European Parliament
2019-2024

Plenary sitting

A9-0432/2023

12.12.2023

REPORT

on geothermal energy
(2023/2111(INI))

Committee on Industry, Research and Energy

Rapporteur: Zdzisław Krasnodębski

CONTENTS

Page

MOTION FOR A EUROPEAN PARLIAMENT RESOLUTION

on geothermal energy
(2023/2111(INI))

The European Parliament,

– having regard to Article 194 of the Treaty on the Functioning of the European Union (TFEU),

– having regard to Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law')[1],

– having regard to Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652[2],

– having regard to the amendments adopted by Parliament on 14 March 2023 on the proposal for a directive of the European Parliament and of the Council on the energy performance of buildings (recast)[3],

– having regard to the Commission proposal for a Regulation of the European Parliament and of the Council on Amending Regulations (EU) 2019/943 and (EU) 2019/942 as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union's electricity market design,

– having regard to the amendments adopted by Parliament on 14 September 2023 on the proposal for a regulation of the European Parliament and of the Council establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) 168/2013[4],

– having regard to the amendments adopted by Parliament on 21 November 2023 on the proposal for a Regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act) (COM(2023)0161)[5],

– having regard to the Commission communication entitled 'REPowerEU Plan' (COM(2022)0230),

[1] OJ L 243, 9.7.2021, p. 1.
[2] OJ L, 2023/2413, 31.10.2023.
[3] Texts adopted, P9_TA(2023)0068.
[4] Texts adopted, P9_TA(2023)0325.
[5] Texts adopted, P9_TA(2023)0401.

– having regard to the amendments adopted by Parliament on 14 December 2022 on the proposal for a directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency[6],

– having regard to the Sustainable Finance Taxonomy Regulation (EU) 2019/2088[7] and the associated Delegated Regulation establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives[8],

– having regard to Commission Regulation (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters[9],

– having regard to Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment[10],

– having regard to Commission Implementing Regulation (EU) 2023/138 of 21 December 2022 laying down a list of specific high-value datasets and the arrangements for their publication and re-use[11],

– having regard to the International Renewable Energy Agency report of February 2023 entitled ‘Global geothermal market and technology assessment’[12],

– having regard to the report of the Clean Energy Technology Observatory entitled ‘Deep Geothermal Heat and Power in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets’[13],

– having regard to the report of the Clean Energy Technology Observatory entitled ‘Overall Strategic Analysis of Clean Energy Technology in the European Union – 2022 Status Report’[14],

---

[6] Texts adopted, P9_TA(2022)0441.
[7] Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector, OJ L 317, 9.12.2019, p. 1.
[8] OJ L 442, 9.12.2021, p. 1.
[9] OJ L 239, 6.9.2013, p. 136.
[10] OJ L 124, 25.4.2014, p. 1.
[11] OJ L 19, 20.1.2023, p. 43.
[12] ISBN: 978-92-9260-495-0.
[13] Bruhn, D. et al., *Clean Energy Technology Observatory: Deep Geothermal Heat and Power in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets*, Publications Office of the European Union, Luxembourg, 2022.
[14] Georgakaki, A. et al., *Clean Energy Technology Observatory: Overall Strategic Analysis of Clean Energy Technology in the European Union – 2022 Status Report*, Publications Office of the European Union, Luxembourg, 2022.

– having regard to the European Commission study entitled ‘Geothermal plants and applications emissions: overview and analysis’[15],

– having regard to the Commission report entitled ‘District heating and cooling in the EU – Overview of markets and regulatory frameworks under the revised Renewable Energy Directive’[16],

– having regard to the Joint Research Centre report entitled ‘The heat pump wave: opportunities and challenges’[17],

– having regard to the European Commission 2023 study entitled ‘Overview of heating and cooling - Perceptions, markets and regulatory frameworks for decarbonisation’[18],

– having regard to its resolution of 15 December 2021 on the implementation of the Energy Performance of Buildings Directive[19],

– having regard to its resolution of 10 July 2020 on a comprehensive European approach to energy storage[20] and the Commission recommendation of 14 March 2023 on Energy Storage – Underpinning a decarbonised and secure EU energy system[21],

– having regard to its resolution of 21 January 2021 on access to decent and affordable housing for all[22],

– having regard to Rule 54 of its Rules of Procedure,

– having regard to the report of the Committee on Industry, Research and Energy (A9-0432/2023),

A. whereas geothermal energy is a valuable and local source of renewable energy that can provide, in a cost-effective way, dispatchable electricity, heat or a combination of both and has great potential for the power sector and for heat production, as well as for sustainable production of raw materials and can be a source of quality jobs;

B. whereas the EU solar energy strategy stated that the proportion of the energy demand covered by solar heat and geothermal must increase at least threefold if the EU is to meet its 2030 climate and energy targets;

