SAPHEA

INTEGRATING GEOTHERMAL HEATING AND COOLING NETWORKS IN EUROPE

Financial schemes for GeoDHC networks

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This deliverable is based on an extraction of the dataset "*EU-27 Country Mapping of Financing Schemes to Decarbonize Buildings, Heating and Cooling*." (Conforto and Hummel, 2024a), available at: https://zenodo.org/records/13886860

The complete mapping of financing instruments was possible thanks to the combined efforts of the projects SAPHEA and CoolLIFE. The costs associated with that work were split among the two projects which both benefit from it, any other funds received in each project were dedicated to the research specific to that project. The authors confirm that no double funding has been received for this work.

Similarities can be found between this document and the CoolLIFE deliverable D4.2 (Conforto et al., 2024) mostly in the references and the annexe of national resources used to conduct the mapping, in the overall methodology and the findings relative to the main mapping such as the correlation matrix, but not to aspects specific to each project. The CoolLIFE deliverable D4.2 focuses on space cooling and summer comfort, while this document focuses on supporting the market uptake of geothermal district heating and cooling networks developing the research questions relevant to this topic.

Executive Summary

With the planet heating faster than predicted, decarbonising the largest emitting sectors, such as buildings, is even more pressing. Studies estimate that district heating and cooling (DHC) might grow from 7% of heating and cooling (H&C) supply in buildings to up to 30%-40%, with geothermal energy among its main renewable energy sources (RES), growing from 2.5% of the DHC energy mix to up to 16-18% in some countries.

However, both technologies face significant financial barriers due to their capital-intensive nature and risk profile. To help lower those barriers and provide a comprehensive database of financing options, we mapped all current financial mechanisms for geothermal DHC (GeoDHC) across the EU-27. Then we analysed the dataset against selected social, energy, economic and financial indicators to identify any relevant trends. This report presents the most significant trends and findings derived from the mapping and its analysis.

The study adopted a comprehensive approach. A far-reaching literature review gathered existing knowledge on financing schemes for the decarbonization of buildings, heating, and cooling, to establish a base of policies at the EU level. Existing mappings of national schemes were collected from various sources, including national strategic documents (NECPs, NEEAPs, LTRS, RRPs, Comprehensive Assessments), other policy databases (ODYSSEE-MURE, EBRD, IEA, OECD, EIB, etc.) and national agencies promoting climate action. Thorough desk research compiled a list of schemes by scanning these sources and carrying out additional research in English and national language for each country. A shortlisting retained only currently active public and private schemes with selected information, including the coverage of a few focus sectors: building efficiency, RES and efficiency in H&C, DHC, and Geo DHC. The mapping so obtained underwent a thorough third-party review, before being analysed. Pivot tables and a correlation matrix were used to identify trends and correlations between the number of schemes, public energy spending, population, GDP, energy consumption, climate, and other financial indicators. Expert interviews on the main barriers and drivers of financing GeoDHC and what could close the investment gap complemented the findings.

Out of 590 financing schemes identified for the decarbonization of buildings and H&C across the EU-27, only 315 (53%) are relevant to geothermal DHC: 244 (77%) public and 71 (23%) private ones. This disparity shows the public support for GeoDHC, but also the well-known perception bias of investors and banks that see RES and efficiency projects as more risky and less profitable. The highest number of schemes were found at the EU level, in France, Poland, the Netherlands, Austria and Germany, where geothermal and DHC are widely adopted.

Despite literature showing several types of financing instruments used for the decarbonization of buildings and H&C, traditional instruments prevail in the mapping: grants/subsidies and loans among public incentives; green loans and green bonds among private products. Conventional instruments could be preferred because easier to issue, manage, and communicate, which raises concerns on how suitable innovative financing instruments can be and to which extent they can attract private capital.

Very few schemes target specifically DHC or geothermal energy for DHC. Schemes showed mostly a wide focus: efficiency and RES in heating (and less often cooling), and overall building envelope. Non-residential sites are more commonly addressed in these schemes, as serving large consumers increases the profitability of DHC networks.

A strong correlation was detected between public expenditure on energy efficiency in buildings and industry, number of financing schemes, population, total gross floor area, and final energy consumption in buildings. Heating needs (HDD) correlate strongly to the share of DHC in energy consumption, indicating greater adoption in cold climates. Climate,

economic and financial indicators, as well as high shares of DHC and geothermal in final energy consumption do not seem to significantly affect the financing offer for GeoDHC. However, countries that have no or low DHC seem also to not support its introduction through public incentives.

A survey was circulated among experts from Research and Academia, energy companies, Associations/Lobbies, Energy Agencies, International Organisations, Government Departments and Architects. Below are the main results.

Securing Financing for Geothermal DHC Projects:

- **Ease**: Responses varied, from difficult due to high upfront costs, reliance on grants and complex processes, to relatively easy, especially with public funding support.
- **Phase**: Funding was sought mostly during research & exploration.
- **Information**: Feasibility studies, project proposals, and technical reports were commonly requested by credit institutes/investors. Financial evaluators generally lack expertise in the geothermal sector, affecting their assessment of GeoDHC projects' profitability and risks.

Barriers and Drivers:

- **Drivers**: Public support, policies, and reduced energy costs.
- **Barriers**: high upfront costs, regulatory uncertainty, lack of awareness. Solutions: Document successful projects, increase investor confidence, and a standardized financing template.
- **Increase Profitability and reduce Risk**: abundant geothermal resources, efficient design, low operational costs, long lifespan, reliable subsurface data, and standardized technologies.
- **Facilitate Access to Finance**: Open-access subsurface data, successful project data, certification standards, transparency in green project financing, and technical expertise support.
- **Increase Uptake**: Strong political commitment; coordinate efforts among industry, policymakers, and financial institutions; simplify permitting processes; de-risking mechanisms; promote pilot projects; and increase public awareness.

Pricing Formulas:

- Commonly based on costs (CAPEX, OPEX),
- Often indexed to inflation or alternative fuels,
- Sometimes under ESCO or rental contracts, incorporating profit margins.

We must acknowledge the inherent limitations of this mapping exercise, as the dynamic nature of funding schemes leads to rapid obsolescence. The absence of historical overviews hampers contextualization, hindering assessment of trends like public funding spikes, e.g. the COVID-19 pandemic, elections, etc. One remarkable challenge was posed by budget disclosure: uneven for public schemes and absent for private ones. As the bottom-up overall public expenditure proved too inconsistent to be representative, we used the IEA aggregate country data on public spending for energy efficiency in buildings and industry. While numerous schemes exist, their effectiveness and utilization remain unclear, with many addressing broadly H&C and very few targeting geothermal for DHC. Private credit/investment for geothermal and DHC projects is rarely the object of commercial products, being mostly negotiated on a case-by-case basis. Varying public expenditure indicates the intensity of public support, while the varying number of schemes reflects

different strategies: few umbrella programmes or multiple targeted schemes, complicating interpretation. Other factors, such as the urgency and political commitment to the energy transition can influence support but are harder to quantify. A higher propensity to invest in renewable and efficiency projects can be found in countries where private finance is more developed and the market is more mature, however, this does not compensate for the interest rate differentials which remain a challenge. Despite the blossoming of public and private financing schemes, the investment gap to achieve decarbonization persists, which suggests how incentives alone seem to be insufficient without legal obligations to decarbonize.

Efforts from European and national policymakers are crucial to expedite the uptake of GeoDHC by establishing enabling policy and financing frameworks, incentives, awareness raising, technical assistance and workforce training. This systematic mapping of financing schemes for GeoDHC was very resource-intensive, stressing the need for improved accessibility of funding information. Centralized access points, offering comprehensive overviews and direct links to application pages could enhance resource utilization. To maximise the outreach of this study, the full mapping will be accessible through the SAPHEA Tool and Knowledge Hub, empowering stakeholders to access comprehensive information about their financing options and decisionmakers about the current financing landscape.

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List of Acronyms

CDD	Cooling Degree Days
CHP	Combined Heat and Power
DHC	District Heating and Cooling
EED	Energy Efficiency Directive
EGS	Enhanced Geothermal Systems
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
EU	European Union
FEC	Final Energy Consumption
GeoDHC	Geothermal District Heating and Cooling Network
GDP	Gross Domestic Product
GFA	Gross Floor Area
HDD	Heating Degree Days
H&C	Heating and Cooling
LTRS	Long-Term Renovation Strategy
NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plan
PPS	Power Purchasing Standard
RES	Renewable Energy Sources
RRP	Recovery and Resilience Plan

Introduction

Climate change accelerates faster than previously estimated and global warming is heading to catastrophic levels unless drastic measures are implemented (Hansen et al., 2023; IPCC, 2023). Thus, it becomes even more urgent to decarbonize the largest emitting sectors, such as heating and cooling (**H&C**) in buildings, which are responsible for half of the energy consumption and emissions in the EU. District Heating and Cooling (**DHC**) networks emerge as a pivotal component in decarbonizing the sector, offering vast potential to improve energy efficiency and reduce emissions. Estimates show that DHC might grow from the current 7% of H&C supply in buildings (Figueira et al., 2022) to up to 50% by 2050 (Euroheat & Power, 2023). The DHC's potential to decarbonize H&C is even greater when supplied by low-carbon energy sources. Geothermal energy is likely to be among the main renewable energy sources of DHC, growing from 2.5% to up to 16-18% of the DHC energy mix in some countries, e.g., France (Euroheat & Power, 2023).

DHC offers countless advantages (Schmidt and Leitner, 2021): it allows significant reductions in primary energy consumption, provides affordable and reliable H&C, allows to decarbonize the supply without counting on individual action, resulting in increased indoor comfort with higher efficiency and lower emissions, alleviated energy poverty and reduced heat island effects. Geothermal energy is abundant and widely available, it can be harnessed virtually everywhere, offering a reliable and continuous source of carbon-neutral thermal energy, operable round the clock and suitable for baseload supply, paired with heat pumps, can supply both heating and cooling. Nonetheless, a fast and wide uptake of geothermal DHC is hindered by significant barriers. DHC is capital-intensive, requiring infrastructure and construction investments (GeoDHC et al., 2020). Geothermal energy has a distinct risk profile that limits its appeal to investments, facing high exploration risk before the first drilling can confirm its success. Innovations like the 4th and 5th generation of DH, closed-loop, advanced and Enhanced Geothermal Systems (AGS/**EGS**) can help address these challenges, but in general, financing is one of the major barriers for both technologies.

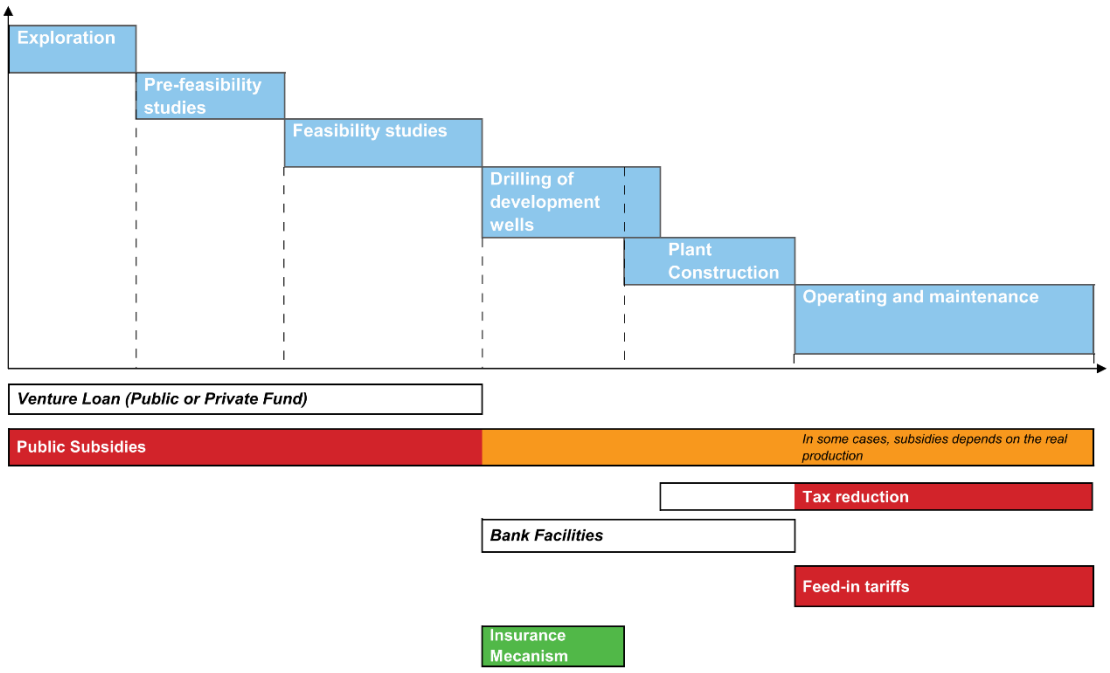

Figure 1: Geothermal project process and financing instruments (GEOFAR)

The project GEOFAR (GEOFAR, 2010) documented how various sources of funding intervene in different development phases of a geothermal project, as reported in Figure 1. In particular, GEOFAR suggested that the early exploration phase could be sustained by Seed Capital and then integrated by Venture Capital, that Private Equity could intervene in the pre-feasibility phase, followed by Mezzanine Debt and Bridge Debt in the Feasibility phase, Construction Debt in the development phase, and Project Financing, as well as Tax equity in the operation and maintenance phase (GEOFAR, 2010). Please note, however, that for GeoDHC there are currently no feed-in tariffs but long-term insurances, and that after the plant contrition, grants for heat infrastructures can intervene.

With Venture Capital, we mean a form of private equity aimed at financing projects, start-up companies, and small businesses with long-term growth potential. Venture capital typically comes from various sources: investors, investment banks, financial institutions, pension funds, insurance companies, endowments, sovereign wealth funds and family offices, as well as wealthy individuals, commonly known as business angels, and hedge funds, specialized in investments that are riskier but offer higher return.

The THERMOS project[1], quoting a previous study carried out by the CoolHeating[2] project (THERMOS, 2021; CoolHeating, 2017), summarized the sources of capital that contribute to the construction and development of DHC projects, which are reported in Figure 2. Geothermal DHC projects combine the complexity of both a geothermal project and a DHC project, which is reflected also in the combination of sources of funding including own funds in some cases, public or private, venture capital, public subsidies and incentives, debt, equity, business angels and more.

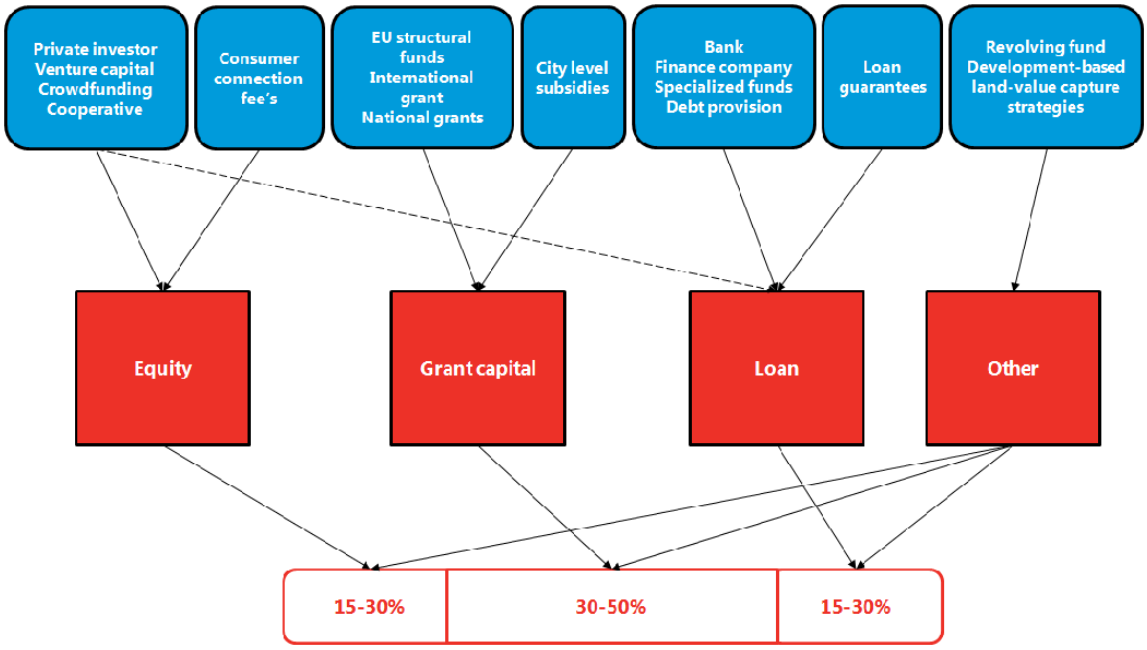

Figure 2: Financial structure of DHC networks (THERMOS and CoolHeating)

Each project is different, so there is no one-size-fits-all solution. However, while incentives cover only a part of the required investment, the crucial role of public funding in promoting Geothermal DHC is widely recognized, as it increases profitability and therefore attracts private investments (Euroheat & Power, 2024). Public and private financing schemes for the clean energy transition have seen significant growth in terms of the number of schemes,

[1] THERMOS Project Homepage: https://www.thermos-project.eu/
[2] CoolHeating Project Homepage: https://www.coolheating.eu/

types of instruments offered, and overall expenditure, so it can be difficult to have a complete overview (Conforto and Hummel, 2022a, 2022b).

