CHP	25	20	Overhaul-based, but gas risk.
II.b.2.2	Gas turbine Combined Cycle	25	20	Same gas-related policy risk.
II.b.2.3	Waste-to-Energy (WtE) CHP	25	25	Medium boiler and recycling risk.
II.b.2.4	Biomass CHP (wood chips / pellets / straw)	25	25	Overhaul and biomass policy risk.
II.b.3.1a	Air/water HP commercial (≤ 5 MW, prefabricated)	20	15	No major overhaul; refrigerant risk.
II.b.3.1b	Air/water HP industrial (> 5 MW, custom)	21	20	Overhaul possible; refrigerant risk.
II.b.3.2a	Water/water HP commercial	24	15	Commercial HP unit risk.
II.b.3.2b	Water/water HP industrial	24	20	Overhaul-based HP lifetime.

II.b.3.3	Seawater / surface water HP	25	20	HP unit assessed separately.
II.b.3.4	Waste heat / industrial excess heat HP	25	15	External heat source risk.
II.b.4.1	Deep geothermal doublet (incl. surface HP)	25	25	Downhole pumps are key risk.
II.b.5.1	Solar district heating (collector field)	30	20	Performance decline over time.
II.b.5.2	Waste heat recovery installation	25	15	External source stranding risk.
II.b.5.3	TEO broninstallatie (Thermische Energie uit Oppervlaktewater)	26	25	Heat exchanger and water quality risk.
II.b.5.4	TEA broninstallatie / rioolwarmtewisselaar (Thermische Energie uit Afvalwater)	26	25	Heat exchanger and effluent risk.
II.b.6.1	Large-scale hot water storage tank	27	27	Vessel-dominated asset.
II.b.6.2	Pit thermal energy storage (PTES)	26	20	Liner and lid drive risk.
II.b.6.3	ATES / WKO (aquifer thermal storage)	30	25	Wells outlive pumps and equipment.
II.b.7.1	Flue gas condensing unit	25	20	Corrosion and condensate risk.
II.b.7.2	Biomass fuel handling and storage system	25	20	Mechanical handling risk.
II.b.7.3	Electric boiler – ancillary services	20	5	High market and regulatory risk.
II.c. Other Tangible Fixed Assets				
II.c.1.1	HIU single-family (individuele afleverset)	19	15	No overhaul; domestic context.
II.c.1.2	HIU multi-storey / commercial	20	20	Better maintenance access.
II.c.1.3	In-building pipework (in pandig leidingstelsel)	45	40	Building renovation risk.
II.c.1.4	Consumer heat meters	15	15	Calibration and electronics.
II.c.1.5	Individual booster heat pump (5th gen DHC)	20	12	Factory unit; rapid technology change.
II.c.2.1	Service vehicles and mobile equipment	10	8	Driven by operating wear.
II.c.3.1	ERP / operations management system (II.c variant)	8	5	Classification depends on policy.
III. Third-Party Contributions				
III	Connection cost contribution (aansluitbijdrage / BAK)	—	—	Not depreciable; reduces RAB.
III	Cost-covering contribution (kostendeckingsbijdrage)	—	—	Not depreciable; offsets investment.
III	Subsidies, grants and other third-party contributions	—	—	Not depreciable; reduces RAB.

Table 3: Summary of all asset categories assessed in this report. The table lists each RAR asset category and asset group, the proposed technical lifetime, the proposed economic lifetime used for regulatory depreciation, and the main reason for the lifetime assessment. Rows are grouped by RAR category: I for intangible fixed assets, II.a for heat networks, II.b for heat production and storage, II.c for other tangible fixed assets, and III for third-party contributions. A dash indicates that no depreciable lifetime is proposed because the item is not depreciated or follows another asset. Full supporting documentation, including source references, component breakdowns and confidence assessments, is provided in the accompanying Excel asset list.

4.1 Key Methodological Choices and Dutch Off-Cases

Several categories require deliberate deviations from a direct ETC application, reflecting Dutch market characteristics, contractor practice, or RAR-specific considerations.

4.1.1 Service connections vs. secondary distribution pipes

The RAR places the leveringsaansluiting (supply connection) within the secundair distributienet (secondary distribution network) (II.a) by convention, because first-installation costs of the connection and the main secondary pipe are typically incurred together and cannot be separated. However, the service connection is a materially distinct asset. It is constructed in PEX rather than pre-insulated steel, it connects an individual building to the main pipe rather than distributing between substations, and its technical lifetime is 30 years rather than 45–60 years. Dutch installation contractors consistently price and specify

these components separately. PlanEnergi agreed with ACM that the service connection is treated as a distinct subcategory within II.a, with its own lifetime and cost structure.

4.1.2 Heat pumps: commercial vs. industrial distinction

The ETC does not distinguish between commercial and industrial scale air/water heat pumps in its technical lifetime entries. For the Dutch context, this distinction is significant. Prefabricated commercial units (typically below 5 MW), sold as integrated factory-assembled systems, are generally not designed to be overhauled: when a major component fails or wears beyond maintenance tolerance, the unit is replaced rather than rebuilt. Custom industrial units (typically above 5 MW), constructed on a skid or in a dedicated plant room from individually specified components, have the physical and economic scale to support a full overhaul — compressor replacement, refrigerant circuit renewal, controls upgrade — further extending the useful life. This produces different economic lifetimes (15 years versus 20 years) despite similar ETC lifetimes (~20 years from component analysis). The same split is applied to water/water heat pumps.