To help unlock the full potential of these technologies to deliver a low-carbon future, we mapped all current public and private financial schemes for geothermal energy in DHC systems across the EU-27 at the European and Member State levels. Collected schemes formed a dataset that was analysed against its main features and relevant indicators to try and identify significant trends. A series of expert interviews completed the study on barriers, drivers and what could help close the gap and accelerate the market uptake of geothermal DHC networks. This report presents the methodology used and the main findings of the mapping, the analysis, and the experts' interviews. The complete mapping dataset will be available on the SAPHEA Tool and Knowledge Hub in open-access format.

Methodology

Mapping

The study used a composite approach to map financial instruments supporting GeoDHC across the EU-27. First, a wide-ranging literature review collected previous reviews and publications on financing schemes for H&C, DHC, RES in H&C and building decarbonization more broadly. (Conforto and Hummel, 2022b; DG Energy et al., 2022; Economidou et al., 2019; EEFIG, 2022; EIB, 2020; OECD, 2021; TPA Group, 2018). This step established a base of EU-level policies and initiatives.

Where possible, previous mappings were scanned to gather relevant financing schemes. These included National Energy and Climate Plans (**NECP**s), Recovery and Resilience Plans (**RRP**s), Comprehensive Assessments on heating and Cooling, National Energy Efficiency Action Plans (**NEEAP**s), Long-Term Renovation Strategies (**LTRS**s) (EBRD, n.d.; EEA, n.d.; EIB, n.d.; EU COR, n.d.; fi-compass, n.d.; IEA, n.d.; ODYSSEE-MURE, n.d.; OECD, n.d.). National agencies promoting climate action and disbursing funding were researched for each Member State (**MS**) and their website was scanned for the indication of additional schemes, e.g.: Ministries (Energy, Environment, and Economics), Energy, Environment, Innovation and Development Agencies, National Energy Efficiency Funds and others.

Additional online research using a set of keywords in English and national language was carried out for each EU 27 country, searching for additional schemes to complement the mapping.

Each scheme was then analysed and mapped as directly or indirectly relevant to 5 sectors:

- **Building Envelope Efficiency**: improvements in the building envelope or overall energy performance, including requirements for minimum energy class or savings.
- **H&C Efficiency**: improvement, upgrade and replacement of heating/cooling systems with cleaner alternatives.
- **Renewable Energy in H&C**: heating and/or cooling systems powered by renewable energy sources, including heat pumps.
- **DHC**: this includes the extension, development, or improvement of DHC networks, as well as the connection of new customers.
- **GeoDHC**: use of geothermal energy in conjunction with the development, extension, or enhancement of DHC networks and connections to buildings.

Only currently active schemes relevant to GeoDHC and DHC were filtered. Schemes relevant for other sectors but not for GeoDHC and DHC were excluded.

The analyses described from this point on refers solely to the sectors explicitly addressed. However, for completeness, the SAPHEA Tool and Market Uptake Hub will make available a dataset of all identified schemes, indicating whether their coverage of the sector was explicit (“Y”) or implicit (“(Y)”).

Schemes were sorted in two tables: public and private schemes. Each scheme was detailed with the name in English and original language, country and level (European, National, Regional), target sector(s), target building sector (residential/non-residential), type of instrument, start and end year, links to relevant sources, and a brief description.

Multiple types of financing schemes were found, so for simplification, they were clustered in a few categories. Financial instruments were categorized as follows.

Public schemes:

- **Advisory Services, Technical Assistance**: expert support and guidance on topics such as technology implementation and process optimization.
- **Energy Efficiency Obligations**: imposing energy companies to achieve energy certain energy savings targets or provide energy services/funding for efficiency actions, including white certificate schemes.
- **Equity Financing**: investment in company ownership shares.
- **Grants/Subsidies**: financial contributions to support specific activities or projects, often without repayment.
- **Guarantees**: substitutes for the collateral, transferring responsibility for another party's debt or performance obligation in case of default.
- **Loans/Soft Loans**: borrowing money with agreed repayment terms, such as lower interest rates or longer repayment periods for soft loans.
- **Tax Incentives**: tax reductions or exemptions to encourage certain behaviours.

For private schemes, financial instruments were categorized as:

- **Advisory Services, Technical Assistance**; **Equity Financing**; **Grants/Subsidies**; and **Guarantees** as defined above for public schemes.
- **Green Bonds**: fixed-income instruments exclusively funding environmentally friendly projects or initiatives.
- **Green Leasing**: leasing agreements incorporating environmentally sustainable practices into property design, construction, or operation.
- **Green Loans**: financing designated for projects with positive environmental impacts.
- **Green Mortgages**: mortgages whose preferential conditions are linked to the purchase or achievement through thermal retrofit of energy-efficient homes.
- **On-bill Financing**: a mechanism repaying energy efficiency or renewable energy costs through property utility bills, structured to ensure energy savings offset repayment costs.

The SAPHEA mapping is a subset of the overall dataset "*EU-27 Country Mapping of Financing Schemes to Decarbonize Buildings, Heating and Cooling*." (Conforto and Hummel, 2024a). Until the SAPHEA tool and Market Uptake Hub will make it available, you can access the full mapping and filter it through the column "SAPHEA", available on: https://zenodo.org/records/13886860

The overall mapping dataset informed the task on financing instruments of the CoolLIFE project and the relative deliverable (Conforto et al., 2024). The CoolLIFE project partners operated a rigorous review of the dataset which was not reiterated in SAPHEA.

Analysis

This assessment searched for significant trends and correlations between the number of financing schemes mapped, the amount of public expenditure for low-carbon energy, and other relevant indicators. Gathering information on budget allocations to each scheme posed a first major issue, as this is inconsistently disclosed for public schemes and completely absent for private schemes. To compensate for that, aggregate data on public energy spending specifically towards building and industry efficiency were utilized (IEA, 2024).

A selection of indicators were collected or derived and calculated to enrich the dataset: cost of borrowing (ECB, 2024), DCH and geothermal energy share in FEC (Bursich, 2020), electricity and gas prices (Eurostat, 2022b), final energy consumption (**FEC**) in buildings (EURAC, 2023), Gross Floor Area (**GFA**) (EURAC, 2023) and building energy intensity, GDP in Purchasing Power Standards (**PPS**) (Eurostat, 2023a), Heating Degree Days (**HDD**), Cooling Degree Days (**CDD**) (Eurostat, 2022a), inflation (derived from the Harmonized Index of Consumer Prices (Eurostat, 2024), interest rates (CEIC Data, 2024), population (Eurostat, 2022c), public deficit (Eurostat, 2023b). public energy spending for energy, building and industry efficiency (IEA, 2024), sovereign yield (MTS Markets, 2024)

The current political majority was initially considered as an indicator but eventually abandoned, as a direct time correlation is hard to verify, and schemes can be inherited from previous governments.

The most recent available year was used for each indicator, as one recent year was not available for all indicators. Please note that this misalignment might influence correlations. Indicators, sources and reference years are reported in Figure 3.

Source	Indicator (Reference Year)
CEICDATA	Interest Rate (2024)
ECB	Cost of borrowing (2023)
EURAC for EU BSO	Building FEC (GWh converted from Mtoe) (2021); Total GFA (m2) (2021);
Eurostat	Population (2021); GDP/capita (in PPS) (2021); HDD (2023); CDD (2023); Electricity Prices (2022); Gas Prices (2022); Inflation (2023); Public Deficit (2022) (2022)
IEA	Public Energy Spending (bn €) (2024); Public Energy Spending in Building and Industry Efficiency (bn €) (2024)
IREES-Bursich for EU Commission	DHC in FEC (%) (2018); Geo in FEC (%) (2018)
MTS Markets	Sovereiegn Yied (2024)
Own Calculation	Energy Spending (€/capita) (2024); Energy Spending in Building and Industry Efficiency (€/capita) (2024); Financing Schemes - Total (2024); Financing Schemes - Public (2024); Financing Schemes - Private (2024); Building Energy Intensity (MWh/cap) (2021); Building Energy Intensity (kWh/m2) (2021)

Figure 3: Additional indicators used for the correlation matrix.

A correlation matrix was employed to examine relationships between all indicators. Special attention was paid to the outliers, researching which factors influenced their particularly high or low values, and to the countries of the case-study areas, which have a dedicated section examining their history and current market and policy development.

Experts Interviews

A select group of GeoDHC experts were interviewed via an online survey. Their responses complemented the main findings of the mapping and assessment, providing valuable insights for further analysis and decision-making. Below are listed the questions they were asked to answer.

- Stakeholder information: name, organisation, current role, and stakeholder category,
- Financing a GeoDHC project
    1. How easy was it for you to secure financing for geothermal DHC project(s)?
    2. When did you start looking for funding for your project?
    3. What information did the credit institute/investor ask for?
    4. Was there an asymmetry between the information available and required?

5. Were credit institutions able to fully assess the profitability and risks associated with the project? Were project developers able to convey them?

- Barriers and Drivers to financing geothermal DHC networks

6. What do you think are the major drivers and barriers to securing financing for geothermal DHC projects? Do they change over time? E.g. after many successful projects, due to market changes or other exogenous factors?
7. What makes, in your opinion, a geothermal DHC project profitable and low risk?
8. What do think would help facilitate access to financing for geothermal projects? E.g. a database of successful projects, estimates on average financial indicators (ROI, rate of success, risks and risk management), a template to provide all necessary information about geothermal projects when applying for funding, support to assess geothermal projects in credit institutions, technical expertise in banks to assess geothermal projects or a centralized service e.g. provided by the national energy agency, or geological survey…
9. What else would accelerate the uptake of geothermal DHC in Europe?
10. What do you think makes a financing scheme for the decarbonization of buildings relevant to geothermal DHC?

- Pricing Formulas

11. Could you briefly describe, how is the heat price set in the GeoDHC network(s) you are familiar with? e.g. indicated to alternative fuels (gas, electricity), based on generation costs plus an index ratio, discounted compared to the heating price in the nearest DHC network, etc.

Results and Findings

Overall Mapping

Out of 590 financing schemes that the mapping identified for the decarbonization of buildings and H&C across the EU-27, only 315 (53%) are relevant to geothermal DHC: 244 (77%) public and 71 (23%) private ones, as shown in Figure 5.

The great prevalence of public schemes over private ones can indicate the growing public support for GeoDHC, but also the known perception bias of investors and banks that often see RES and efficiency projects as riskier and less profitable than traditional alternatives, the challenge of initial and transaction costs, due to lack of standardization, prolonged payback periods and the incognito of the resource risk.

The highest number of schemes were found at the EU level, and in France, Poland, the Netherlands, Austria, Spain and Germany, where geothermal energy and DHC networks are widely adopted.

Public

	Schemes	Building Eff	H&C Eff	H&C RES	DHC	Geo DHC	Cooling	Residential	Non-Residential
Total	**244**	**161**	**210**	**200**	**161**	**141**	**146**	**133**	**170**
Country		**66%**	**86%**	**82%**	**66%**	**58%**	**60%**	**55%**	**70%**
EU-27	23	19	21	21	21	21	21	22	22
Germany	23	10	20	18	10	9	12	10	12
Poland	22	12	22	20	16	15	12	16	10
Austria	21	3	12	11	15	8	6	7	17
Belgium	20	17	17	14	8	5	7	7	16
France	18	12	16	18	17	17	16	7	13
Netherlands	14	11	12	14	12	13	10	11	12
Bulgaria	10	7	7	5	1	1	3	5	7
Czechia	10	8	9	7	4	1	4	4	7
Croatia	8	7	8	6	3	3	7	4	5
Finland	7	4	6	6	5	4	4	4	4
Luxembourg	6	4	6	6	5	5	4	2	4
Slovakia	6	4	6	6	5	5	4	3	4
Denmark	5	3	4	3	3	1	2	1	2
Italy	5	4	5	3	5	5	4	3	3
Hungary	5	4	4	5	4	5	4	2	3
Latvia	5	5	4	5	4	5	4	3	4
Slovenia	5	5	5	5	4	5	5	5	2
Spain	5	3	4	4	3	3	3	3	5
Lithuania	4	3	4	4	4	4	4	2	1
Romania	4	3	3	3	3	0	0	2	3
Sweden	4	2	3	3	1	0	0	2	1
Cyprus	3	3	3	3	3	3	3	2	3
Estonia	3	1	2	2	2	0	0	2	2
Portugal	3	3	3	3	0	0	3	1	3
Greece	2	2	2	2	1	1	2	1	2
Ireland	2	1	1	2	1	1	1	1	2
Malta	1	1	1	1	1	1	1	1	1

Private

	Schemes	Building Eff	H&C Eff	H&C RES	DHC	Geo DHC	Cooling	Residential	Non-Residential
Total	**71**	**55**	**55**	**57**	**40**	**39**	**38**	**46**	**46**
Country		**23%**	**23%**	**23%**	**16%**	**16%**	**16%**	**19%**	**19%**
Sweden	11	9	11	11	7	6	2	10	1
Austria	11	8	8	9	8	8	8	6	9
Germany	8	6	7	8	7	8	7	5	7
Belgium	5	5	3	3	2	2	2	2	3
Finland	4	2	1	1	0	0	0	2	3
Luxembourg	4	3	2	2	1	1	2	2	3
Denmark	3	3	2	2	1	1	0	2	2
France	3	1	3	3	3	3	3	3	3
Portugal	3	3	3	2	2	1	3	2	3
EU-27	3	1	1	2	1	2	2	2	2
Bulgaria	2	1	1	1	1	1	1	1	1
Croatia	2	1	1	1	0	0	1	1	1
Cyprus	2	2	2	2	1	1	1	0	1
Slovakia	2	2	2	2	1	1	1	2	2
Estonia	1	1	1	1	1	1	1	0	1
Hungary	1	1	1	1	1	1	1	1	1
Italy	1	1	1	1	1	1	1	1	1
Latvia	1	1	1	1	1	1	1	1	0
Lithuania	1	1	1	1	0	0	0	1	0
Poland	1	1	1	1	1	0	0	1	0
Romania	1	1	1	1	0	0	0	1	1
Spain	1	1	1	1	0	0	1	0	1
Czechia	0	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0

Figure 4: Public and private schemes by Country, with detail on covered sectors

Public Schemes

Type of Instrument	Count	%
Grant/Subsidy	126	52%
Debt financing	33	14%
Grant/Subsidy, Debt Financing	20	8%
Multiple (Grant/Subsidy, Tax rebate, Debt, Equity, Guarantee, TA)	16	7%
Energy efficiency obligations	14	6%
Tax Incentives	11	5%
Other public scheme	7	3%
Guarantee/Insurance	6	2%
Advisory Service, Technical Assistance	6	2%
Equity financing	5	2%
Grand Total	**244**	**100%**

Private Schemes

Type of Instrument	Count	%
Green Loan	46	65%
Green Bonds	12	17%
Guarantee/Insurance	4	6%
Equity financing	3	4%
Green Loan, Advisory Service	2	3%
Grant/Subsidy	1	1%
Green Leasing	1	1%
On-bill financing	1	1%
Advisory Service, Technical Assistance	1	1%
Total	**71**	**100%**

Public & Private

Sector	Count	%
Building Eff	216	69%
H&C Eff	265	84%
H&C RES	257	82%
DHC	201	64%
Geo DHC	180	57%
Residential	179	57%
Non-Residential	216	69%
Total	**315**	**100%**

Figure 5: Types of instruments and Sectors coverage among mapped schemes

Regarding the types of instruments available, as illustrated in Figure 5, public schemes prominently feature grants and subsidies (52%), loans and soft loans (14%), a combination of both (8%), multiple instruments (7%), energy efficiency obligations (6%) and tax incentives (5%). Conversely, private schemes predominantly offer green loans (65%) with a much smaller offering of green bonds (17%), primarily mentioned as investment options rather than project finance. Concerning risk mitigation (Guarantee/Insurance) only 6 public schemes (2%) and 4 private ones (6%) could be found.

Despite literature showing several types of financing instruments used for the decarbonization of buildings, H&C and DHC, traditional instruments[3] largely prevail in the mapping: grants/subsidies and loans among public incentives; green loans and green bonds among private products. Conventional instruments could be preferred for standard schemes that beneficiaries can apply for because they are easier to issue and manage. More innovative schemes are still an option, but much less frequently offered between public and private schemes, as they need to be set up on a case-by-case basis, which raises concerns about their scalability and their ability to attract private capital.

<table>
<tr><th></th><th colspan="2">Traditional</th><th colspan="2">Innovative</th></tr>
<tr><td rowspan="2">Non-repayable</td><td colspan="2">Grants, Prizes and Subsidies</td><td colspan="2" rowspan="2">Energy-Efficiency Feed-in-Tariff</td></tr>
<tr><td colspan="2">Tax Incentives</td></tr>
<tr><td rowspan="4">Debt</td><td colspan="2" rowspan="2">Loans</td><td>Green/Soft Loans</td><td>Energy Efficient Mortgages</td></tr>
<tr><td>Green Bonds, Community Municipal Investment Bonds, Social Bonds</td><td>On-Bill Financing (OBF) Loans, Tariffs</td></tr>
<tr><td colspan="2" rowspan="2">Credit Enhancement (guarantees, securities, insurances, additional collateral, etc.)</td><td rowspan="2">Energy Performance Contracting (EPC) and Agreements (EPA)</td><td>Energy Service Agreement (ESA)</td></tr>
<tr><td>Green/Energy Revolving Funds</td></tr>
<tr><td>Equity</td><td colspan="2">Third-Party Funding</td><td>Green Leasing, PACE</td><td>Crowdfunding</td></tr>
<tr><td rowspan="2">Other</td><td rowspan="2">Technical Assistance (TA), Project Development Assistance (PDA)</td><td>Advisory Services</td><td colspan="2">Energy Communities/Cooperatives</td></tr>
<tr><td>Capacity Building</td><td colspan="2">Energy Efficiency Quota Obligations</td></tr>
<tr><td colspan="3"></td><td colspan="2">One-stop shops (OSS)</td></tr>
</table>

Figure 6: Financial Instruments for energy efficiency in buildings, building renovation, H&C, DHC

Figure 6 shows all the types of instruments previously documented by (Conforto and Hummel, 2022b), highlighting the instruments most frequently found in this mapping in darker shades of green.

[3] In this study, traditional instruments refer to instruments developed historically, such as loans, equity, and bonds. Innovative instruments offer new approaches to addressing funding gaps, promoting social or environmental goals, and increasing access to capital for underserved communities or projects. They may leverage technology, alternative risk-sharing mechanisms, or non-traditional sources of funding to achieve their objectives. They are generally more recent developments, although in some cases they may have been invented already since a few decades but have not yet acquired the same diffusion of traditional instruments.

As mentioned, the mapping includes all schemes that are also indirectly relevant for Geo DHC and DHC, but looking at the thematic areas directly addressed, as depicted in Figure 5 and Figure 5, the majority of schemes have a broad target, primarily aimed at energy efficiency in H&C systems (84%), RES in H&C (82%), and overall building envelope efficiency (69%). The proportion of schemes specifically addressing DHC (64%) and GeoDHC (57%) may appear relatively high in our mapping but here we are looking at a subset of about half of all the financing schemes supporting the decarbonization of buildings and H&C. If we look at the overall dataset they are an even smaller minority: DHC (34%) and GeoDHC (31%) (Conforto and Hummel, 2024b).

Such a limited share of schemes addressing GeoDHC and DHC could be due to the considerable variation in the prevalence of DHC among Member States, at the narrower target audience (network operators, municipalities) compared to building owners, and at the size and complexity of GeoDHC and DHC projects, compared to the number of buildings to be renovated and H&C systems to be upgraded.

It is interesting to notice how almost all financing schemes at the EU level address GeoDHC and DHC (21 out of 23 schemes), which highlights the importance that is given at the European level to promoting DHC and geothermal energy in DHC. However, this priority is still not fully translated at the national level, and this reminds us how the potential of DHC to decarbonize the H&C sector lies still largely unexploited.

In the overall mapping, residential dwellings (69%) are more frequently targeted than non-residential premises (49%), reflecting the respective proportions of residential and non-residential buildings in the overall building stock. However, this distribution is flipped in the subset of schemes for GeoDHC, which favours non-residential buildings (69%) to residential ones (57%). This finding can be explained by the fact that serving large consumers, such as hospitals, universities, malls, and commercial areas, highly increases the financial feasibility of DHC and Geo DHC projects.

In terms of private offering, in the overall mapping, the focus is largely on building efficiency (84%), H&C efficiency (78%), and RES in H&C (77%), and residential dwellings (81%), with DHC (19%) and GeoDHC (18%) being covered only marginally. This indicates that commercial credit products are not fit to finance projects as large and complex as a GeoDHC network, as a green loan or a green mortgage could be for building renovations. However, it is known that credit and financial institutions may not be the ideal providers of seed capital for geothermal projects. Venture capital investors and public-private partnerships (PPPs) are a much better fit for early-stage investments, but do not offer standard products as banks: they carefully evaluate each project on a case-by-case basis.

The study found on average 11 schemes per country: 9 public and 2 private ones. Top outliers include Austria (32), Germany (31), Belgium (25), Poland (23), France (21), Sweden (15), and the Netherlands (14). However, zooming onto the schemes directly addressing GeoDHC, the top rankers are France (20), Germany (17), Austria (16), Poland (15), and the Netherlands (13). Differences in the number of schemes per Country can be partly explained by the size (e.g., Germany, France, and Poland), but also by the level of penetration of GeoDHC in H&C supply. However, other factors may intervene, e.g. countries with a high level of fragmentation of the banking sector may offer more schemes which are almost duplicates, or national policies may be translated into regional schemes like in Belgium, or into market-based instruments, such as white certificate schemes.

Regarding public expenditure in building and industry efficiency, Italy shows the highest expenditure by far probably due to the costly "Superbonus" scheme (further addresses in the country focus chapter), followed by Germany, France, Spain, Austria, Sweden, Ireland, and Poland.

Correlation with Socioeconomic, Climate, Energy and Financial indicators

Various indicators potentially impacting the offerings of financing schemes for building decarbonization were gathered (Figure 1 and Figure 5). A correlation matrix was then run on this dataset (Figure 7). A strong correlation emerged between public expenditure on energy and building efficiency, population (0.99-0.99), total Final Energy Consumption (FEC) in buildings (1-0.99) and the Gross Floor Area (GFA) (1-0.99). The correlation between public expenditure and the number of financing schemes is moderate on the GeoDHC focus (0.70-0.69). Interestingly, no significant correlation between public expenditure in building efficiency and financial indicators could be found.

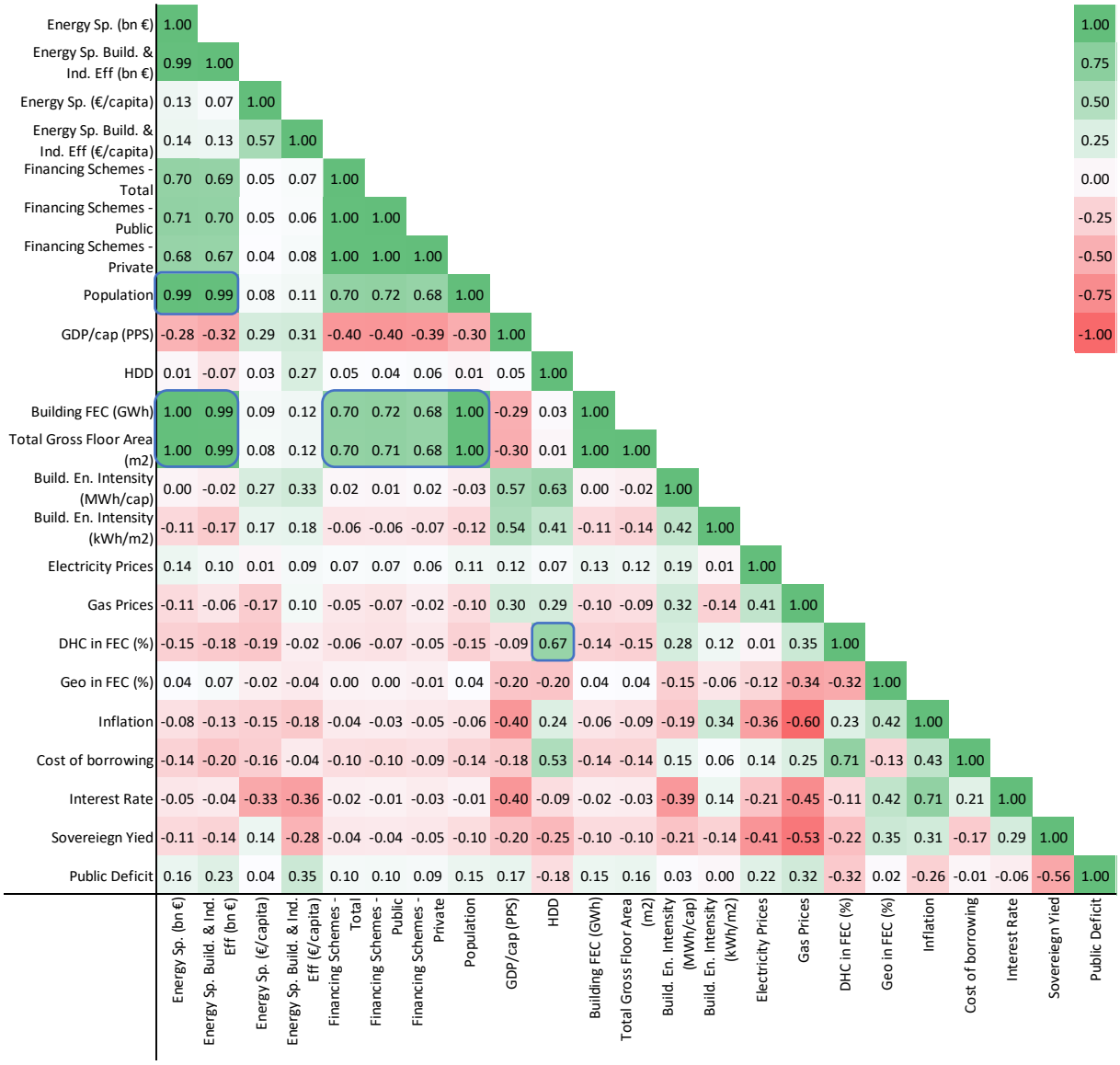

Figure 7: Correlation Matrix of all indicators considered.

The correlation between public energy spending in energy and efficiency and the population is more pronounced for top outliers: countries with the largest population tend to have the largest energy spending but also tend to support financially the decarbonization of the building stock with a similar intensity. Conversely, this correlation

weakens for bottom outliers where the intensity of support to the energy transition becomes more evident.

Countries with a federal organization, such as Austria and Belgium, can disperse modest amounts of public expenditure across many schemes, as similar schemes are multiplied at the regional level, resulting in a higher total number of schemes.

Counterintuitively, public spending on energy and building efficiency showed no correlation with GDP per capita in PPS. However, GDP per capita showed a moderate correlation with the energy intensity of buildings per capita (0.57). This could be explained as wealthier countries experience less energy poverty and higher indoor comfort, resulting in higher final energy consumption, particularly in colder climates. We used GDP in PPS, as this is the GDP value in national currency converted into a common currency with purchasing power parity, so to avoid any currency bias.

Public spending for building efficiency did not correlate with HDD, which means that countries with the coldest climates and thus the highest heating needs, do not try to reduce their energy consumption through public spending on energy efficiency.

Conversely, public spending for building efficiency showed a perfect correlation with total Final Energy Consumption (FEC) in buildings (1), beyond the one already noted with population, and gross floor area, but no correlation with energy intensity per capita (toe/capita) or per surface (kWh/m2), nor with electricity and gas prices.

The share of District Heating and Cooling (DHC) in FEC strongly correlated with HDD. Few schemes addressing DHC could be seen in countries with small or non-existent district networks, as opposed to several schemes in countries where this technology is prevalent. This suggests that while DHC systems are prioritized at the EU level, countries new to this technology or where conditions for DHC are unfavourable (e.g., due to low heat density) may not show equivalent support. No correlation could be found between the share of geothermal energy in DHC and the other indicators, which let us think that the development of geothermal energy can be mostly linked to a strong political commitment and historical factors that favoured the development of this technology.

No significant correlation was found between public spending for building and industry efficiency and the financial indicators analysed.

Most schemes commenced in the past five years, with fewer ongoing schemes which had started further back. This highlights how evolving needs, political priorities, and market conditions prompt the constant introduction, merging, or discontinuation of schemes.

It's essential to note that there may be biases in the correlations as the data may not be complete and the years of the data do not always align between the schemes and other variables. The review of the schemes is based solely on their descriptions and no data was collected on their actual application for specific interventions and technologies.

Case Study Areas

This section dives into the specific circumstances influencing the offer of funding instruments in the countries of the SAPHEA Case Study Areas.

Austria

Austria shows one of the EU's highest public energy expenditures in building and industry efficiency, even with the smallest share of schemes for energy efficiency in buildings. This follows a shift in focus towards H&C systems over building envelopes since a significant

renovation wave in 2009 allowed a significant number of building renovations. In addition, Austria opts for a decentralized implementation of national schemes, limiting the proliferation of regional equivalent schemes.

In Austria, DHC supplies 23% of H&C in buildings, of which 47% through RES. In total, 34% of H&C energy consumption is supplied by RES (RES DHC, 2021). There are currently about 90,000 geothermal heat pumps, generating approximately 2.3 TWh of heat (RES DHC, 2021). The country also hosts ten heat generation plants tapping into naturally occurring thermal water sources, collectively producing around 300 GWh of heat and roughly 2.5 GWh of electrical energy. The utilization of low-temperature geothermal energy for cooling purposes is also on the rise in significance. Notably, Energie Krieau has implemented such a system in Viertel Zwei, a district in Vienna. Wien Energie, the utility company of the city of Vienna, has plans to harness hydrothermal energy from depths of around 3,000 meters and supply the heat to the DHC network serving approximately 200,000 households by 2030. In the joint venture "Deeep", Wien Energie and OMV have just announced their first successful drilling and plan for the development of up to seven deep geothermal energy systems within the city (Fallahnejad and Kranzl, 2022).

Subsidies related to district heating and cooling in Austria can be divided into 4 categories:

- DHC grid infrastructure
- Renewable and efficient DHC generation
- Research, technology development and demonstration of innovative DHC systems
- Connection of end users to DHC grids (Fallahnejad and Kranzl, 2022).

Several Austrian public schemes support the development of DHC networks supplied via geothermal energy: 7 at the national level (Heating and Cooling Line Expansion Act[4]; Innovative local heating networks[5]; Geothermal Systems[6]; Building component activation - Energy flexibility[7]; Energy Communities[8]; Energy efficiency obligation scheme - White certificates[9]; and Green Project Finance Programs to mobilize private capital[10]) and 2 at federal level (Upper Austria Clean Energy Program - Funding program for renewable energies & efficient energy use[11]; THEWOSAN – Vienna funding scheme for buildings thermal renovation[12]). In addition, 6 schemes support the development of DHC networks without explicitly mentioning the use of geothermal energy: District heating connection ≥ 100 kW for businesses and municipalities[13]; Climate-friendly district heating systems: Expansion and decarbonization, Optimization measures[14]; "Out of oil and gas" for

[4] http://www.awista.at/gesetze-regelwerke/bgbl-i-722014/
[5] https://www.umweltfoerderung.at/betriebe/innovative-nahwaermenetze/unterkategorie-waerme-aus-erneuerbaren-ressourcen
[6] https://www.umweltfoerderung.at/betriebe/geothermieanlagen/unterkategorie-waerme-aus-erneuerbaren-ressourcen
[7] https://www.umweltfoerderung.at/betriebe/bauteilaktivierung.html
[8] https://www.umweltfoerderung.at/privatpersonen/energiegemeinschaften/energiegemeinschaften
[9] https://www.ca-eed.eu/ia_document/national-implementation-report-austria/
[10] https://www.bmk.gv.at/green-finance.html
[11] https://www.land-oberoesterreich.gv.at/files/publikationen/us_Ooe_Clean_Energy_Program.pdf
[12] http://www.wohnfonds.wien.at/
[13] https://www.umweltfoerderung.at/fileadmin/user_upload/umweltfoerderung/betriebe/Fernwaermeanschluss_Standardfall/UFI_Standardfall_Infoblatt_FERNW.pdf
[14] https://www.umweltfoerderung.at/betriebe/klimafreundliche-fernwaerme

companies: DHC connection[15] and heat pumps <100kW[16]; Energy centres for internal heat and cold supply[17]; Construction and conversion/retrofitting of existing heating systems - funding application (Vienna)[18]; Environmental support for district heating conversion (Graz)[19]. Other schemes support more broadly the decarbonization of H&C. Also, the private credit sector is actively offering debt, equity and assistance in green investments that can include GeoDHC from institutes such as Bank Austria, Erste Bank, Raiffeisen, Hypo Voralberg and the Reenag Group and Holding.

After the completion of the mapping, the Climate and Energy Fond published its yearly programme for 2024[20], announcing 10 million € for deep geothermal energy for climate-neutral heating. The program includes creating an Austria-wide geo-depth information system (GeoTIS Austria) by digitizing underground data from various sources, funding feasibility studies, and supporting exploration initiatives. This programme is particularly noteworthy because it is the first technology-specific funding programme in Austria.

Denmark

Denmark has since long had the highest DHC share in Europe: 66% of total energy consumption is for space heating (dbdh, 2018) of which 57% is through RES if we count biomass. In total, 47% of H&C energy consumption is supplied by RES (RES DHC, 2021). This achievement traces back to the oil crises in 1973, which prompted a significant shift towards DH as a cost-effective alternative to oil-based heating solutions. Strong support from central authorities, backed by clear and steady energy policies aimed at achieving a green and cost-efficient energy mix, played a crucial role. Key measures included national least-cost energy planning, zoning regulations favouring DH, and investment subsidies for utilities and consumers. Municipalities also played a pivotal role, viewing the DH network as an integral urban infrastructure and incorporating heat planning into urban development. Consumer ownership and non-profit DH companies are prevalent, ensuring that costs align with the actual production expenses. Efficient financing, often sourced from international credits at competitive rates, is supported by stable national energy policies, municipal loan guarantees, and consumer obligations. The technical landscape is diverse, fostering innovation and cooperation among DH companies, equipment suppliers, and consultants. Overall, Denmark's success in DH is attributed to integrated systems, heat accumulation techniques, and a focus on simple yet effective technical solutions (Mordor Intelligence, 2024a).