4.1.3 WKO, TEO and TEA: Dutch aquathermy sources and reinvestment treatment

Three source technologies are common in the Dutch district heating context but have no direct equivalent in the ETC: Warmte-Koude Opslag (WKO/ATES), Thermische Energie uit Oppervlaktewater (TEO) and Thermische Energie uit Afvalwater (TEA). All three are assessed on the basis of Dutch regulatory and engineering sources, which converge on a consistent 30-year project period.

WKO/ATES source (borehole, groundwater system)

The technical lifetime of an open WKO system (boring, well casings, filters and groundwater infrastructure) is 30 years. This is consistent with the Dutch source base (Cardose, June 2022) (Koster, November 2022) (Nationaal Programma Lokale Warmtetransitie (NPLW)) (Wikipedia NL) (de Fockert, May 2021). The economic lifetime is set at 25 years.

A WKO system is not a single asset with one uniform lifetime. Dutch regulatory accounting (Raad voor de Jaarverslaggeving (RJ), 2022) requires that components with materially different lifetimes should be treated as separate depreciable assets (componentenbenadering). For WKO, the split at initial capitalization is: (1) WKO wells and groundwater system — approximately 72.5% of capital expenditures (CAPEX), 30-year asset; and (2) well pumps and mechanical package — approximately 27.5% of CAPEX, 15-year asset. The heat pump (energy central) is a distinct asset assessed separately under II.b.3 (water/water heat pump). This directly resolves the treatment of the reinvestment costs after 15 years identified in cost calculations (Cardose, June 2022): the well pump replacement at year 15 is a new capital expenditure, capitalized as a new 15-year asset and added to the regulated asset value at that time rather than treated as operating expenditure (OPEX). This mirrors how *WarmingUP* (Cardose, June 2022) models the reinvestment as an explicit CAPEX event at year 15 in its 30-year total cost of ownership (TCO) projection.

WKO falls under RAR Art. 62g (secondary distribution network, temperature categories c and g) when integrated in a 5th generation network. In standalone configurations serving as the primary heat source, WKO is classified under RAR Art. 63 (heat source and storage). The heat pump is always assessed as a separate asset regardless of classification.

TEO source installation (Thermal Energy from Surface Water)

The TEO system extracts thermal energy from surface water (river, lake or canal) via a plate or tube heat exchanger. The source installation lifetime is based on the *WarmingUp/Deltares* report (de Fockert, May 2021), which documents a minimum lifetime of 30 years for integrated heat exchangers and 50 years for prefabricated external types. *WarmingUp* applies a 30-year project period to aquathermy TCO calculations. The circulation pump has a 15-year replacement cycle. However, PlanEnergi's experience verified by a component assessment shows a technical lifetime of 26 years. An economic lifetime of 25 years is applied to the source installation as a whole, consistent with *WarmingUp/Deltares* (de Fockert, May 2021) and *WarmingUp* (Cardose, June 2022) TCO. The heat pump is assessed separately, just like for the WKO.

TEA source installation / sewage heat exchanger (Thermal Energy from Wastewater)

The TEA system extracts thermal energy from wastewater via a heat exchanger integrated in or adjacent to the sewer pipe. The heat exchanger element is predominantly passive with no moving parts. The source installation lifetime is based on the *WarmingUp/Deltares* report (de Fockert, May 2021), which gives the same expected lifetimes as for a TEO system. A key constraint is that the TEA installation must not shorten the lifetime of the host sewer system. Based on a component assessment, a technical lifetime of 26 years is applied. The economic lifetime is set to 25 years, consistent with the sources mentioned in this section. Only the heat exchanger and connecting pipework are included in the regulated asset value.

4.1.4 Heat interface unit lifetimes: ETC reference vs. Dutch residential reality

The ETC (Danish Energy Agency and Energinet, April 2026) gives a central lifetime of 25 years for individual HIU, with a sensitivity range of 20–30 years. For single-family residential applications in the Netherlands, a component assessment of the HIU sub-assemblies (heat exchanger plate pack, expansion valve, circulating pump, controls enclosure) produces a cost-weighted average of approximately 19 years — reflecting that domestic HIUs are accessed rarely, maintained minimally, and replaced as a unit rather than overhauled when performance drops. Economic lifetime is thereby set at 15 years for the same reasons. Multi-storey and commercial HIUs, with better access conditions and stronger maintenance incentives, are assessed at 20 years for both technical and economic lifetime, which is closer to the ETC estimate.