The widespread adoption of district heating has facilitated the efficient utilization of combined heat and power plants in Denmark. These plants supply excess heat generated in tandem with electricity to the district heating sector. Furthermore, Denmark's district heating sector plays a crucial role in balancing the fluctuations arising from a high proportion of variable renewable energy production, particularly from wind power. It also

[15] https://www.umweltfoerderung.at/fileadmin/user_upload/umweltfoerderung/private/TGS_Priv_2023/Infoblatt_raus_aus_Oel_2023_2024_EFH.pdf ; https://www.umweltfoerderung.at/betriebe/fernwaermeanschluss-100-kw/unterkategorie-waerme-aus-erneuerbaren-ressourcen ; https://kesseltausch.at/

[16] https://www.umweltfoerderung.at/betriebe/waermepumpe-100-kw/unterkategorie-waerme-aus-erneuerbaren-ressourcen

[17] https://www.umweltfoerderung.at/betriebe/energiezentralen.html

[18] https://www.wien.gv.at/amtshelfer/bauen-wohnen/wohnbaufoerderung/wohnungsverbesserung/heizungsinstallationen.html

[19] https://www.graz.at/cms/beitrag/10023441/7882683/Fernwaerme_Foerderung_Heizungsumstellung.html

[20] https://www.klimafonds.gv.at/wp-content/uploads/sites/16/Jahresprogramm_2024.pdf

offers cost-effective energy storage through the utilization of highly adaptable CHP plants.(Johannsen and Sorknæs, 2022)

The DHC energy mix is mostly supplied by renewables: waste and biomass. However, geothermal energy supplies only 2% of DHC and 4% of heat pumps in Denmark. In 2023 the Danish parliament approved a new law that will exempt geothermal heat projects from the price regulation already in place to support further development of geothermal energy in H&C (GeoEnergy, 2023). Current scenarios estimate that the share of geothermal energy could grow to 10-15% by 2050 (Danish District Heating Association, 2024). Direct heat utilization is expected to drive the market. Low-temperature geothermal heat is utilized alongside many other DHC energy sources. However, geothermal 5th-generation district heating and cooling is not processed under the Heat Supply Act, which prevents municipalities from supporting these projects with municipal debt guarantees. This lack of support creates a bias towards traditional DHC technologies, which in turn, hampers the decarbonization of the Danish heating and cooling sector, more specifically in the rural areas where traditional DHC is not possible. Deep geothermal resources in Denmark span two sedimentary basins, while shallow geothermal energy is commonly used for ground source heating and cooling. Notably, a 30-year agreement was signed in 2022 to develop the largest European geothermal heating plant in Aarhus. With rising energy demand and untapped resources, geothermal energy holds immense potential and the demand for geothermal technologies is expected to grow (Mordor Intelligence, 2024a)

Today, the Danish DHC market is sufficiently mature that few public schemes support further development of the sectors, while a few public schemes, as well as other financing models, are well established. In particular, the “Business subsidy for energy efficiency improvements”[21] shows an interesting design: the greater the energy or CO2 savings the project creates, the greater the subsidy. Other relevant schemes include a “Competitive subsidy scheme for energy savings and energy efficiency improvements in businesses” [22], a scheme targeting overall building decarbonization “Green housing agreement: 2021-2026 Landsbyggefonden's framework”[23] and a scheme supporting new energy technologies: “Energy Technology Development and Demonstration Program (EUDP)” [24]. Among private schemes, DLR offers green loans for sustainable properties and investments, Nordea issues Green Bonds, and Energilån offers green loans for energy-saving home improvements, that can be used to exploit geothermal energy but are hard to develop and DHC network.

France

In France, DHC supplies 6% of H&C in buildings, of which 56% through RES. In total, 22% of H&C energy consumption is supplied by RES (RES DHC, 2021). DHC systems in France saw significant development post-1950, primarily led by municipalities as a public service. Presently, they serve as a prominent avenue for leveraging renewable energies and recovery methods, including heat from waste incineration plants, biomass, industrial heat, geothermal, and solar, among others. Predominantly concentrated in densely populated urban regions, district heating and cooling (DHC) networks currently derive 53% of their supply from renewable energies and recovery sources. However, despite these advancements, district heating systems only constitute 6% of the national heat sector for domestic hot water and heating systems (Cerema, 2022). Significant expansion is

[21] https://ens.dk/ansvarsomraader/energibesparelser/virksomheder/erhvervstilskud-til-energieffektiviseringer
[22] https://www.retsinformation.dk/api/pdf/226439
[23] https://www.measures.odyssee-mure.eu/energy-efficiency-policies-database.html#/measures/4367
[24] https://www.eudp.dk/

anticipated considering the ambitious targets outlined in the 2015 Energy Transition Law. RES-based DHC is expected to grow fivefold by 2030 compared to 2012 levels. France's national low-carbon strategy (SNBC), adopted in 2019, delineates the pathway towards achieving carbon neutrality by 2050. District heating systems serve as a crucial conduit for decarbonizing heat, which constitutes 50% of final energy consumption.

France is still the largest GeoDHC country in the EU and leads also in terms of projects commissioned, with a total of 5 – adding 48.7 MWth to existing capacity, and 21 projects in the pipeline (Dumas, 2022). Such a development was possible in France due to de-risking mechanisms combined with business models based on public-private partnerships and local authorities' planning. Starting from 1980 France effectively managed geological risks associated with geothermal energy projects through two funds: the Short-Term Fund and the Long-Term Fund. The Short-Term Fund provides subsidies and loans to cover drilling costs and geological risks during project implementation. Managed by SAF Environment, it facilitated the installation of 500 MW of thermal power and substantial fuel savings over 35 years. The Long-Term Fund offered guarantees against geological incidents during the operational lifespan of geothermal installations. Backed by the state and insurers, it provided coverage for 15 years initially, later extended to adapt to economic changes. Together, these funds supported numerous projects, contributed to CO2 emissions reduction, and promoted geothermal energy development in France. Similar successful models have been observed in other European countries, highlighting the potential for wider adoption and support for geothermal projects.

Despite such a successful development of geothermal resources, geothermal energy still supplies only 7% of H&C in DHC networks. Therefore, in 2023 the Ministry of Energy Transition published the report “Geothermal energy: an action plan to accelerate” (Ministère de la Transition Énergétique, France, 2023).

Many public schemes currently support GeoDHC projects through grants and subsidies, loans, tax rebates and more: “Installations for producing heat and cooling from a geothermal tempered water loop”[25], “Installations for the production of renewable heat and cooling from surface geothermal and aerothermal sources”[26], “Extension and creation of district heating or cooling networks”[27]. Additional schemes target companies, and especially SMEs, carrying out ecological projects: “The energy performance contract for local authorities”[28], “Financial assistance to carry out energy audits and opportunity/feasibility studies”[29], “Green loans”[30] “Energy savings loan”[31] “Climate Action Loan”[32], “ADEME Green loan”[33], “Energy renovation tax credit for SMEs”[34], “Programme Pro-

[25] https://agirpourlatransition.ademe.fr/entreprises/aides-financieres/2024/installations-production-chaleur-froid-a-partir-boucle-deau-temperee
[26] https://agirpourlatransition.ademe.fr/entreprises/aides-financieres/2024/installations-production-chaleur-froid-renouvelable-a-partir-geothermie
[27] https://agirpourlatransition.ademe.fr/entreprises/aides-financieres/2024/extension-creation-reseaux-chaleur-froid
[28] https://www.ecologie.gouv.fr/contrat-performance-energetique-collectivites-territoriales-0
[29] https://agirpourlatransition.ademe.fr/entreprises/demarche-decarbonation-industrie/action-decarboner-industrie
[30] https://www.bpifrance.fr/catalogue-offres/transition-ecologique-et-energetique/pret-vert
[31] https://www.bpifrance.fr/catalogue-offres/transition-ecologique-et-energetique/pret-economies-denergie-pee
[32] https://www.bpifrance.fr/catalogue-offres/transition-ecologique-et-energetique/pret-action-climat
[33] https://www.bpifrance.fr/catalogue-offres/transition-ecologique-et-energetique/pret-vert-ademe
[34] https://www.ecologie.gouv.fr/plan-relance-credit-dimpot-renovation-energetique-des-pme

SMEn"[35], "Energy Environmental Loan"[36], "Energy efficiency check - Ile de France"[37], "Energy efficiency obligation scheme (White certificates)"[38].

The private offer of financing schemes for GeoDHC is quite varied: La Banque Postale offers a Green Loan for local authorities, Acceptable Corporate(S) and BPCE, using EIB funds, offer a scheme called "Action for the climate III", and ENGIE offers a Green Capex Program.

Germany

The share of renewable energy in the energy mix steadily increases, with wind, solar, and hydroelectric power collectively meeting around 50% of the electricity supply. However, the heating sector continues to heavily depend on fossil fuels, with only 11.5% of heating demand being met by renewable sources as of 2020. DHC supplies 9% of H&C in buildings, of which 14% through RES. (RES DHC, 2021). Despite these challenges, Germany has set ambitious targets for renewable energy adoption: 80% of electricity demand from renewable sources by 2030, and a reduction of 80% of primary energy used for heating by 2050.

Geothermal energy shows a huge potential in Germany, mostly untapped as it provides only 1.3% of heating and cooling needs. However, it is estimated that it could meet about 25% of the nation's heating requirements according to the Roadmap for Deep Geothermal Energy in Germany conducted by the Fraunhofer Institute Germany (Bracke et al., 2022). According to this study, the market potential in Germany opens up expansion targets of well over 300 TWh of annual energy or 70 GW of installed capacity. This initially applies to the aforementioned areas with current or foreseeably available hydrothermal technologies for direct utilisation alone or in combination with large heat pumps. Added to this are the potentials of petrothermal geothermal energy, large seasonal underground heat underground heat storage facilities (> 500 TWh/a) and shallow geothermal energy for heating and cooling buildings.

Similarly, Agora Energiewende suggests that the number of shallow geothermal units should increase from 420,000 to 2.5 to 3 million units. The roadmap shallow geothermal energy (Born et al., n.d.) estimates the potential for the use of ground source heat pumps to cover about 75 % of the German heat demand, which means 600 TWh/a. Additionally, it is stated that a significant part of the cooling demand could be also covered. Germany has at the moment the largest pipeline with 102 projects, followed by France with 24, the Netherlands with 22, and Italy and Poland with 21 respectively (Dumas, 2022).

However, in the Munich area, geothermal energy has been widely developed: since 1998 26 deep geothermal projects were completed. Munich's utility provider, Stadtwerke München (SWM), is the primary user of these resources. SWM aims for Munich to have a 100% climate-neutral district-heating network by 2040, providing the baseload in total by geothermal energy.

The geothermal developments in Munich and its surrounding areas owe their success to three key factors. Firstly, the Bavarian Geothermal Atlas, funded by the Bavarian State Ministry for Economic Affairs, Infrastructure, Transport, and Technology, has played a significant role. This atlas provides detailed information on where favourable conditions for geothermal energy exploitation exist, aiding municipalities, utility companies, and private investors in recognizing the potential for geothermal energy in the region.

[35] https://pro-smen.org/le-programme-pro-smen
[36] https://www.bpifrance.fr/catalogue-offres/transition-ecologique-et-energetique/pret-energie-environnement
[37] https://www.iledefrance.fr/aides-et-appels-a-projets/cheque-efficacite-energetique
[38] https://www.ecologie.gouv.fr/dispositif-des-certificats-deconomies-denergie

Secondly, long-term government support and financial incentives have been crucial, especially in the early stages of market development. National and state governments provided grants for drilling geothermal wells, plant development, and district heating network development, along with low-interest loans and insurance schemes for covering technical risks. This support boosted the economic viability of projects, facilitating significant investments such as the €50 million loan for the Holzkirchen scheme, which now generates over €10 million annually.

Lastly, research and innovation initiatives, like the €8 million GRAME project, supported by the Federal Ministry for Economic Affairs and Energy, played a vital role. These efforts focused on acquiring geophysical data, conducting experiments, and modelling to enhance understanding of the geothermal resource. As knowledge and experience grew, along with advancements in drilling technology, geological risks reduced, drilling efficiencies improved, and costs decreased, making deep geothermal projects in and around Munich less dependent on government subsidies. (Abesser and Walker, 2022).

Germany adopted a national roadmap for deep geothermal energy (Bracke, R; Huenges, E, 2022) and promoted the development of a risk guarantee scheme (BMWK, 2022) to achieve the target of 100TWh from geothermal energy. In addition, a roadmap for shallow geothermal energy is provided (Bracke, R. et al. 2022) giving policy recommendations to reach development goals for ground source heat pumps in the fields of permit procedures, qualified employees, administration, incentives, data and social acceptance.

To date, several financing schemes are available for GeoDHC: from the targeted "Federal funding for efficient heating networks"[39] and "Replacement of electric heating and oil boilers"[40], to the more generic "Renewable Energies Program - Standard 270"[41], "Federal funding for energy and resource efficiency in the economy - grant and loan EEW"[42], "Local real-life labs for the energy transition"[43], and the local schemes "Promotion of heat pumps in selected residential neighbourhoods in Lower Saxony"[44], and "Efficient buildings PLUS Berlin"[45]. A special mention goes to the "Climate protection agreements funding program - Carbon Contracts for Difference (CCfD)"[46] which promotes at the same time decarbonization, efficiency and least-cost solutions. However, many more public schemes are available for the integration of RES, and the decarbonization of H&C and buildings. Concerning the private offer, several institutes offer green loans and green bonds: Umweltbank, Landwirtschaftliche Rentenbank, Berlin Hyp, Munchener Hyp, Deutsche Hypo and the Landesbank Baden-Württemberg.

Italy

[39] https://www.bafa.de/DE/Energie/Energieeffizienz/Waermenetze/Effiziente_Waermenetze/effiziente_waermenetze_node.html;jsessionid=D04DFADE38653ECFF9D01257481D59B9.intranet242
[40] https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Land/Bremen/ersatz-von-oelheizkesseln.html
[41] https://www.kfw.de/inlandsfoerderung/Unternehmen/Energie-Umwelt/F%C3%B6rderprodukte/Erneuerbare-Energien-Standard-(270)/
[42] https://www.bafa.de/DE/Energie/Energieeffizienz/Energieeffizienz_und_Prozesswaerme/energieeffizienz_und_prozesswaerme_node.html (Temporarily suspended due to budget revision)
[43] https://www.energieforschung.de/lw_resource/datapool/systemfiles/elements/files/EE85B8F-BE8EA6705E0537E695E862120/current/document/F%C3%B6rderkonzept_Reallabore_28-06.pdf
[44] https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Land/Niedersachsen/waermepumpen-in-niedersaechsischen-wohnquartieren.html
[45] https://www.ibb.de/de/foerderprogramme/effiziente-gebaeudeplus.html
[46] https://www.bmwk.de/Redaktion/DE/Artikel/Klimaschutz/klimaschutzvertraege.html

In Italy, DHC supplies 4% of H&C in buildings, of which 24% through RES. In total, 14% of H&C energy consumption is supplied by RES (RES DHC, 2021). Geothermal energy share in the Italian primary energy consumption more than doubled in the last decade, but it still provides less than 1.5% and it supplies less than 2.5% of DHC. Transitioning H&C to RES faces several hurdles in Italy: RES-based DHC face higher capital expenditure compared to natural gas combined heat and power (CHP) solutions. The competitive market prioritizes price, favouring natural gas boilers, which are prevalent in the heating sector. Moreover, national incentives for DH projects are limited, with no specific investment grants available, and previous support through white certificates has been reduced. Additionally, Italy's short winter season and limited space availability often make fossil heating solutions more appealing, especially without regulatory constraints. Furthermore, DH is perceived as outdated and inefficient, necessitating awareness campaigns to highlight its environmental and social benefits and empower stakeholders to choose RES heating options more consciously.(Spirito et al., 2022)

Despite a significant potential for geothermal energy, a technology for which Italy was a frontrunner, awareness remains low, and political ambitions modest. In the National Integrated Plan for Energy and Climate (PNIEC) by 2040 and Italy's Long-Term Strategy for Greenhouse Gas Emission Reduction, by 2050, geothermal energy is mostly overlooked, and minimal growth is estimated. The main obstacles to geothermal development include limited awareness of its potential benefits, resistance from local communities, perceived environmental risks, the challenge of business risk, and administrative and regulatory hurdles, worsened by the absence of supportive policies. Italy's geothermal industry faces stagnation, with innovative solutions overshadowed by bureaucratic complexities. Overcoming these challenges demands clear energy policies, fiscal incentives, risk mitigation schemes, streamlined administrative processes, and robust industrial revitalization efforts. Moreover, a comprehensive awareness campaign is vital to underscore the economic and energy security benefits of geothermal energy, especially amidst rising energy poverty concerns, while emphasizing its minimal environmental impact compared to conventional alternatives.(Bonino and Levato, 2024)

Italy showed the highest public expenditure in building and industry efficiency, but this is due mostly to one large scheme, the "Superbonus", that cost around 100 billion € (ENEA, 2023) for modest energy efficiency gains in building renovation (Alpino et al., 2022). Originally introduced in 2020 mostly to stimulate the economy and construction sector after the first pandemic wave of COVID-19, the scheme was repeatedly criticised. Its regressive nature benefits property owners rather than more vulnerable subjects. The 110% tax rebate led to inflated renovation prices, fuelling debate over its efficacy and fairness. Its multiple impacts were analysed also by the MICAT project (Berger, 2024). Revised several times since 2022 (Romano, 2023), from 2024 it is limited to a 70% tax rebate for the renovation of condominiums (Gavi, 2024).