5 International Benchmarking

International benchmarking validates whether the proposed Dutch lifetimes are consistent with established practice in comparable regulated district heating markets. The benchmark is used to identify significant divergences that require justification — not to override the Dutch-specific assessment. The following countries are assessed as a part of this study:

- **Denmark** (primary): The ETC is the primary technical source for this report. Danish regulatory practice for district heating companies typically uses economic lifetimes of 15–30 years for equipment and 30–45 years for network infrastructure in cost-based tariff calculations, consistent with the values proposed here. Specific ETC chapter and technology references are documented in the Excel asset list (Appendix 1).
- **Germany:** German guidance supports the use of reference lists as indicative benchmarks rather than fixed values. German practice in the *Energie- und Wasserwirtschaft* is therefore broadly aligned with the ETC logic used in this report: depreciation periods are anchored in the expected useful life of the asset. They may be adjusted where normal overhaul, general inspection or life-extension cycles are relevant. In practice, the starting point is the ordinary service life under normal operation and maintenance; for complex or overhaulable installations, the relevant period may instead be the time until a major inspection, renewal decision or economically meaningful life-extension investment.

Key references for lifetimes in Germany are:

- 1) official AfA tables issued by the German Federal Ministry of Finance, notably the sector-specific AfA table for *Energie- und Wasserversorgung* (Bundesministerium der Finanzen, 1995). These may be supplemented by practice-oriented lists used by utilities, associations and auditors for infrastructure, plant and metering assets. Together, these lists provide a structured starting point for setting depreciation periods for energy and water-sector assets, but the final period should be calibrated to the specific asset type, operating conditions and expected reinvestment profile.
 - 2) VDI-2067 sheets (VDI, 2012): Calculation method for assessment of expectable lifetime for (energy) assets, by the German Engineering Association.
 - 3) the KWW-Technikkatalog Wärmeplanung (Kompetenzzentrum Kommunale Wärmewende (KWW), 2026), developed for municipal heat planning. Often referring to VDI 2067 and/or ETC.
- **Sweden:** Sweden has limited guidelines for lifetime expectancy on district heating components. An extensive literature study was conducted, and Swedish district heating experts were consulted on the matter. (Energimarknadsinspektionen, 2010) (Statens energimyndighet, March 2023) The official standard for district heating pipes demands a lifetime of at least 30 years, while the Swedish district heating organization (Svensk fjärrvärme ab, 2015) estimates the actual technical lifetime to be much longer. There are examples of seawater heat pumps in Sweden that are almost 40 years old and are expected to be in service for another 15 years. These heat pumps have been serviced with change of refrigerant and controls. Further concrete examples from Sweden are found in the accompanying Excel asset list (Appendix 1).

Overall, the benchmarking of Danish data with German and Swedish sources confirms the validity of the lifetime estimation approach used in Denmark.

6 Depreciation Cap and Residual Value

The consultation version of the Besluit collectieve warmte 2024 (Bcw) (Decree on collective heat supply) suggests a maximum depreciation period of 30 years for assets in the RAB. Several categories assessed in this report have economic lifetimes that exceed 30 years: transmission and distribution pipes (45 years), low temperature ambient loop pipes (60 years), operations and administration buildings (45 years), civil works (45 years), and in-building pipework (40 years).

Forcing full depreciation within 30 years for these assets would overstate allowed revenues in the early years of regulation and would cause assets to appear fully depreciated in the RAB while still providing material economic value. To correctly reflect the asset's remaining service potential, a residual value should be recognised at year 30 for all assets with an economic lifetime above the cap. The residual value is calculated as the proportion of the asset's value associated with the remaining useful life beyond year 30.

Setting a depreciation cap at 30 years could affect the economic feasibility of certain district heating projects by increasing costs of capital throughout the depreciation period. This would risk exposing certain district heating projects to failure due to insufficient economic performance. It is therefore important to consider the impact that a depreciation cap may have on implementing district heating and phasing out natural gas in the Netherlands.

For a new district heating project assessed on its full 45-year economic life, a 30-year cap without residual value recognition would truncate the capital cost recovery stream. A project expecting to recover capital-related revenues through years 31 to 45, where RAB-based returns contribute meaningfully to project NPV, will show a worse financial profile than one allowed to recognise residual values.

This matters particularly for projects where long-lived infrastructure (pipes, civil works) constitutes the majority of investment, which is typical for urban district heating projects. In a project where 70% of CAPEX is in network infrastructure with a lifetime of 45 years, a 30-year cap without residual value treatment effectively denies the project $15/45 = 33\%$ of its expected capital recovery horizon on those assets. Depending on the discount rate and tariff structure, this can make the difference between a viable and an unviable project.

Recognising residual values correctly is therefore not merely a regulatory accounting choice; it is a prerequisite for district heating projects to be financeable over the long term and for the Netherlands to successfully build out the network infrastructure needed for the heat transition away from natural gas.

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7 Appendix 1: Asset list

The following pages show an overview of the asset list for regular district heating companies.

The detailed asset list can be found in the accompanying Excel spreadsheet.