The “Efficient District Heating”[47] is a financing scheme funded by the RRP supporting the extension and transformation of efficient DHC networks. Other schemes can support GeoDHC projects, despite not targeting this technology explicitly: the “Thermal Account 2.0”[48] that incentivizes the production of thermal energy and energy efficiency in buildings, the “Energy efficiency obligation scheme (White certificates)”[49], the “Green Transition Fund

[47] https://www.gse.it/servizi-per-te/efficienza-energetica/teleriscaldamento-efficiente
[48] https://www.gse.it/servizi-per-te/efficienza-energetica/conto-termico
[49] https://www.gse.it/servizi-per-te/efficienza-energetica/certificati-bianchi

- Support to start-ups and venture capital active in the ecological transition" [50] also funded by the RRP and the Italian Energy Efficiency Fund II (IEEF II)[51]. Despite many products being offered by commercial banks in Italy to support the energy transition of buildings, only one is suitable for GeoDHC: the Green Eligible Loans offered by BPM[52].

Poland

Poland's heating sector heavily relies on fossil fuels. As a member of the EU, Poland is mandated to achieve complete decarbonization by 2050. The plan "Poland's Energy Policy until 2040" plan set the goal to increase the share of renewable heat to 28% by 2030, but still no financial incentives have been established to drive the transformation of the Polish heating sector. In Poland, DHC supplies 25% of H&C in buildings, of which 9% through RES. In total, 15% of H&C energy consumption is supplied by RES (RES DHC, 2021).

Poland's district heating sector faces significant challenges due to climate policies and rising CO2 emission costs. Without addressing these challenges through modernization and emission reduction measures, heat prices are expected to rise, impacting district heating networks' share in heat supply. It is important to notice that since 2019, the profitability of all licensed DHC companies has remained negative. This is primarily due to the poor profitability of CHP sources, which operate under simplified tariffs that fail to account for market fluctuations and actual operational expenses (Polish Energy Regulatory Office, 2023).

Poland is the 6th largest market for geothermal heat pumps in the EU, recording 78,638 units and an annual increase of 28% of sales in 2022. (Kumar, 2024). In 2022 the Ministry of Climate and Environment published a road map for the development of geothermal energy until 2040, with a perspective until 2050: the "Multi-year Program for the Development of the Use of Geothermal Resources in Poland" (Ministry of Climate and Environment, Poland, 2022).

Several schemes support DHC: "Digitization of District Heating Networks[53]", "Cogeneration for District Heating [54]" and "Cogeneration for Energy and Industry" [55]. Two schemes have been announced so far to specifically support geothermal energy: "Sharing thermal waters in Poland"[56] and "Energy Plus"[57]. Other schemes support RES in H&C "Renewable energy sources – heat source for heating"[58], "Support for the energy-intensive industry"[59], and "Energy efficiency obligation scheme (White certificates)"[60]. Several schemes support the thermal modernization of buildings in conjunction with RES projects: "Thermal modernization bonus with the option of a thermal modernization grant[61]", and "Renewable

[50] https://www.mise.gov.it/it/pnrr/progetti-pnrr/pnrr-supporto-a-start-up-e-venture-capital-attivi-nella-transizione-ecologica
[51] https://www.mase.gov.it/energia/efficienza-energetica/fondo-nazionale-efficienza-energetica
[52] https://gruppo.bancobpm.it/media/dlm_uploads/BancoBPM_Green_Social_and_Sustainability_Bonds_Framework_2023.pdf
[53] https://www.gov.pl/web/nfosigw/digitalizacja-sieci-cieplowniczych
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[56] https://www.gov.pl/web/nfosigw/udostepnianie-wod-termalnych-w-polsce-2021
[57] https://www.gov.pl/web/nfosigw/nabor-iv-wnioskow-2023-2024
[58] https://www.gov.pl/web/funduszmodernizacyjny/Programy-Priorytetowe
[59] https://www.gov.pl/web/nfosigw/wsparcie-dla-przemyslu-energochlonnego
[60] https://www.gov.pl/web/klimat/system-zobowiazujacy-do-efektywnosci-energetycznej-inaczej-zwany-bialymi-certyfikatami
[61] https://www.bgk.pl/programy-i-fundusze/programy/program-termo/premia-termomodernizacyjna-z-opcja-grantu-termomodernizacyjnego/

energy grant"[62]. At the same time, only one private scheme, the loan for green changes offered by BNP Paribas Polska, is suitable to support DHC projects.

United Kingdom

In the UK, DHC supplies 1% of H&C in buildings, and 34% of H&C energy consumption is supplied by RES (RES DHC, 2021). The United Kingdom has various low to medium-heat resources, with shallow geothermal gaining increasing popularity in recent times. Utilizing ground source heat pumps, this energy is harnessed to provide heating and cooling for homes and buildings. The southwest of England stands out as particularly favourable, with large granite plutons generating heat flows and geothermal gradients higher than the rest of the UK. Cornwall possesses a large geothermal resource, with granite outcropping or lying at shallow depths across large parts of the county. Cornwall is also set to host the UK's inaugural deep geothermal power plant, the United Downs Deep Geothermal Project, which is being developed by Geothermal Engineering Ltd. (GEL) and is due for completion in late 2024. This project has been funded through a combination of private and public funds. In addition to power production, Geothermal Engineering Ltd (GEL) is working alongside the local government to explore the potential for the provision of DHC to approximately 3000 homes and surrounding infrastructure (Mordor Intelligence, 2024b). Further sites are being developed in Cornwall for heat and power production, with two sites being approved and two in the UK planning process (as of May 2024).

In 2022 the British Parliament published a research briefing on geothermal energy (Abesser and Walker, 2022). This provided an overview of the current status and future potential of geothermal energy in the UK, which includes a series of steps needed to establish the geothermal market. These include setting clear geothermal targets, risk-mitigation mechanisms, adequate legislative support, local and regional heat planning with a focus on DHC zoning, as well as identifying geothermal opportunities. In 2023, the Energy Security Bill introduced a regulation to enable heat zoning for DHC. According to the Climate Change Committee, about 18% of heat consumption in the UK could be supplied through DHC by 2050 (IEA, 2023)

The effectiveness of upfront grants, such as the Boiler Upgrade Scheme, and subsidies like the now-closed Renewable Heat Incentive, in fostering technology adoption is widely acknowledged. However, concerns have been raised regarding the adequacy of the current level of support and its duration to facilitate market development. Although there is some financial assistance available for geothermal power projects, there is currently no support for geothermal heating systems with a capacity exceeding 45 kW unless they are integrated into a heat network. EGEC has often emphasized the importance of geothermal risk mitigation schemes as crucial mechanisms for stimulating the development of deep geothermal projects, particularly during phases of low market maturity. Regrettably, such schemes are currently absent in the UK (Abesser and Walker, 2022). Also, since the UK is no more part of the EU-27, this country was not covered by the overall mapping.

Experts Interviews

Through a series of expert interviews, we addressed factors that may affect access to finance for geothermal DHC projects, and information that finance providers use to assess credit and investment requests. The perspectives shared by experts from diverse stakeholder groups are summarized below. These are not intended to be statistically representative, but rather to offer qualitative insights that complement our analysis.

[62] https://www.bgk.pl/programy-i-fundusze/programy/program-termo/grant-oze/

The survey engaged 20 experts, from diverse professional backgrounds and experiences. Below is the breakdown of respondents across various stakeholder categories:

- Research and Academia: 14
- Energy Company/Utility: 2
- Association/Lobby: 2
- H&C Planning/Consulting: 1
- Public Administration: 2
- Development/Energy Agency: 1
- International Organization: 1
- Engineering Industry: 1
- Architect/Project Developer: 1

Link to the survey used for the interviews: https://forms.gle/GPiHWRQsFCQN5GdB8

Financing a GeoDHC Project

1. Ease of Securing Financing: Some found it challenging, while others described it as relatively easy. The majority relied on grants, with limited involvement from investors or banks due to perceived profitability challenges, particularly for public projects. In Greece, the process was deemed quite difficult, while in Spain, public funding avenues were highlighted. One respondent from Austria detailed a complex process involving subsidies, commercial loans, and contractor selection for a social housing retrofit project, highlighting the involvement of multiple stakeholders. Another respondent from Bavaria noted sufficient interest from the government but limited funding for research projects. Overall, while financing varied in accessibility and complexity, grants were a common source, with challenges often associated with profitability perceptions and project scope.

2. Development Phase for Seeking Funding: In most cases, this began in the initial or early stages of project development, research, exploration, and planning phases. Others began after conducting feasibility studies or preliminary exploration to establish project viability. One respondent mentioned starting it at the implementation stage after estimating project costs and considering financing sources, including own capital and credit.

3. Information Required by Credit Institutions/Investors: Information typically requested includes a rough draft of the investment, feasibility studies, environmental approvals, community acceptance, risk assessments, financial analyses, and cost-benefit analyses. Specific requirements vary based on the technology involved, government funding, project proposals, technical project reports, energy savings achieved, and administrative and research documentation. Some public funding schemes may include negotiations with credit institutions and specialized financing entities.

4. Asymmetry in Information: Some indicated that there was little or no asymmetry in the information available and the information required, while others highlighted instances where managers possessed more information about firms than investors due to this imbalance. However, most challenges arose due to reviewers' limited expertise, leading to asymmetry in knowledge. Additionally, some credit institutions focused primarily on aspects such as construction costs, location, and rent rates, rather than considering the broader picture. Despite these variations, funding criteria are usually clear, although justifying subsidies could pose challenges.

5. Assessment of Profitability and Risks: Credit institutions face challenges and limitations in assessing fully these aspects. A solution to overcome this issue could be to establish a harmonized classification system to aid financial institutions in evaluating geothermal projects, particularly those aligned with investors' climate ambitions. However, some

project developers expressed difficulties in fully communicating profitability and risks, citing challenges in conveying technical details or facing limitations in the information requested by banks.

Barriers and Drivers to Financing GeoDHC

6. Major Drivers and Barriers

Drivers: Economic viability, **policy support**, **technological advancements**, sustainable and reliable renewable heat supply, climate change mitigation efforts, strategic political decisions, awareness of geothermal opportunities, government commitments to achieving net zero emissions, sector-based roadmaps to net zero, gradual decarbonization of business models, incentives for geothermal energy investment.

Barriers: High upfront costs, **lack of reliable data**, **geological risks**, **regulatory uncertainty**, focus on LCOE and upfront cost, lack of awareness among public and policymakers, initial investment costs, lack of human resources, low creditworthiness of project developers, cultural perception of risk, lack of transparency in the financing of green projects, high drilling costs, geological uncertainties, financial risks, lack of experience in geothermal energy utilization, complexities in calculating final energy prices.

Some of these drivers and barriers evolve, with technology advancements and changes in political priorities. A successful track record of projects can help grow awareness and improve access to funding.

7. Profitability and Low-Risk Factors:

Several factors contribute to the increased profitability and reduced or managed risks of a GeoDHC project:

- Favourable geological conditions: abundant and easily accessible geothermal sources.
- Efficient project design, with low operational costs.
- Supportive regulations and subsidies.
- Political commitment, geopolitical stability.
- Detailed feasibility studies, specialized workers, and meticulous project design.
- Controllable, reliable, and predictable production of heating and cooling year-round.
- Securing sufficient and stable market demand.
- Long lifespan and low maintenance requirements.
- Cooperation with diverse experts and established communication channels.
- Well-understood geological conditions and open-access data on the subsurface.
- Developing long-term business plans considering infrastructure investment amortization.
- Advanced technologies mitigate risks during drilling.
- Integral planning and continuous communication with stakeholders.

8. Facilitating Access to Financing

Several measures were proposed:

- Establishing a centralized database of successful geothermal projects.
- Providing comprehensive financial indicators and risk assessments to investors.
- Offering technical expertise and support to credit institutions to evaluate GeoDHC projects.
- Implementing standardized templates for project funding applications.

- Fostering collaboration between national energy agencies, geological surveys, and financial institutions.
- Better understanding of underground conditions and potentials.
- Demonstrating cost-effectiveness compared to alternative systems.
- Sharing case studies and demonstration projects to build confidence.
- Standardizing assurance and certification processes.
- Providing preferential loans and financial support for geothermal development.
- Engaging directly with investment companies to address their value propositions.
- Establishing green energy offices for advice and assistance.
- Showcasing successful projects and available financial resources.
- Creating a transnational platform with information on public incentives.
- Government subsidies and guarantees to mitigate risks and encourage investment.
- Collaboration with ministries and referencing successful case studies for investor confidence.

9. Accelerating the market uptake of geothermal DHC:

Accelerating the uptake of geothermal DHC in Europe requires a multi-faceted approach:

- Supportive regulatory frameworks especially expedited permitting processes.
- Strong political commitment and collaboration at national, local, and EU levels.
- Increased awareness through knowledge sharing, public campaigns, and successful case studies to promote GeoDHC and heat pump benefits.
- Geothermal risk mitigation strategies and de-risking mechanisms for investors.
- Systematic mapping of potential sources of investment for geothermal energy.
- Coordinated efforts and dialogue (e.g. fora) among policymakers, industry stakeholders, financial institutions, investors, and geothermal developers.
- Education and training programs to motivate young professionals and inform technical experts about geothermal systems.
- Development of simple, cost-effective, and safe geothermal DHC technologies.
- Intense participation in EU-funded projects to leverage resources and expertise.
- Government investment, subsidies, and motivation for oil companies to invest in geothermal.
- Piloting and industrial implementation of geothermal projects and DHC networks until a well-functioning supply chain is established.
- Establishing uniform framework conditions and fair energy prices to incentivize geothermal energy uptake, such as tax rebates accounting for the environmental positive impact of DH systems.

10. Relevance of Financing Schemes to Summer Comfort

A financing scheme is relevant to geothermal DHC if:

- It addresses upfront costs, making projects economically viable.
- It accelerates the transition to low-carbon heating, contributing to decarbonization efforts.
- It includes specific measures offering financing options, incentives, grants, and subsidies for geothermal heating systems.
- It provides technical support, long-term planning certainty, and political support, strengthening investor confidence to advance the energy transition.

Pricing Formulas

The heat price is typically set based on a combination of factors. These include the project's capital and operational expenditures, with a fixed and variable component, often indexed to inflation. In some cases, DHC prices are also indexed to electricity prices, particularly for the operation of heat pumps. Alternatively, in an ESCO format, the price may be determined by total investment CAPEX, OPEX, plus profit for the ESCO amortized over time and capped relative to the price of the nearest DHC network. Another approach involves offering an all-inclusive rental contract where the rent includes both heating and cooling services. In specific regions like the Canary Islands and Austria, various indices such as the Consumer Price Index and Energy Wood Index are considered, although there is no dedicated index for geothermal energy in Austria.

Discussion

Despite various aspects of financial mechanisms supporting GeoDHC are examined in this assessment, certain aspects remain open for discussion: first, the intrinsic limitations of a mapping exercise like this. Despite our efforts, the dispersed and constantly evolving nature of funding initiatives poses a barrier: we acknowledge that this mapping might have missed some financing instruments and that is exposed to inevitable rapid obsolescence. To mitigate this weakness, we provide in Annexe the complete list of sources used to compile the mapping, to allow users to replicate and update the mapping for their area of interest.

Lacking a historical overview of expired schemes, we cannot contextualize the present situation, for instance, by assessing trends such as spikes in public funding, e.g., in response to the COVID-19 pandemic (e.g., Recovery and Resilience Plan) or approaching elections.

Compiling a bottom-up funding allocation for each scheme was not possible as specific budget information was sparsely available and only for public schemes. The opacity of budget data complicates comparisons between public and private financing initiatives and hinders assessments of their effectiveness. Similarly, data on the results and impacts of schemes are rarely available, and mostly in separate ex-post reports. Further research for each scheme could gather data on budget, results, and impacts, but this was not possible within the scope and resources allocated to the present study.

We do not have any insights into the actual utilization of schemes: if their funds were fully used, and which technologies or interventions they were used for. The public expenditure on building efficiency may serve as a proxy for the intensity of public support for decarbonization. However, the IEA data includes expenditure for energy efficiency in building envelopes, decentralized H&C systems and industry, which may bias the analysis.

Considering the number of public financing schemes is not a clear indication of the strength of public support for decarbonization, but it rather indicates if the policy strategy favours broader “umbrella” schemes, covering various sectors and actions, or rather specific schemes targeting selected aspects and segments.

Numerous other factors, beyond those that we evaluated, could contribute to the variations across countries for the magnitude of public expenditure and number of schemes supporting GeoDHC: perceived significance and urgency of advancing the energy transition, priority of tackling energy poverty, political commitment, geothermal and DHC market developments, the presence of influential market players advocating for solutions and lobbying for support schemes, dedicated initiatives and so on.