Asset Life Assessment DH companies | Two-Step Methodology: Technical Lifetime -> Economic Lifetime

IDENTIFICATION			STEP 1: TECHNICAL LIFETIME										STEP 2: ECONOMIC LIFETIME			
RAR Cat.	ID	Asset Category / Component	Description	Baseline Lifetime [yr]	ETC Range [yr]	Source	Asset Composition	ETC Compatibility	Step 1 Notes	Use Component Assessment (if available)	Comp. Wtd Avg [yr]	Technical Lifetime [yr]	Degradation Risk	Policy / Stranding Risk	Step 2 Notes	Economic Lifetime [yr]
I. Intangible Fixed Assets																
I.1 Software and Licences																
I	I.1.1	Operations management / ERP	Enterprise resource planning and customer management software incl. server hardware and licences.	8	-	PlanEnergi/BPC (Engineering judgement)	2	N	Life driven by vendor support cycles and functional obsolescence.	No	0	8	1	0	MEDIUM technical risk: IT hardware cycles. LOW policy risk.	5
I	I.1.2	GIS and asset management software	Geographic information system and asset register software for network mapping and maintenance planning.	10	-	PlanEnergi/BPC (Engineering judgement)	2	N	GIS data migration costs extend practical economic life vs ERP.	No	0	10	1	0	GIS data often outlives the platform; migration options extend useful life.	8
I	I.1.3	R&D and development costs	Capitalised development and design costs for new heat systems, if separately identified in the RAB.	-	-	Accounting policy	N	N	Life = useful life of resulting asset. ACM/RJ determination required.	No	0	-	N	N	Not a standalone depreciable asset in all jurisdictions.	-
II.a. Heat Networks																
II.a.1 Transport and Distribution Pipes																
II.a	II.a.1.1	Transmission pipes	Pre-insulated steel carrier pipe DN200+, >100°C forward. Long-distance backbone. Incl. pipes, fittings, welded joints.	45	30-60	ETC 08 Ch. #3.1	0	0	Physical/technical lifetime much higher. Heavily corrected for insulation degradation etc.	No	0	45	0	0	Insulation degradation, starts operating less effectively. Common book keeping practice	45
II.a	II.a.1.2	Primary distribution pipes	Pre-insulated steel carrier pipe (usually DN50-200 operating at 65-85°C). From source to neighbourhood distribution point.	45	30-60	ETC 08 Ch. #3.2	1	0	Same as transmission pipe. Physical lifetime identical.	No	0	45	0	0	Insulation degradation, starts operating less effectively. Common book keeping practice	45
II.a	II.a.1.3	Secondary distribution pipes	Pre-insulated carrier pipe (usually DN32-150 operating at 65-85°C). From distribution point to local area.	45	30-60	ETC 08 Ch. #3.3	1	0	Same assessment. Smaller diameter, equal lifetime.	No	0	45	0	0	Insulation degradation, starts operating less effectively. Common book keeping practice	45
II.a	II.a.1.4	Service connections / house connections	Pre-insulated PEX or steel pipe DN20-50 from distribution grid to building boundary. Incl. isolation valve and house connection box.	30	-	PlanEnergi/BPC (Engineering judgement)	0	N	PEX technical life ~30yr. No ETC range entry.	No	0	30	0	1	MEDIUM policy risk: building-level HPs and renovation may render connections redundant before technical end-of-life.	25
II.a	II.a.1.5	Low temperature ambient loop pipes	Low-temperature ambient loop for 5th gen DHC (usually operating at up to 25°C). Predominantly plastics (PE/HDPE/PEX) at low pressure and temperature.	75	-	PlanEnergi/BPC (Engineering judgement)	0	N	Technical life well above Bcw cap. Very low operating stress.	No	0	75	0	0	No policy risk for the pipe itself. Bcw cap is the binding constraint.	60
II.a.2 Heat Transfer Stations and Substations																