Countries with well-established GeoDHC networks are likely to have more mature markets, with private investors more prone to invest in such projects. Grants and soft loans mitigate initial investments but, differentials in the cost of borrowing remain across countries. Guarantees could be used to alleviate the issue.

Even with such a proliferation of public and private financing schemes, the investment gap to achieve EU climate targets is far from being closed, which brings to four main observations:

1. Public incentives are essential to catalyse action in developing the geothermal resource, they help raise awareness and create movement, and they mobilize private finance, as projects that obtained a public incentive have passed a first check that makes them more likely to raise private finance as well. In addition, public incentives also help create a level playing field for both geothermal energy and fossil fuels that have been subsidized for decades.

2. Nonetheless, incentives alone proved so far not enough to close the climate investment gap without the legal obligation to decarbonize H&C. Investment rates still fall short of the EU climate targets, despite the availability of financing schemes across all countries. Other barriers, unrelated to financing, need to be addressed, such as the availability of skilled professionals, suitable services/offers, permitting processes, etc.
3. Financing schemes require much more clarity and visibility to effectively reach project developers and investors. A high number of schemes available in a country may not necessarily be an advantage, as it could lead to confusion. Centralized portals and one-stop shops can help overcome this barrier.
4. Public and private financing schemes are just a small part of the instruments that are used to finance GeoDHC projects. Most funding is negotiated on a case-by-case basis and involves instruments that are not suitable for public incentives nor standard commercial products (e.g., venture capital) and often combine financing with a unique business model, as it happens for instance with energy communities. This suggests a potential shortcoming that could be addressed by developing blueprints of financing instruments for GeoDHC.

Among these special combinations of business and financing models, energy communities look particularly promising in supporting the wider uptake of GeoDHC. To date we have seen a flourishing growth of energy communities for photovoltaic, but not yet for GeoDHC. The Danish experience, however, shows how developing DHC networks that are owned by consumers was one of the key elements that allowed DHC to be adopted so widely. An interesting example could be provided by the Bürger-Energie Tübinge[63], even though this DHC network is supplied by biomass.

Identifying and tackling these challenges will be crucial in enhancing financing incentives to drive H&C decarbonization efforts. Future research could also explore:

- Potential correlations between policies and the emergence of private schemes, e.g. green loans through subsidized interest rates.
- Potential links between the development of private initiatives and the growing acknowledgement of the environmental benefits of low-carbon H&C and buildings by financial institutions.
- Long-term effects of the Recovery and Resilience Plans: whether the initiatives it funded transformed the market structure and readiness for GeoDHC or merely resulted in short-term spikes in renewable energy and energy efficiency projects.
- Determining what eligibility criteria or requirements could be implemented to ensure that financing schemes for the decarbonization of the buildings' stock also contribute to supporting the market uptake of GeoDHC networks.

Financing GeoDHC projects cannot forgo the application of the “energy efficiency first” principle, for which first the energy demand for space heating and cooling should be reduced as much as possible by improving the efficiency of building envelopes, through insulation, shading and other passive measures, then a much smaller demand should be met via DHC supplied by low-carbon and renewable sources such as geothermal energy.

Distributed H&C systems determine temperature conditions for the network, e.g., high-temperature old radiators vs low-temperature floor heating systems. However, financing schemes may support the development of DHC networks without addressing the upgrade of distributed systems, or vice-versa. With EU and national policies geared towards

[63] https://www.aee-intec.at/0uploads/dateien1783.pdf

significantly increasing renovation rates, there is a substantial risk of missed opportunities or a lock-in effect if renovation schemes primarily target distributed systems. Conversely, addressing building renovations, distributing systems and DHC networks jointly offers the opportunity to adjust renovation projects while ensuring optimal cost-benefit rates of indoor comfort, emissions, and implementation costs.

The Recast Energy Efficiency Directive EU EED (EU)2023/1791 mandates Member States to assess H&C needs and potential DHC options in Comprehensive Assessments for heating and cooling. Future updates to these assessments, due by June 30, 2024, as part of the final update of National Energy and Climate Plans, may offer improvements. The directive also provides a new definition of energy poverty criteria that could potentially foster greater development of DHC networks to supply decarbonized H&C to social housing and lower-income dwellings.

Nevertheless, a gap remains in linking mitigation and adaptation measures concerning H&C in buildings. Despite this importance, integrated approaches were not identified in this review, likely due to the focus on building efficiency and cooling systems. This may also stem from the fact that building renovation schemes primarily target building owners, while adaptation solutions are predominantly developed at the urban level, seeing municipalities as key stakeholders and initiators.

Conclusion and Recommendations

Despite the proliferation of financing schemes, concerted efforts from European and national policymakers are indispensable to escalate the development and adoption of GeoDHC networks. This requires establishing robust policy and financial frameworks for DHC networks supplied by geothermal energy, incorporating legislative mandates, incentives for building refurbishment, advocacy for renewable energy technologies, support for vulnerable households, and the gradual phasing out of fossil fuels. Furthermore, technical assistance, capacity building, and workforce training programs are equally essential to an effective energy transition.

This systematic mapping of financing initiatives for GeoDHC proved to be a resource-intensive task, which indicates that there is room for improvement in enhancing the accessibility of information on available funding programs. Centralized platforms offering a comprehensive overview of all active incentives at the European or national level, with details and links to application pages, could significantly improve the widespread and efficient utilization of resources provided.

To lower the information barrier, the mapping dataset compiled in this study will be made available in open access on the SAPHEA Tool and Market Uptake Hub and it will be promoted in training, communication and dissemination activities. Recognizing the rapid obsolescence of such mapping, a meticulous curation of sources and keywords is provided in the Annexe. Users will be thus able to verify the status of listed programs as well as to update the overview for the area of their interest and identify emerging opportunities. The SAPHEA Tool and Market Uptake Hub will empower stakeholders to access comprehensive information and use it in informed decision-making and to formulate evidence-based strategies towards achieving Europe's net-zero targets.

This mapping of financing schemes marks the starting point of further analysis planned in SAPEHA such as formulating business models and financing blueprints to support wider uptake of GeoDHC networks.

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Annexe

EU Databases

COR Division of Powers: https://portal.cor.europa.eu/divisionpowers/

EBRD Projects: https://www.ebrd.com/project-finder

EIB Projects: https://www.eib.org/en/projects/loans/

Fi-compass Country Data: https://www.fi-compass.eu/country-data

IEA Policies: https://www.iea.org/policies

Odyssee-Mure Database: https://www.measures.odyssee-mure.eu/energy-efficiency-policies-database.html#/

OECD Library: https://www.oecd-ilibrary.org/

OECD Affordable Housing Database: https://www.oecd.org/housing/data/affordable-housing-database/

Recovery and Resilience Facility Projects: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility

NECPs: https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en#national-energy-and-climate-plans-2021-2030

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages_en

LTRS: https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/long-term-renovation-strategies_en#national-long-term-renovation-strategies-2020

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Main Sources at the Member State level

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Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/austrias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/84846ac4-c2fa-43bf-baad-20952579e2b7_en?filename=at_2020_ltrs_en_0.pdf

NEEAP: https://energy.ec.europa.eu/document/download/5c8cee5b-9f8b-487f-8dc0-7693e44e29f4_en?filename=at_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/39e37a54-13d0-4f5a-9c21-226592f329ab_en?filename=at_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts:
Upper Austria: www.energiesparverband.at
Carinthia: www.neteb-kaernten.at
Lower Austria: www.enu.at
Burgenland: https://www.burgenland.at/themen/wohnen
Vorarlberg: https://www.energieinstitut.at/buerger/energieberatung
Tyrol: https://www.energie-tirol.at
Vienna: https://www.hauskunft-wien.at
Styria: https://www.wohnbau.steiermark.at
Salzburg: https://www.salzburg.gv.at

National Energy Efficiency Fund: Climate and Energy Fund https://www.klimafonds.gv.at/

Austrian Energy Agency - Funding: https://www.energyagency.at/fakten/foerderungen

Austrian Environmental Funding: https://www.umweltfoerderung.at/

Austrian Federal Ministry for Digital and Economic Affairs: http://www.bmwfw.gv.at/

Austrian Federal Government Portal: www.oesterreich.gv.at

Austrian Government Services Portal - Help.gv.at: https://www.help.gv.at/

Austrian Federal Economic Chamber (WKO) - Austrian Federal Economic Chamber: https://www.wko.at/

Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK): https://www.bmk.gv.at/

Desk Research Keywords: Österreich Finanzierung, Energiefonds, Effizienz, Förderprogramm, Heizung, Grün, Subventionen, Förderung, Unterstützung, erneuerbare Energien in Gebäuden, Heizung und Kühlung, Fernheizung und -kühlung, DHC, geothermisch, Geothermie, Überschusswärme, Abwärme, Gebäudesanierung, Dekarbonisierung, thermische Sanierung, Isolierung

BELGIUM

Belgium - Brussels

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Building Renovation National Contacts: Homegrade Brussels https://homegrade.brussels

Energy Watchers: https://www.energywatchers.be

Brussels Environment: https://environnement.brussels/

Renovation works in Brussels: https://www.travaux-de-renovation.be/

Renolution Brussels: https://renolution.brussels/

Brussels Regional Investment Company: https://www.finance.brussels/produits

Desk Research Keywords: Belgique, Bruxelles, Financement, fonds énergétique, efficacité, programme de soutien, chauffage, vert, subventions, financement, soutien, énergies renouvelables dans les bâtiments, chauffage et refroidissement, chauffage et refroidissement urbains, DHC, géothermie, énergie géothermique, chaleur excédentaire, chaleur perdue, rénovation de bâtiments, décarbonation, rénovation thermique, isolation

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https://energy.ec.europa.eu/document/download/39e37a54-13d0-4f5a-9c21-226592f329ab_en?filename=at_annual_report_eed_2020_tra.pdf (2021Progress Report)

Building Renovation National Contacts & Flemish Government - Building, Housing, and Energy: https://www.vlaanderen.be/bouwen-wonen-en-energie

Flemish Environment Agency - Energy, Climate, and Environment: https://omgeving.vlaanderen.be/energie-klimaat-en-milieu

Flemish Government: https://www.vlaanderen.be/

Desk Research Keywords: België, Vlaanderen, financiering, energiefonds, efficiëntie, ondersteuningsprogramma, verwarming, groen, subsidies, financiering, ondersteuning, hernieuwbare energie in gebouwen, verwarming en koeling, stadsverwarming en -koeling, DHC, geothermie, geothermische energie, overtollige warmte, restwarmte, renovatie van gebouwen, decarbonisatie, thermische renovatie, isolatie

Belgium – Wallonia

NECP: https://energy.ec.europa.eu/document/download/d472bcb4-3559-408b-b9e8-0b64debe8f29_en (2019)

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LTRS: https://energy.ec.europa.eu/document/download/921e2081-983c-4812-b416-4de8943df275_en?filename=beflanders_ltrs_2020_en.pdf (2020)

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Building Renovation National Contacts & National Energy Agency: https://energie.wallonie.be/

Federal Public Service Economy, SMEs, Self-Employed and Energy - Belgium: https://economie.fgov.be/fr/themes/energie/transition-energetique/

Walloon Region: https://www.wallonie.be/

Housing information in Wallonia: https://logement.wallonie.be/

Desk Research Keywords: Belgique, Wallonie, financement, fonds énergétique, efficacité, programme de soutien, chauffage, vert, subventions, financement, soutien, énergies renouvelables dans les bâtiments, chauffage et refroidissement, chauffage et refroidissement urbains, DHC, géothermie, énergie géothermique, chaleur excédentaire, chaleur perdue, rénovation de bâtiments, décarbonation, rénovation thermique, isolation

BULGARIA

NECP: https://energy.ec.europa.eu/system/files/2020-06/bg_final_necp_main_en_0.pdf (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/bulgarias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/32cf5db2-d79b-48e0-bf75-25859526cb46_en?filename=bg_ltrs_2020_en_version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/601608d9-831b-4657-b3d7-db00b2567dcf_en?filename=BG_NEEAP_2017_v2_en.pdf (2017)
https://energy.ec.europa.eu/document/download/88367a6c-79cd-4a71-a2a7-

9e2dc755e4ea_en?filename=2020%20Annual%20Progress%20Report%20of%20Bulgaria%20on%20implementation%20of%20NEEAP%202014-2020.pdf (2020Progress Report)

Building renovation national contacts: https://www.seea.government.bg/bg/za-domakinstvata

Energy Efficiency and Renewable Sources Fund: https://www.bgeef.com/en/

ABEA (Association of Banks in Bulgaria): https://new.abea-bg.org/?lng=EN

Bulgarian Ministry of Economy: https://www.sme.government.bg/

Bulgarian Ministry of Energy: https://www.me.government.bg/en

Ministry of Regional Development and Public Works of Bulgaria: http://www.mrrb.government.bg/

United Nations Economic Commission for Europe (UNECE): https://unece.org/DAM/energy/se/pdfs/eneff/FEEI/FEEI_Report_7_Nov_2018.pdf

Bulgarian EcoFund: https://ecofund-bg.org/

National Guarantee Fund in Bulgaria: https://www.ngf.bg/

Desk Research Keywords: България, Финансиране, Енергийни фондове, Ефективност, Програма за подпомагане, Отопление, Зелено, Субсидии, Подпомагане, Подкрепа, Възобновяеми енергии в сградите, Отопление и охлаждане, Дистанционно отопление и охлаждане, Дистанционно отопление и охлаждане, Геотермални, Геотермия, Излишък на топлина, Топлинни отпадъци, Ремонт на сгради, Декарбонизация, Топлотна реновация, Изолация

CROATIA

NECP: https://commission.europa.eu/publications/croatia-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/croatias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/b87dca97-b7c1-452e-ae65-fad83be5f80b_en?filename=hr_2020_ltrs_en_version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/05fcf4cc-3361-4ba1-afb5-2aec8a376d8f_en?filename=hr_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/f73c663f-2a03-4c71-affb-b1f1b7cb4db5_en?filename=croatian_report_on_the_progress_achieved_towards_national_energy_efficiency_targets_for_2020.pdf (2020Progress Report)

Environmental Protection and Energy Efficiency Fund: https://www.fzoeu.hr/en/home/

Hrvatska elektroprivreda (HEP), national electricity company: https://www.hera.hr/en/html/index.html

Ministry of Environmental Protection and Energy: https://www.mzoip.hr/

Government of Croatia: https://gov.hr/

Croatian Bank for Reconstruction and Development: https://www.hbor.hr/

Fund for Environmental Protection and Energy Efficiency: https://www.fzoeu.hr/

Energy Institute Hrvoje Požar: https://www.enu.hr/

Desk Research Keywords: Hrvatska, Financiranje, energetski fond, učinkovitost, program podrške, grijanje, zeleno, subvencije, financiranje, potpore, obnovljivi izvori energije u zgradama, grijanje i hlađenje, daljinsko grijanje i hlađenje, DHC, geotermalna, geotermalna energija, višak topline, otpadna toplina, obnova zgrada, dekarbonizacija, toplinska sanacija, izolacija

CYPRUS

NECP: https://commission.europa.eu/publications/cyprus-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/cyprus-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/ef04806b-a8af-4421-943a-ec5ee6b2191c_en?filename=cyprus_2020_ltrs_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/177af34e-ea9f-407f-a9c3-c3b44fa82782_en?filename=cy_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/ced58d71-a5a7-4b44-8814-13d65447d9c0_en?filename=cy_annual_report_eed_2020.pdf (2020Progress Report)

Building renovation national contacts: RES and Energy Conservation Fund (Cyprus)
https://www.resecfund.org.cy/el/sxedia

Cyprus Energy Agency: https://www.cea.org.cy/

Ministry of Energy, Commerce, and Industry of Cyprus:
http://www.mcit.gov.cy/mcit/energyse.nsf/index_gr/index_gr?opendocument

Funding Programmes Portal of Cyprus: https://www.fundingprogrammesportal.gov.cy/

Ministry of Energy, Commerce, and Industry of Cyprus: https://meci.gov.cy/

Cyprus Energy Regulatory Authority: https://www.oeb.org.cy/

Desk Research Keywords: Κύπρος, Χρηματοδότηση, Ενεργειακοί Ταμείς, Αποδοτικότητα, Πρόγραμμα Ενίσχυσης, Θέρμανση, Πράσινο, Επιδοτήσεις, Ενίσχυση, Υποστήριξη, Ανανεώσιμες Ενέργειες σε Κτίρια, Θέρμανση και Ψύξη, Απομακρυσμένη Θέρμανση και Ψύξη, DHC, Γεωθερμική, Γεωθερμία, Υπερβολική Θερμότητα, Απόβλητη Θερμότητα, Ανακαίνιση Κτιρίων, Δεκαρμβονισμός, Θερμική Ανακαίνιση, Μόνωση

CZECHIA

NECP: https://commission.europa.eu/publications/czech-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/czechias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/0bcf9658-374d-41f1-a827-2e5f6f1651d3_en?filename=cz_2020_ltrs_official_translation_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/af260a22-7edd-42af-ab3b-40b530ddde16_en?filename=ener-2017-00343-00-00-en-tra-00.pdf (2017)
https://energy.ec.europa.eu/document/download/570ab9e2-3d51-46ec-8c33-1e6060313cad_en?filename=cz_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: State Support for Energy Efficiency
https://zkrotimeenergie.cz/statni-podpora/