II.a	II.a.2.1	Area-level heat transfer station / substation	Intermediate station transferring heat between transmission and distribution. Incl. plate heat exchanger, pumps, expansion vessel, controls, enclosure.	25	-	PlanEnergi/BPC (Engineering judgement)	2	N	Equipment-heavy: pumps+controls ~55% of cost at 15yr.	Yes	26	26	1	0	MEDIUM technical risk: pumps and controls require mid-life replacement.	20
II.a.3 Pumping Stations																
II.a	II.a.3.1	Main network circulation pumping station	Central pump sets, motors, VFDs, manifold pipework. Incl. control panel and automation. Excl. building (see II.a.6.1).	20	-	PlanEnergi/BPC (Engineering judgement)	2	N	Pump-dominated	Yes	25	25	1	0	MEDIUM technical risk: pumps replaced at ~15yr but structure lasts longer.	20
II.a	II.a.3.2	Booster pump station	Smaller intermediate pump station for pressure maintenance in remote grid zones. Incl. pump set, VFD, controls and enclosure.	20	-	PlanEnergi/BPC (Engineering judgement)	2	N	Same assessment as main pumping station.	No	0	20	1	0		20
II.a.4 Valves and Control Equipment																
II.a	II.a.4.1	Network isolation and control valves	Gate, butterfly or ball valves DN50-600 for network sectoring. Incl. valve chamber and actuators where applicable.	25	-	PlanEnergi/BPC (Engineering judgement)	1	N	Manual valves 30yr; actuated valves 15yr. (actuators ~35% of cost).	No	0	25	1	0	MEDIUM technical risk: actuator electronics drive earlier economic life.	20
II.a	II.a.4.2	Pressure regulation and expansion equipment	Pressure-reducing valves, expansion vessels and safety valves.	20	-	PlanEnergi/BPC (Engineering judgement)	2	N	Dynamic loading and membrane wear. Shorter than isolation valves.	No	0	20	1	0		15
II.a.5 Metering and Instrumentation																
II.a	II.a.5.1	District-level metering and instrumentation	Flow meters, pressure transducers and temperature sensors at transmission/district boundary. Incl. remote reading.	18	-	PlanEnergi/BPC (Engineering judgement)	2	N	Electronic transmitters shorter than mechanical sensors.	No	0	18	1	0		15
II.a	II.a.5.2	SCADA and network control system	Supervisory control and data acquisition for network monitoring and pump control. Incl. servers, software, communication and RTUs.	12	-	PlanEnergi/BPC (Engineering judgement)	1	N	Hardware-dominated. Vendor support cycles and software obsolescence drive life.	No	0	12	2	1	HIGH technical risk: IT hardware obsolescence. MEDIUM policy risk: cybersecurity requirements may force earlier upgrades.	10
II.a.6 Buildings and Civil Works																
II.a	II.a.6.1	Utility and Equipment Buildings	Lightweight utility and equipment building (typically a steel-frame structure, possibly prefabricated) housing technical equipment such as pumps and booster units.	40	-	PlanEnergi/BPC (Engineering judgement)	0	N	Civil structure dominated. No equipment intensity concern.	No	0	40	0	0		35
II.a	II.a.6.2	Operations and Administration Building	Permanent concrete or masonry building housing operational, administrative and process-related functions (e.g. control rooms, workshops, offices, boiler houses and heat production equipment).	50	-	PlanEnergi/BPC (Engineering judgement)	0	N	Civil structure dominated. No equipment intensity concern.	No	0	50	0	0		45
II.a	II.a.6.3	Civil works - excavation, reinstatement and crossings	Excavation, backfill, road reinstatement and HDD for pipe installation. Typically embedded in pipe asset cost.	45	30-60	ETC 008 Ch. #3.1-3.4	0	1	Civil component of pipe investment. Technical life = pipe life.	No	0	45	1	0	Follows life of corresponding pipe.	45