Czech State Environmental Fund - Modernisation Fund: https://www.sfzp.cz/en/about-the-modernisation-fund/

Czech Energy Regulatory Office of the Czech Republic: http://www.eru.cz/en

Czech National Bank: https://www.nrb.cz/

Czech State Environmental Fund: https://www.sfzp.cz/

Czech Public Procurement Portal: https://opzp.cz/

Ministry of Industry and Trade of the Czech Republic - Energy Efficiency: https://www.mpo-efekt.cz/

Desk Research Keywords: Česká republika, Financování, Energetické fondy, Účinnost, Program podpory, Vytápění, Zelená, Subvence, Podpora, Podpora, Obnovitelné energie v budovách, Vytápění a chlazení, Vzdálené vytápění a chlazení, Dálkové vytápění a chlazení, DHC, Geotermální, Geotermie, Přebytečné teplo, Odpařené teplo, Rekonstrukce budov, Dekarbonizace, Tepelná rekonstrukce, Izolace

DENMARK

NECP: https://commission.europa.eu/publications/denmark-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/denmarks-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/efa5ef64-d3ca-40a3-9686-2dacdf76aeed_en?filename=dk_2020_ltrs_official_en_translation.zip

NEEAP: https://energy.ec.europa.eu/document/download/d078709c-b0ba-4baf-906c-5cf6c00241eb_en?filename=dk_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/c1a9f18e-3bb2-4df8-b5bf-c205c9fceba1_en?filename=dk_annual_report_eed_2020.pdf (2020 Progress Report)

Building renovation national contacts: https://sparenergi.dk/

Danish Green Financing Fund: https://dgff.dk/

Danish Energy Agency - Grants and Support Schemes: https://ens.dk/service/tilskuds-stoetteordninger

Danish Government: https://www.regeringen.dk/

Danish Ministry of Finance: https://fm.dk/

Danish Ministry of Transport: https://www.trm.dk/

Danish Legal Information: https://www.retsinformation.dk/

Desk Research Keywords: Denamark, Finansiering, Energifonde, Effektivitet, Støtteprogram, Opvarmning, Grøn, Subsidier, Støtte, Støtte, Vedvarende energi i bygninger, Opvarmning og køling, Fjernvarme og -køling, DHC, Geotermisk, Geotermi, Overskudsvarme, Affaldsvarme, Bygningsrenovering, Dekarbonisering, Termisk renovering, Isolering

ESTONIA

NECP: https://commission.europa.eu/publications/estonia-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/estonias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/8d683200-6b42-459c-9282-d582e0ea6153_en?filename=ee_2020_ltrs_official_translation_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/71a8cd78-fef5-4b32-bfaf-c12bd6e889ae_en?filename=ee_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/0ac918dc-53e9-4f88-ae3b-0a48020c4553_en?filename=ee_annual_report_eed_2020.pdf (2020Progress Report)

Building renovation national contacts: Ministry of Economic Affairs and Communications of Estonia - Housing Renovation Wave: https://www.mkm.ee/ehitus-ja-elamumajandus/elamud-ja-hooned/renoveerimislaine

Estonian Ministry of the Environment: https://kliimaministeerium.ee/en/climate-and-environment-protection/climate/modernisation-fund

KredEx Foundation: https://kredex.ee/

Nordic Energy Research: https://www.nordicenergy.org/

SmartCap (Estonia): https://smartcap.ee/

Nordic Investment Bank (NIB): https://www.nib.int/ (1 occurrence)

Environmental Investment Centre (Estonia): https://www.kik.ee/

Desk Research Keywords: Eesti, Rahastamine, Energiafondid, Tõhusus, Toetusprogramm, Küte, Roheline, Subsidieerimine, Toetus, Toetus, Taastuvenergia hoonetes, Küte ja jahutus, Kaugküte ja -jahutus, DHC, Geotermiline, Geotermia, Üleliigne soojus, Reoveesoojus, Hoone renoveerimine, Dekarboniseerimine, Termiline renoveerimine, Isolatsioon

FINLAND

NECP: https://commission.europa.eu/document/download/78c7f4bd-a3ca-4e83-8732-65f1e0d0baaa_en?filename=DRAFT%20NECP%20update_Finland.pdf (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/finlands-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/58721db6-4127-4a14-9d59-b6ea055a58db_en?filename=fi_2020_ltrs_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/5ca116c7-7971-48ea-98b6-cbcaab87020c_en?filename=fi_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/8517d638-d5f6-4894-8601-41c79821b314_en?filename=fi_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: Housing Finance and Development Centre of Finland (ARA): https://www.ara.fi/en-US/Housing_finance

Business Finland - Energy Aid for Finnish Customers: https://www.businessfinland.fi/en/for-finnish-customers/services/funding/energy-aid

Finnish Energy Authority: https://energiavirasto.fi/en/frontpage

Business Finland: https://www.businessfinland.fi/

Finnish Ministry of Economic Affairs and Employment: https://tem.fi/

Motiva Oy - Finnish Energy Efficiency: https://www.motiva.fi/

Finnish Tax Administration: https://www.vero.fi/

Desk Research Keywords: Suomi, Rahoitus, Energiarahasto, Tehokkuus, Tukiohjelma, Lämmitys, Vihreä, Subventiot, Tuki, Uusiutuvat energiat rakennuksissa, Lämmitys ja jäähdytys, Kaukolämmitys ja -jäähdytys, Kaukolämpö ja -jäähdytys, DHC, Geoterminen, Geoterme, Ylijäämälämpö, Jätelämpö, Rakennusten korjaus, Dekarbonisaatio, Lämpötilan korjaus, Eristys

FRANCE

NECP: https://commission.europa.eu/publications/france-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/frances-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/aeb8a440-69a4-4a74-b2e0-29e1f3fd6084_en?filename=fr_ltrs_2020_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/bc1592ef-b5f6-4743-818c-06fd9747644f_en?filename=fr_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/f22bd441-4c93-476d-9c21-29d870678eb9_en?filename=fr_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: France Renov - Government platform for renovation in France: https://france-renov.gouv.fr

French Ministry for the Ecological Transition - Green Fund: https://www.ecologie.gouv.fr/fonds-vert

French Environment and Energy Management Agency (ADEME): https://www.ademe.fr

French Ministry for the Ecological Transition: https://www.ecologie.gouv.fr/

French Ministry of Economy, Finance, and Recovery: https://www.economie.gouv.fr/

National Observatory of Energy Poverty (ONPE): https://onpe.org/

Bpifrance - French Public Investment Bank: https://www.bpifrance.fr/

French Public Service Portal: https://www.service-public.fr/

Les Aides - Platform for French financial assistance: https://les-aides.fr/

Desk Research Keywords: France financement, fonds énergétique, efficacité, programme de soutien, chauffage, vert, subventions, financement, soutien, énergies renouvelables dans les bâtiments, chauffage et refroidissement, chauffage et refroidissement urbains, DHC, géothermie, énergie géothermique, chaleur excédentaire, chaleur perdue, rénovation de bâtiments, décarbonation, rénovation thermique, isolation

GERMANY

NECP: https://commission.europa.eu/publications/germany-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/germanys-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/e81f8b45-cea3-4737-a2ef-d866b6631ed6_en?filename=de_2020_ltrs_official_en_translation.pdf

NEEAP: https://energy.ec.europa.eu/document/download/3a0ea42f-29cd-4279-962c-4cf4b054435e_en?filename=de_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/07f42cf0-7d8c-4bf3-8973-dc870107dffd_en?filename=de_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: Energiewechsel - German platform for the energy transition: https://www.energiewechsel.de/KAENEF/

German Federal Government: https://www.bundesregierung.de/breg-de/aktuelles/ktf-sondervermoegen-2207614

German Energy Agency (dena): https://www.dena.de/startseite/

German Federal Ministry for Economic Affairs and Energy: http://www.bmwi.de/EN/root.html

German Federal Ministry for Education and Research: https://www.bmwk.de/

Dossier on energy transition in the building sector: https://www.bmwk.de/Redaktion/DE/Dossier/energiewende-im-gebaeudebereich

KfW German Development Bank: https://www.kfw.de/

German Federal Office of Economics and Export Control (BAFA): https://www.bafa.de/

German Funding Database: https://www.foerderdatenbank.de/FDB/DE/Foerderprogramme/foerderprogramme.html

Desk Research Keywords: Deutschland Finanzierung, Energiefonds, Effizienz, Förderprogramm, Heizung, Grün, Subventionen, Förderung, Unterstützung, erneuerbare Energien in Gebäuden, Heizung und Kühlung, Fernheizung und -kühlung, DHC, geothermisch, Geothermie, Überschusswärme, Abwärme, Gebäudesanierung, Dekarbonisierung, thermische Sanierung, Isolierung

GREECE

NECP: https://commission.europa.eu/publications/greece-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/greeces-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/154abea9-f01e-4151-8c19-b4e5036ed983_en?filename=el_2020_ltrs_en_version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/22a0d07b-8339-4172-8164-326cc4f1d03a_en?filename=el_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/4cd36983-7396-405c-aaa1-a8453d33b567_en?filename=guiding_template_annual_reports_24_1.pdf (2020Progress Report)

Fi-Compass - Financial instruments for EU funds: https://www.fi-compass.eu/financial-instruments/greece/erdf-energy-efficiency-fund-ii

Regulatory Authority for Energy (RAE) - Greece: https://www.rae.gr/en

Ministry of Environment and Energy of Greece: http://www.ypeka.gr/Default.aspx?tabid=37&locale=en-US&language=el-GR

Greek National Recovery and Resilience Plan: https://exoikonomo2021.gov.gr

Hellenic Electricity Distribution Network Operator (HEDNO): https://hlektra.gov.gr/

Desk Research Keywords: Ελλάδα, Χρηματοδότηση, Ενεργειακοί Ταμείς, Αποδοτικότητα, Πρόγραμμα Ενίσχυσης, Θέρμανση, Πράσινο, Επιδοτήσεις, Ενίσχυση, Υποστήριξη, Ανανεώσιμες Ενέργειες σε Κτίρια, Θέρμανση και Ψύξη, Απομακρυσμένη Θέρμανση και Ψύξη, DHC, Γεωθερμική, Γεωθερμία, Υπερβολική Θερμότητα, Απόβλητη Θερμότητα, Ανακαίνιση Κτιρίων, Δεκαρμβονισμός, Θερμική Ανακαίνιση, Μόνωση

HUNGARY

NECP: https://commission.europa.eu/publications/hungary-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/hungarys-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/45d3424e-4a6d-45ff-8c3b-e52cb1092b39_en?filename=hu_2020_ltrs_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/4af83a02-1a18-463b-ab5b-d9b60cf14ba1_en?filename=hu_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/1392dd75-9b0c-4996-a219-9cededd5e5c9_en?filename=hungary_annual_reports_24_1_eed_2020_fin_1.zip (2020Progress Report)

Building renovation national contacts: Hungarian Energy and Public Utility Regulatory Authority (MEKH) - Advisory services: https://www.mmk.hu/tanacsadas

Hungarian Competition Authority (GVH) - Hungarian Energy Office: https://www.gvh.hu/en/gvh/cooperation_agreements/hungarian_energy_office

Vali.hu - Hungarian tender and procurement platform: https://vali.hu/

Pályázatok.org - Information on grants and funding opportunities in Hungary: https://palyazatok.org/

Hungarian National Energy and Climate Plan: https://www.enhat.mekh.hu/

Hitelnet.hu - Information on the Family Housing Support (CSOK) program in Hungary: https://hitelnet.hu/csok/

Desk Research Keywords: Magyarország, Finanszírozás, Energiaalap, Hatékonyság, Támogatási program, Fűtés, Zöld, Támogatás, Támogatás, Támogatás, Megújuló energiák épületekben, Fűtés és hűtés, Távfűtés és -hűtés, Távfűtés és -hűtés, Távfűtés és -hűtés, DHC, Geotermikus, Geotermia, Túlmelegedés, Hőleadás, Épületfelújítás, Dekarbonizáció, Hőszigetelés

IRELAND

NECP: https://energy.ec.europa.eu/system/files/2020-08/ie_final_necp_main_en_0.pdf (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/irelands-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/5cf8a54b-ed5f-41c6-afc2-e2df796c5b4e_en?filename=ie_2020_ltrs.pdf

NEEAP: https://energy.ec.europa.eu/document/download/9c870c0b-4cdb-4cc6-b65b-73004d0029d5_en?filename=ie_neeap_2017.pdf (2017)
https://energy.ec.europa.eu/document/download/083a447d-2796-40f6-8ff4-e19160dec023_en?filename=ie_annual_report_eed_2020.zip (2020Progress Report)

Building renovation national contacts: Sustainable Energy Authority of Ireland (SEAI) https://www.seai.ie/

Global Ambition - Green Transition Fund: https://globalambition.ie/green-transition-fund/

Department of the Environment, Climate and Communications (Irish government): https://www.gov.ie/en/organisation/department-of-the-environment-climate-and-communications/

Revenue Commissioners (Irish Tax and Customs Authority): https://www.revenue.ie/

Citizens Information - Information on public services in Ireland: https://www.citizensinformation.ie/

Selectra - Energy price comparison platform: https://www.selectra.ie/

An Post - Irish postal service: https://www.anpost.com/

Desk Research Keywords: Irish Financing, energy fund, efficiency, support program, heating, green, subsidies, funding, support, renewable energies in buildings, heating and cooling, district heating and cooling, DHC, geothermal, geothermal energy, excess heat, waste heat, building renovation, decarbonization, thermal renovation, insulation

ITALY

NECP: https://commission.europa.eu/publications/italy-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/italys-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/49a04289-fd3e-4b4f-a398-644101813e6a_en?filename=2020_ltrs_italy_-_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/02b0fb3c-c2a8-424a-80a5-255117c1c9db_en?filename=it_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/d0809cb4-9f11-48d6-8a3a-175d2de274a7_en?filename=it_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: National portal on the energy performance of buildings https://pnpe2.enea.it

Ministry of Economic Development (Italy) - National Energy Efficiency Fund: https://www.mase.gov.it/energia/efficienza-energetica/fondo-nazionale-efficienza-energetica

ENEA - Italian National Agency for New Technologies, Energy and Sustainable Economic Development: https://www.enea.it/it/

ISPRA - Italian National Institute for Environmental Protection and Research: http://www.isprambiente.gov.it/it/sistema-nazionale-protezione-ambiente

Ministry of Ecological Transition (Italy): http://www.minambiente.it/

Ministry of Economic Development (Italy): https://www.mise.gov.it/

GSE - Gestore dei Servizi Energetici (Italian Energy Services Operator): https://www.gse.it/

Confcommercio - Italian General Confederation of Enterprises, Professions and Self-Employment: https://www.confcommercio.it/

Desk Research Keywords: Italia, Finanziamento, Fondo energetico, Efficienza, Programma di sostegno, Riscaldamento, Verde, Sovvenzioni, Sostegno, Sostegno, Energia rinnovabile negli edifici, Riscaldamento e raffreddamento, Teleriscaldamento e raffreddamento, DHC, Geotermico, Geotermia, Calore in eccesso, Calore residuo, Ristrutturazione edilizia, Decarbonizzazione, Ristrutturazione termica, Isolamento

LATVIA

NECP: https://energy.ec.europa.eu/system/files/2020-04/lv_final_necp_main_en_0.pdf (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/latvias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/61861e0c-f141-4fc1-9062-848a5ca31a88_en?filename=lv_2020_ltrs_official_translation_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/51ba8e7f-ee18-432b-a4c0-ff9fafb0c694_en?filename=lv_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/514d94e0-eca5-4617-b2f9-41848a76e83e_en?filename=lv_guiding_template_annual_reports_24_1_eed_2020_final.pdf (2020Progress Report)

Building renovation national contacts: ALTUM - Latvian development finance institution https://www.altum.lv/

ALTUM Services for Residents: https://www.altum.lv/pakalpojumi/iedzivotajiem/privatmaju-energoefektivitate/

ALTUM State Energy Efficiency Fund: https://www.altum.lv/investoriem/valsts-energoefektivitates-fonds/

Ministry of Economics of the Republic of Latvia: https://www.em.gov.lv/en/

Legal Information System of Latvia: https://likumi.lv/about.php

F-Cubed - Project Labeef (Latvia-Belgium Energy Efficiency Fund): https://fcubed.eu/labeef/

Desk Research Keywords: Latvija, Finansējums, Enerģijas fonds, Efektivitāte, Atbalsta programma, Apkure, Zaļš, Subsīdijas, Atbalsts, Atbalsts, Atjaunojamās enerģijas ēkās,

Apkure un dzesēšana, Attālā apkure un dzesēšana, Attālā apkure un dzesēšana, DHC, Ģeotermālais, Ģeotermija, Pārmērīgais siltums, Atkritumu siltums, Ēku renovācija, Dekarbonizācija, Termiskā renovācija, Izolācija

LITHUANIA

NECP: https://commission.europa.eu/publications/lithuania-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/lithuanias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/73b6debd-95d7-4754-abf5-7f77c45f7d4e_en?filename=lt_2020_ltrs_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/12ba57fc-0362-484f-a71a-3cd2e15019d2_en?filename=lt_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/1cd126a1-1249-41c2-aeef-6323f021ebdd_en?filename=0.eed_2019_ataskaitafinal_tranlsation_in_en.pdf (2020Progress Report)