Asset Life Assessment DH companies | Two-Step Methodology: Technical Lifetime -> Economic Lifetime

IDENTIFICATION				STEP 1: TECHNICAL LIFETIME										STEP 2: ECONOMIC LIFETIME		
RAR Cat.	ID	Asset Category / Component	Description	Baseline Lifetime [yr]	ETC Range [yr]	Source	Asset Composition	ETC Compatibility	Step 1 Notes	Use Component Assessment (if available)	Comp. Wtd Avg [yr]	Technical Lifetime [yr]	Degradation Risk	Policy / Stranding Risk	Step 2 Notes	Economic Lifetime [yr]
II.b. Heat Production and Storage																
II.b.1 Heat only Boilers, incl. Backup and Peak Heat Production																
II.b	II.b.1.1	Gas boiler - peak / backup	Natural gas-fired hot water boiler. Incl. burner, heat exchanger vessel, controls and safety systems.	25	20-30	ETC 0018 Ch. #44	1	0	Burner+controls ~30% of cost at 25yr.	No	0	25	0	2	HIGH policy risk: gas phase-out post-2035. Economic life shortened to 20yr.	20
II.b	II.b.1.2	Electric boiler - peak / backup	Electric resistance or electrode boiler. Incl. power supply connection and controls. Typically connected at mid (or low) voltage.	20	20-25	ETC 0018 Ch. #41	1	0	Simple technology. Low equipment intensity.	Yes	23	23	0	0	LOW risk on both axes.	20
II.b	II.b.1.3	Wood chip boiler - standalone production unit	Biomass-fired hot water boiler (wood chips). Incl. furnace, heat exchanger, filtration, pumps and controls. Excludes common plant infrastructure.	25	20-30	ETC 0018 Ch. #09a	1	0	Component analysis (RAR prod. unit 1 - wood chip boiler): wtd avg = 26yr confirms ETC 25yr.	No	0	25	1	1	MEDIUM technical risk: inspection-based maintenance. MEDIUM policy risk: biomass sustainability.	20
II.b.2 Combined Heat and Power (CHP)																
II.b	II.b.2.1	Gas engine CHP	Reciprocating gas engine with heat recovery. Incl. generator, heat recovery unit, cooling system and controls.	25	20-30	ETC 0018 Ch. #06	1	0	Engine overhaul cycles at 8-10yr. ETC 25yr with major overhaul assumption.	No	0	25	1	2	MEDIUM technical risk: overhaul economics valid. HIGH policy risk: gas phase-out.	20
II.b	II.b.2.2	Gas turbine Combined Cycle	Gas turbine (combined cycle) with heat recovery. Incl. turbine, generator, HRSG and auxiliaries.	25	20-30	ETC 0018 Ch. #04/#05	1	0	Turbine overhaul at 10-15yr. Same ETC approach.	No	0	25	1	2	Same as gas engine CHP.	20
II.b	II.b.2.3	Waste-to-Energy (WtE) CHP	Municipal solid waste combustion with steam cycle and heat extraction. Incl. grate/boiler, flue gas treatment, turbine and heat exchanger.	25	20-30	ETC 0018 Ch. #08	1	0		No	0	25	1	1	MEDIUM technical risk: boiler pressure parts may need replacement. MEDIUM policy risk (increasing recycling rates).	25
II.b	II.b.2.4	Biomass CHP (wood chips / pellets / straw)	Biomass-fired boiler with steam turbine or back-pressure extraction. Incl. boiler, fuel handling, turbine and condenser.	25	20-30	ETC 0018 Ch. #09a/b/c	1	0	Component analysis (RAR prod. unit 3 - wood chip CHP): wtd avg = 26yr confirms ETC 25yr. Same range for smaller scale (ORC).	No	0	25	1	1	MEDIUM technical risk: overhaul-based. MEDIUM policy risk: biomass sustainability regulations.	25
II.b.3 Heat Pumps																
> Air/Water Heat Pump (A/W HP)																
II.b	II.b.3.1a	A/W HP - commercial type (<=5 MW, factory unit)	Standardised factory-assembled compression HP. All refrigerant components pre-assembled. Not overhauled - unit replaced at end of life.	25	15-40	ETC 0018 Ch. #40	1	1	ETC 25yr biased toward industrial type. Commercial units NOT overhauled: effective technical life = 15yr.	Yes	20	20	2	1	HIGH technical risk: no overhaul access; compressor replacement = new unit. MEDIUM policy risk: refrigerant regulations.	15
II.b	II.b.3.1b	A/W HP - industrial type (>5 MW)	Custom-built large-scale compression HP. Industrial refrigeration components maintained via scheduled overhaul.	25	15-40	ETC 0018 Ch. #40	1	0	ETC 25yr applies with overhaul assumption. Custom design enables overhaul economics.	Yes	21	21	1	1	MEDIUM technical risk: overhaul-based (8-10yr cycles). MEDIUM policy risk: refrigerant regulations.	20
> Water/Water Heat Pump (W/W HP)																
II.b	II.b.3.2a	W/W HP - commercial type	Factory unit compression HP using ground/aquifer/surface water. All refrigerant components pre-assembled. No overhauls.	25	15-40	ETC 0018 Ch. #40	1	1	Same split rationale as ASHP. Component analysis incl. WKO wells (40yr) gives wtd avg = 24yr, but wells skew upward.	Yes	24	24	2	1	HIGH technical risk: no overhaul access. MEDIUM policy risk: Refrigerant regulation and exploration of heat source.	15
II.b	II.b.3.2b	W/W HP - industrial type	Custom large-scale compression HP with water heat source. Overhaul-based maintenance on industrial refrigeration components.	25	15-40	ETC 0018 Ch. #40	1	0	Component analysis wells-inclusive: 24yr. HP unit with overhauls: 25yr.	Yes	24	24	1	1	MEDIUM policy risk: Refrigerant regulation and exploration of heat source.	20
II.b	II.b.3.3	Seawater / surface water HP	Compression HP using sea, lake or river water. Incl. compressor unit, water intake/discharge and heat exchangers.	25	15-40	ETC 0018 Ch. #40	1	0	Water intake civil works: separate asset.	No	0	25	1	1	MEDIUM policy risk: Refrigerant regulation and exploration of heat source.	20
II.b	II.b.3.4	Waste heat / industrial excess heat HP	Compression HP recovering low-grade heat from industrial processes, data centres or wastewater.	25	15-40	ETC 0018 Ch. #40	1	0	Same HP lifetime rationale. Primary-side industrial process piping excluded from DH RAB.	No	0	25	1	2	HIGH policy/stranding risk: Refrigerant regulations. Additionally, the future of an industrial heat source is not determined by the utility company.	15

Asset Life Assessment DH companies | Two-Step Methodology: Technical Lifetime -> Economic Lifetime

IDENTIFICATION				STEP 1: TECHNICAL LIFETIME										STEP 2: ECONOMIC LIFETIME		
RAR Cat.	ID	Asset Category / Component	Description	Baseline Lifetime [yr]	ETC Range [yr]	Source	Asset Composition	ETC Compatibility	Step 1 Notes	Use Component Assessment (if available)	Comp. Wtd Avg [yr]	Technical Lifetime [yr]	Degradation Risk	Policy / Stranding Risk	Step 2 Notes	Economic Lifetime [yr]
II.b.4 Geothermal																
II.b	II.b.4.1	Deep geothermal doublet (incl. surface HP)	Deep geothermal doublet (1,200-2,000 m) with downhole pumps and surface HP. Incl. well casing, downhole equipment and surface interconnecting pipework.	25	25-30	ETC 0018 Ch. #45.1-45.3	1	0	Well casings: ~40yr. Downhole pumps: 10-15yr. Surface HP: 15-25yr.	No	0	25	1	0	MEDIUM technical risk: downhole pump replacement at 10-15yr is expensive. LOW policy risk (renewable heat). Stranding risk of deep geothermal is very high initially, but minimized at the time of investment decision.	25
II.b.5 Solar and Waste Heat Recovery																
II.b	II.b.5.1	Solar district heating - collector field	Large-scale flat-plate or evacuated-tube solar collector array with primary circuit and heat exchangers.	30	25-35	ETC 0018 Ch. #46	0	0	ETC 30 yr validated by Danish large-scale installations.	No	0	30	1	0	Proven technology. Economic lifetime lowered due to expected declining performance over time.	20
II.b	II.b.5.2	Waste heat recovery installation	Heat exchanger capturing industrial excess heat or data-centre heat. Incl. primary-side heat exchanger, secondary pumps and controls.	25	-	PlanEnergi/BPC (Engineering judgement)	1	N		No	0	25	1	2	Considerable stranding risk, if the heat source is depleted/ends (e.g. processes are adapted or company shut down).	15
II.b	II.b.5.3	TEO broninstallatie (Thermische Energie uit Oppervlaktewater)	Heat exchanger system capturing thermal energy from surface water (river, lake or canal). Includes filters, plate/tube heat exchanger, civil intake works and connecting pipework.	30	-	PlanEnergi/BPC (Engineering judgement)	1	N		Yes	26	26	1	0	Heat exchangers are most critical component. Slight political risk of changing water quality and environmental regulations.	25
II.b	II.b.5.4	TEA broninstallatie / rioolwarmtewisselaar (Thermische Energie uit Afvalwater)	Heat exchanger system capturing thermal energy from treated waste water (effluent). Includes filters, plate/tube heat exchanger, civil intake works and connecting pipework.	30	-	PlanEnergi/BPC (Engineering judgement)	1	N		Yes	26	26	1	0	Heat exchangers are most critical component. Slight political risk of changing water quality and environmental regulations.	25
II.b.6 Heat Storage																
II.b	II.b.6.1	Large-scale hot water storage tank	Insulated steel pressure vessel or atmospheric tank for daily/weekly heat storage. Incl. tank, insulation, stratification systems and ancillary pipework.	40	30-50	ETC 0011 Ch. #141	0	0	Tank vessel (~67% of cost) at 40yr dominates.	Yes	27	27	0	0	LOW risk on both axes. Proven long-life asset.	27
II.b	II.b.6.2	Pit Thermal Energy Storage (PTES) - short-mid-term or seasonal	Excavated pit with floating insulated cover for inter-seasonal heat storage. Incl. liner, top lid, stratification system and heat exchanger.	30	25-35	ETC 0011 Ch. #140	1	0	Component analysis: top lid (20yr+) + pumps/controls (15yr) pull below ETC 30yr.	Yes	26	26	1	0	MEDIUM technical risk: Liner guaranteed performance for 20 yr, but being the critical component, the technical risk remains medium. LOW policy risk.	20
II.b	II.b.6.3	ATES / WKO - Aquifer Thermal Energy Storage	Underground aquifer for seasonal heat/cold storage via injection and production wells. Incl. well infrastructure, HPs and surface equipment.	30	-	PlanEnergi/BPC (Engineering judgement)	1	1	Key split: well casings (~40yr), downhole pumps (~15yr), surface HP (15-25yr).	No	0	30	1	0	Little application in DK/ETC. Consolidated technology in NL.	25
II.b.7 Auxiliary and Ancillary Systems																
II.b	II.b.7.1	Flue gas condensing unit	Condensing economiser recovering latent heat from boiler or CHP flue gas. Incl. stainless heat exchanger, condensate handling and controls.	25	-	PlanEnergi/BPC (Engineering judgement)	1	N	Corrosion-heavy environment. Condensation on heat exchanger.	No	0	25	1	0	MEDIUM technical risk: condensate environment accelerates degradation. Economic life 15yr.	20
II.b	II.b.7.2	Biomass fuel handling and storage system	Fuel reception, conveying, screening and storage for solid biomass. Incl. conveyors, silos, bunkers, dust extraction.	25	-	PlanEnergi/BPC (Engineering judgement)	1	N	Mechanical handling equipment (~40% of cost at 15-20yr) drives AMBER intensity.	No	0	25	1	1	MEDIUM risk of failure of critical components. Political risk follows considerations regarding use of biomass.	20
II.b	II.b.7.3	Electric boiler - Ancillary services	Electric boiler used primarily for other primary goals than backup and peak production (e.g. ancillary services). Typically connected at mid-high voltage.	20	20-25	ETC 0018 Ch. #41	1	0	Simple technology. Low equipment intensity.	Yes	0	20	1	2	High stranding risk, primarily due to risk of boundary conditions (electricity market changes).	5

Asset Life Assessment DH companies | Two-Step Methodology: Technical Lifetime -> Economic Lifetime