Building renovation national contacts: Public Procurement Office of Lithuania: www.apva.lt

Central Project Management Agency (CPVA) - Energy Efficiency Fund: https://www.cpva.lt/en/energy-efficiency-fund/577

Energy Agency (ENA) - Lithuania: https://www.ena.lt/about-us/

Ministry of Agriculture of the Republic of Lithuania: https://am.lrv.lt/en/

Ministry of Energy of the Republic of Lithuania: https://enmin.lrv.lt/en/

Nordic Energy Research: https://www.nordicenergy.org/

Seimas of the Republic of Lithuania - E-Seimas: https://e-seimas.lrs.lt/

INVEGA - Lithuanian Innovation and Business Promotion Agency: https://invega.lt/en

Desk Research Keywords: Lietuva, Energetikos fondas, Efektyvumas, Paramos programa, Šildymas, Žalia, Subsidijos, Parama, Parama, Atsinaujinantys energijos šaltiniai pastatuose, Šildymas ir vėsinimas, Tolimojo šildymo ir vėsinimo, DHC, Geoterminis, Geotermybė, Perteklinis šiluma, Atliekų šiluma, Pastatų renovacija, Dekarbonizacija, Termo renovacija, Izoliacija

LUXEMBOURG

NECP: https://commission.europa.eu/publications/luxembourg-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/luxembourgs-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/fee986f3-614a-49aa-89c7-a56bc037b123_en?filename=lu_2020_ltrs_official_en_translation.pdf

NEEAP: https://energy.ec.europa.eu/document/download/86dd80a4-3cf5-498f-8db5-650e0b7ffe71_en?filename=lu_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/eeece3a6-756f-4151-b4f8-8c9f237cd30a_en?filename=neunter_monitoringbericht_luxemburgs_2021_gemass_art_24_abs_1_der_richtlinie_2012-27-eu_final.doc.pdf (2020Progress Report)

Building renovation national contacts: Luxembourg Agency for Climate Change: www.klima-agence.lu

Luxembourg Agency for Climate Change - French version: https://www.klima-agence.lu/fr/FCE

Luxembourg Energy Agency: https://www.energieagence.lu/de/

Ministry of the Environment, Climate and Sustainable Development (Luxembourg): https://aev.gouvernement.lu/en.html

Ministry of the Economy of the Grand Duchy of Luxembourg: https://mea.gouvernement.lu/en.html

Public Housing in Luxembourg: https://logement.public.lu/

Guichet.lu - Luxembourg Public Services Portal: https://guichet.public.lu/

Energy Efficiency Fund (Enoprimes) in Luxembourg: https://www.enoprimes.lu/

Luxembourg Agency for Climate Change - Assistance programs for sustainable housing and mobility: https://www.klima-agence.lu/fr/les-aides-pour-mon-projet/programmes-daides-pour-lhabitat-et-la-mobilite-durable

Desk Research Keywords: Luxembourg financement, fonds énergétique, efficacité, programme de soutien, chauffage, vert, subventions, financement, soutien, énergies renouvelables dans les bâtiments, chauffage et refroidissement, chauffage et refroidissement urbains, DHC, géothermie, énergie géothermique, chaleur excédentaire, chaleur perdue, rénovation de bâtiments, décarbonation, rénovation thermique, isolation

MALTA

NECP: https://commission.europa.eu/document/download/f30c8368-abf8-4272-9a97-93e41e221fcb_en?filename=MALTA_DRAFT%20UPDATED%20NECP%202021%202030.pdf (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/maltas-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/d2fbf9ea-ff9f-44eb-b7b0-260a67a2d325_en?filename=mt_2020_ltrs.pdf

NEEAP: https://energy.ec.europa.eu/document/download/d8f5a8e2-d4f0-4c9c-a77b-65613228c8e1_en?filename=mt_neeap_2017.pdf (2017)
https://energy.ec.europa.eu/document/download/cd93176e-0743-4890-ab3d-addace668e26_en?filename=mt_annual_report_eed_2020.zip (2020Progress Report)

Building renovation national contacts: Building and Construction Authority (Malta): https://bca.org.mt

Energy and Water Agency (Malta): https://energywateragency.gov.mt/

Malta Intelligent Energy Management Agency (MIEMA): http://www.miema.org/

Environment and Resources Authority (ERA) - Malta: https://era.org.mt/

Department of Sustainable Development (Malta): https://sustainability.gov.mt/

Desk Research Keywords: Maltese Financing, energy fund, efficiency, support program, heating, green, subsidies, funding, support, renewable energies in buildings, heating and cooling, district heating and cooling, DHC, geothermal, geothermal energy, excess heat, waste heat, building renovation, decarbonization, thermal renovation, insulation

NETHERLANDS

NECP: https://commission.europa.eu/publications/netherlands-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/netherlands-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/c246db45-160e-4fd5-8f65-7811b5c9ccee_en?filename=nl_2020_ltrs_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/033a0da1-c992-4c8e-b25b-60afd20830b9_en?filename=nl_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/24c1dc34-7b3d-4da1-8bc7-4088e1c29b31_en?filename=nl_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: Verbeter je Huis (Improve your Home) - Netherlands: https://www.verbeterjehuis.nl

E3 Partners - Dutch Residential Energy Labeling System (DREF): https://www.e3partners.nl/dref/

Netherlands Emissions Authority (NEa): https://www.emissionsauthority.nl/about-the-nea

Netherlands Environmental Assessment Agency (PBL): https://www.pbl.nl/en

Ministry of Economic Affairs and Climate Policy (Netherlands): https://www.government.nl/ministries/ministry-of-economic-affairs-and-climate-policy

Netherlands Enterprise Agency (RVO): https://www.rvo.nl

Warmtefonds - National Fund for the Financing of Heating Transition: https://www.warmtefonds.nl

Duurzaamthuis (Sustainable Home) - Netherlands: https://www.duurzaamthuis.nl

Nationaal Energiebespaarfonds (National Energy Saving Fund) - SVN: https://www.svn.nl

Desk Research Keywords: Nederland financiering, energiefonds, efficiëntie, ondersteuningsprogramma, verwarming, groen, subsidies, financiering, ondersteuning, hernieuwbare energie in gebouwen, verwarming en koeling, stadsverwarming en -koeling, DHC, geothermie, geothermische energie, overtollige warmte, restwarmte, renovatie van gebouwen, decarbonisatie, thermische renovatie, isolatie

POLAND

NECP: https://energy.ec.europa.eu/system/files/2020-01/pl_final_necp_main_pl_0.pdf (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/polands-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/system/files/2022-06/PL%202020%20LTRS%20_%20EN%20version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/2a9a7899-dc84-4077-b682-5ea937d79ed6_en?filename=pl_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/27fcfde0-13c4-464f-8da7-452e5106fbbd_en?filename=pl_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: Clean Air Program (Poland) - Warm Apartment: https://czystepowietrze.gov.pl/cieple-mieszkanie/

Clean Air Program (Poland): https://czystepowietrze.gov.pl/

Energy Regulatory Office (URE) - Poland: http://www.ure.gov.pl/en/

Ministry of Development, Labour and Technology (Poland): https://www.mos.gov.pl/en/ministry/

Ministry of Climate and Environment (Poland): https://www.gov.pl/web/klimat

Bank Gospodarstwa Krajowego (BGK) - Poland: https://www.bgk.pl/

Tax Portal (Ministry of Finance) - Poland: https://www.podatki.gov.pl/

Voivodeship Funds for Environmental Protection and Water Management (WFOŚiGW) - Poland: https://wfosigw.pl/

Desk Research Keywords: Polska, Finansowanie, Fundusz energetyczny, Wydajność, Program wsparcia, Ogrzewanie, Zielony, Dotacje, Wsparcie, Wsparcie, Energia odnawialna w budynkach, Ogrzewanie i chłodzenie, Ciepłownictwo i chłodnictwo, DHC, Geotermalny, Geotermia, Nadmiar ciepła, Ciepło odpadowe, Remont budynków, Dekarbonizacja, Termiczny remont, Izolacja

PORTUGAL

NECP: https://commission.europa.eu/publications/portugal-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/portugals-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/e6de7ed6-d8a0-4fe8-8fdb-26a7f2cbaf91_en?filename=2020_pt_ltrs_-_en_version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/3ad86ad6-85e9-43c9-804b-347da479c6a9_en?filename=pt_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/3e14e9a5-791c-4f96-b71d-9212817a1b21_en?filename=guiding_template_annual_reports_24_1_eed_2020.xlsb_.pdf (2020Progress Report)

Portuguese Environmental Fund: https://www.fundoambiental.pt/

Portuguese Energy Agency (ADENE): https://www.adene.pt/adene-eng/

Portuguese Environment Agency (APA): https://apambiente.pt/en/apa/portuguese-environment-agency-apa

DECO Proteste - Consumer Protection Association (Portugal): https://www.deco.proteste.pt/

Directorate-General for Energy and Geology (DGEG) - Portugal: https://www.dgeg.gov.pt/

Desk Research Keywords: Portugal, Financiamento, Fundo de energia, Eficiência, Programa de apoio, Aquecimento, Verde, Subsídios, Apoio, Apoio, Energias renováveis em edifícios, Aquecimento e refrigeração, Aquecimento e refrigeração remotos, DHC, Geotérmico, Geotermia, Excesso de calor, Calor residual, Renovação de edifícios, Descarbonização, Renovação térmica, Isolamento

ROMANIA

NECP: https://commission.europa.eu/publications/romania-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/romanias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/2c11f72a-47aa-4cd8-bc54-9fcdcfdebde1_en?filename=ro_2020_ltrs_en_version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/75dcfb0f-a64f-476a-98e9-1ef93cb028d0_en?filename=ro_neeap_ro.pdf (2017)
https://energy.ec.europa.eu/document/download/59bbaef4-27e6-492b-83be-703bb47a4848_en?filename=ro_annual_report_eed_2020_en.pdf (2020Progress Report)

European Union Opportunities - Modernization Fund (Romania): https://oportunitati-ue.gov.ro/program/fondul-pentru-modernizare/

Romanian Foundation for Energy Efficiency (FREE) - Funding of Projects: https://free.org.ro/funding-of-project/

National Energy Regulatory Authority (ANRE) - Romania: https://anre.ro/

Environmental Fund Administration (AFM) - Romania: https://www.afm.ro/

Ministry of Environment, Waters, and Forests (Romania): http://www.mmediu.ro/messages/send

Ministry of Justice (Romania): https://just.ro/

Environmental Fund Administration (AFM) - Romania: https://www.afm.ro/

Ministry of Energy (Romania) - Funding for the Energy Sector: https://energie.gov.ro/finantari-sector-energetic/

Desk Research Keywords: România, Finanțare, Fond energetic, Eficiență, Program de sprijin, Încălzire, Verde, Subvenții, Sprijin, Sprijin, Energie regenerabilă în clădiri, Încălzire și răcire, Încălzire și răcire la distanță, DHC, Geotermal, Geotermie, Căldură în exces, Căldură reziduală, Renovare clădiri, Decarbonizare, Renovare termică, Izolație

SLOVAKIA

NECP: https://commission.europa.eu/publications/slovakia-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/slovakias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/52d79c38-a80d-4766-8c51-8f041e1e0f93_en?filename=sk_2020_ltrs_en_version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/b9721710-f20a-4a46-8671-f886a30a1fc1_en?filename=sk_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/f705b16d-ff1c-4807-90ff-f65917db3ad3_en?filename=sk_annual_report_eed_2020_tra.pdf (2020Progress Report)

Building renovation national contacts: Slovak Innovation and Energy Agency (SIEA) - Free Consultancy: https://www.siea.sk/bezplatne-poradenstvo

International Energy Agency (IEA) - Information on Slovak Energy Efficiency and Renewable Energy Finance Facility (SlovSEFF III): https://www.iea.org/policies/795-the-slovak-energy-efficiency-and-renewable-energy-finance-facility-slovseff-iii

Slovak Innovation and Energy Agency (SIEA): https://www.siea.sk/en/

Slovak Environmental Agency (SAZP) - Slovak Environment Agency: https://www.sazp.sk/en/slovak-environment-agency-sea.html

Ministry of Economy of the Slovak Republic: https://www.economy.gov.sk/en/ministry

Government of the Slovak Republic: https://www.gov.sk/

Slovak Innovation and Energy Agency (SIEA): https://www.siea.gov.sk/

Slovak Investment Holding (ASB): https://asb.sk/

Environmental Fund Slovakia (Envirofond): https://envirofond.sk/

Desk Research Keywords: Slovensko, Financovanie, Energetický fond, Účinnosť, Program podpory, Kúrenie, Zelená, Subvencie, Podpora, Podpora, Obnoviteľné energie v budovách, Kúrenie a chladenie, Diaľkové kúrenie a chladenie, DHC, Geotermálny, Geotermia, Prebytočné teplo, Tepelný odpad, Renovácia budov, Dekarbonizácia, Tepelná renovácia, Izolácia

SLOVENIA

NECP: https://commission.europa.eu/publications/slovenia-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/slovenias-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/4bed459f-121c-4309-97d2-507495e94e0f_en?filename=sl_ltrs_2020_en.pdf

NEEAP: https://energy.ec.europa.eu/document/download/384da776-fd64-4647-95c1-15032695e322_en?filename=si_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/5b84c187-7643-48ef-b674-53b7509d9e3a_en?filename=guiding_template_annual_reports_24_1_eed_2020_slovenia_final.pdf (2021 Progress Report)

Slovenian Environmental Public Fund (Eko Sklad): https://www.ekosklad.si/english

Energy Agency of the Republic of Slovenia (AGER RS): https://www.agen-rs.si/web/en

Environmental Agency of the Republic of Slovenia (ARSO): http://www.arso.si/en/

Ministry of Infrastructure of the Republic of Slovenia - Directorate for Energy: https://www.gov.si/en/state-authorities/ministries/ministry-of-infrastructure/about-the-ministry/direktorat-za-energijo/

Central Alpine Environmental Commission (AlpES) - European Energy Efficiency Directive: https://www.ca-eed.eu/

Slovenian Environmental Public Fund (Eko Sklad): https://ekosklad.si/

Desk Research Keywords: Slovenija, Financiranje, Energetski sklad, Učinkovitost, Program podpore, Ogrevanje, Zelena, Subvencije, Podpora, Podpora, Obnovljivi viri energije v stavbah, Ogrevanje in hlajenje, Daljinsko ogrevanje in hlajenje, DHC, Geotermalni, Geotermija, Odvečna toplota, Toplota odpadkov, Obnova stavb, Dekarbonizacija, Termična obnova, Izolacija

SPAIN

NECP: https://commission.europa.eu/publications/spain-draft-updated-necp-2021-2030_en (2019)

Recovery and Resilience Plan: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/spains-recovery-and-resilience-plan_en

LTRS: https://energy.ec.europa.eu/document/download/35ac6823-6ce8-47db-a796-6be8f9b81146_en?filename=es_2020_ltrs_en_version.pdf

NEEAP: https://energy.ec.europa.eu/document/download/5127ab96-7d4b-4b47-b968-2883f47582b3_en?filename=es_neeap_2017_en.pdf (2017)
https://energy.ec.europa.eu/document/download/b36f7223-d6c6-46b2-961d-bfde094bf604_en?filename=ener-2020-00764-00-00-en-tra-00.zip (2020Progress Report)

Building renovation national contacts: Ministry of Transport, Mobility and Urban Agenda (Spain) - Housing and Urban Agenda: https://www.mitma.gob.es/ministerio/proyectos-singulares/prtr/vivienda-y-agenda-urbana/programa-de-ayudas-para-la-rehabilitacion-integral-de-edificios-residenciales-y-viviendas

Institute for Diversification and Energy Saving (IDAE) - National Energy Efficiency Fund: https://www.idae.es/en/support-and-funding/national-energy-efficiency-fund

EnerAgen - Spanish Network of Energy Agencies: https://www.eneragen.org/

Ministry for the Ecological Transition and the Demographic Challenge (Spain): https://energia.gob.es/en-us/Paginas/index.aspx

Institute for Diversification and Energy Saving (IDAE) - Support and Financing: https://www.idae.es/ayudas-y-financiacion_0

Ministry of Finance (Spain) - Call for Proposals: https://www.pap.hacienda.gob.es/bdnstrans/GE/es/convocatorias

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Desk Research Keywords: España, Financiación, Fondo de energía, Eficiencia, Programa de apoyo, Calefacción, Verde, Subvenciones, Apoyo, Apoyo, Energías renovables en edificios, Calefacción y refrigeración, Calefacción y refrigeración centralizadas, DHC, Geotérmico, Geotermia, Exceso de calor, Calor residual, Renovación de edificios, Descarbonización, Renovación térmica, Aislamiento

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Desk Research Keywords: Sverige Finansiering, Energifond, Effektivitet, Stödprogram, Uppvärmning, Grönt, Subventioner, Stöd, Stöd, Förnybar energi i byggnader, Uppvärmning och kylning, Fjärrvärme och fjärrkylning, DHC, Geotermisk, Geotermi, Överskottsvärme, Avfallsvärme, Byggnadsrenovering, Dekarbonisering, Termisk renovering, Isolering