IDENTIFICATION				STEP 1: TECHNICAL LIFETIME								STEP 2: ECONOMIC LIFETIME				
RAR Cat.	ID	Asset Category / Component	Description	Baseline Lifetime [yr]	ETC Range [yr]	Source	Asset Composition	ETC Compatibility	Step 1 Notes	Use Component Assessment (if available)	Comp. Wtd Avg [yr]	Technical Lifetime [yr]	Degradation Risk	Policy / Stranding Risk	Step 2 Notes	Economic Lifetime [yr]
II.c. Other Tangible Fixed Assets																
II.c.1 Customer / End-User Installations (DH-owned)																
II.c	II.c.1.1	HIU - single-family house (individuele afleverset, company-owned)	Compact delivery set connecting the DH network to a single-family house. Indirect connection incl. small Heat exchanger, thermostatic valve, heat meter connection and controls. In RAB only if the varmebedrijf owns and maintains the HIU.	25	20-30	ETC 007 Ch. #203 (single family)	2	0	ETC 25yr too high per field experience. ETC Ch.07 #203: 25yr central, 20-30yr range for DH substation/HIU.	Yes	19	19	2	1	MEDIUM-HIGH technical risk: not overhauled; domestic environment. MEDIUM policy risk: individual HP competition.	15
II.c	II.c.1.2	HIU - multi-storey / commercial (individuele afleverset, company-owned)	Larger delivery set for multi-storey residential or commercial buildings. Indirect connection, incl. plate heat exchanger, pumps, thermostatic controls and heat meter. Better maintenance access than single-family. In RAB only if the varmebedrijf owns and maintains the HIU.	25	20-30	ETC 007 Ch. #203 (apartment complex)	2	0	Better maintenance access than single-family. ETC Ch.07 #203: 25yr central, 20-30yr range.	Yes	20	20	1	1	MEDIUM technical risk: maintenance accessible; pumps replaceable. Same policy risk considerations as single-family HIU.	20
II.c	II.c.1.3	In-building distribution pipework (in pandig leidingstelsel, company-owned)	Collective riser and distribution pipework inside a (multi-unit) building, running between the central delivery connection at building entry and individual HIU connections at each apartment. In RAB only if the varmebedrijf owns and has capitalised this infrastructure. Ownership varies significantly.	45	-	PlanEnergi/BPC (Engineering judgement)	0	1	The delivery boundary in Danish systems is outside or just inside the building, hence this is not a technology covered in ETC. However, the piping is the same as other and similar figures apply.	No	0	45	0	1	MEDIUM policy risk: building renovation cycles and DH customer churn.	40
II.c	II.c.1.4	Customer heat meters (company-owned)	Ultrasonic or mechanical heat meter at customer connection, owned and installed by the varmebedrijf. Incl. flow sensor, temperature sensors and calculator. May be integrated in the HIU or be a separate unit (depending on ownership forms and delivery boundaries). In RAB only if the company owns the meters.	15	-	PlanEnergi/BPC (Engineering judgement)	1	N	Life driven by calibration requirements and electronic obsolescence.	No	0	15	1	1	Well-proven technology, still being developed on. Change of versions of meters (in new connections etc.) may apply, posing a stranding risk of compatability between versions.	15
II.c	II.c.1.5	Individual booster heat pump (5th gen DHC - building level)	Small compression HP at building/apartment level boosting ambient loop (<=25 degC) to usable heating temperature. Typically 5-30 kW per unit.	20	15-25	ETC Ch.07 #207 (air-water HP, single - closest comparable)	2	1	No specific ETC DH entry. Comparable to 07 Ch. #207 air-water HP. Technical life 20 yr pr Ch.07.	No	0	20	2	1	HIGH technical risk: factory unit, no overhaul in domestic context. MEDIUM policy risk: technology evolving rapidly.	12
II.c.2 Vehicles and Mobile Equipment																
II.c	II.c.2.1	Service vehicles and mobile equipment	Service vehicles, lifting equipment and mobile test equipment for network O&M.	10	-	PlanEnergi/BPC (Engineering judgement)	1	N		No	0	10	1	0		8
II.c.3 Other Fixed Assets																
II.c	II.c.3.1	ERP / operations management system (II.c variant)	Cross-reference I.1.1. Placement under II.c depends on ACM capitalisation policy.	8	-	PlanEnergi/BPC (Engineering judgement)	2	N	Life driven by vendor support cycles and functional obsolescence.	No	0	8	1	0	MEDIUM technical risk: IT hardware cycles. LOW policy risk.	5
III. Third-Party Contributions																
III	III.1	Connection cost contribution (aansluitbijdrage / BAK)	One-off customer contribution towards DH connection costs. Reduces the net RAB; not itself depreciated.	-	-	Wcw / ACM methodology	N	N	Not a depreciable asset.	No	0		N	N	Not depreciable.	-
III	III.2	Cost-covering contribution (kostendeckingsbijdrage)	Contributions from customers or third parties to cover part of the investment. Reduces the net RAB.	-	-	Wcw / ACM methodology	N	N	Not a depreciable asset.	No	0		N	N	Not depreciable.	-
III	III.3	Subsidies, grants and other third-party contributions (WIS, SDF++ FIU)	Government subsidies, EU grants or other public contributions received. Reduces the net Regulatory Asset Base (RAB).	-	-	Wcw / ACM methodology	N	N	Not a depreciable asset.	No	0		N	N	Not depreciable.	-