---

[15] Ernst & Young, RINA Consulting S.p.A , Vito *Study on ‘Geothermal plants’ and applications’ emissions: Overview and analysis*, Publications Office of the European Union, Luxembourg, 2020.
[16] Bacquet, A., Galindo Fernández, M., Oger, A. et al., *District heating and cooling in the European Union – Overview of markets and regulatory frameworks under the revised Renewable Energy Directive. Annexes 6 and 7 – Final version*, Publications Office of the European Union, 2022.
[17] Toleikyte, A., et al., *The Heat Pump Wave: Opportunities and Challenges*, Publications Office of the European Union, Luxembourg, 2023.
[18] Breitschopf, B., et al., *Overview of heating and cooling – Perceptions, markets and regulatory frameworks for decarbonisation – Final report*, Publications Office of the European Union, 2023.
[19] OJ C 251, 30.6.2022, p. 58.
[20] OJ C 371, 15.9.2021, p. 58.
[21] OJ C 103, 20.3.2023, p. 1.
[22] OJ C 456, 10.11.2021, p. 145.

C. whereas the production and use of energy account for more than 75 % of the EU's greenhouse gas emissions; whereas regrettably more than a half of final energy consumption in the residential sector for space heating is covered by fossil fuels[23];

D. whereas the energy price crisis and Russia's war of aggression against Ukraine have demonstrated the urgent need to increase Europe's open strategic autonomy; whereas geothermal heating, cooling and power has already contributed to the EU's efforts to reduce imports of fossil fuels;

E. whereas geothermal energy can contribute to the objectives laid out in the REPowerEU Plan, especially to increasing the production of clean energy and diversifying energy supplies and it has the potential to provide reliable and affordable electricity and heat to industries and businesses, particularly to SMEs, strengthening their competitiveness, as well as to citizens, addressing, among other things, the problem of energy poverty;

F. whereas geothermal energy is a renewable, constant and reliable source of energy that is readily accessible once the necessary infrastructure is in place and that provides a net-zero and local solution to decarbonise district heating networks, in line with the Energy Efficiency Directive's[24] definition of 'efficient district heating and cooling systems', and which can contribute to building local 'energy communities' and to collective self-sufficiency in renewable energy consumption;

G. whereas the energy sector's integration of geothermal technologies will play a crucial role in enhancing the flexibility and efficiency of the energy sector and decreasing its carbon footprint;

H. whereas heat pumps and geothermal energy technologies are listed as strategic net-zero technologies for Europe in the annex of the Commission's proposal for a Net Zero Industry Act;

I. whereas the industry estimates that geothermal energy can supply more than 75 % of the heating and cooling consumed in Europe and over 15 % of its electrical power by 2040;

K. whereas the comprehensive policy conditions and frameworks needed to boost the development and use of geothermal energy in Europe are still absent at EU level; whereas advances in different policy areas at national level are also urgently needed so as to enable geothermal actors to boost deployment of projects through improved research, strengthening of the supply chain, efficient support schemes and increased public awareness.

Development and potential

1. Notes that the development of technologies has broadened the area suitable for cost-efficient geothermal projects and their scope;

[23] Eurostat 2021, Energy consumption in households.
[24] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, OJ L 315, 14.11.2012, p. 1.

2. Stresses the potential of the ubiquitous low-temperature, shallow geothermal resources that are available in all Member States; highlights the potential of deep-geothermal energy that can be directly used for heat and power generation;

3. Notes that geothermal energy still often plays a peripheral role in the discussion on renewable energy; draws attention to the fact that geothermal installations do not require critical raw materials to the same extent as other renewables; notes that, based on a sustainable life-cycle approach, geothermal has low environmental impact and typically requires limited land use and can easily be integrated into the landscape;

4. Emphasises that geothermal energy offers long-term benefits that can outweigh the high upfront costs associated with its development, such as its being a sustainable source of energy with a low environmental impact, stable and predictable energy costs, low operating costs, long lifespan and reliability that creates business and employment opportunities in local communities, and helps to reduce dependence on imported fuels;

5. Regrets that the potential of geothermal energy has not been sufficiently exploited sooner and that its recent uptake is largely being driven by the energy crisis and an urgent need to ease the socio-economic pressure of demand for heating and cooling in Europe; warns that that influx of subsidised gas, limited public awareness and high upfront investments needed have been effectively hampering the development of geothermal energy for years;

6. Underlines the potential of geothermal energy to make a substantial contribution to attaining key strategic objectives within the EU, including reaching climate targets by decarbonising different industrial sectors, bolstering the EU's open strategic autonomy by strengthening energy security needs, eliminating fossil-fuel dependencies on unreliable third countries, such as Russia, increasing the competitiveness of European industries and empowering consumers thanks to an affordable and reliable supply of heat and electricity;

7. Stresses that the process of extracting raw materials from geothermal brines in an environmentally sustainable way could help contribute to securing a local and reliable supply of strategic critical raw materials, including lithium, therefore strengthening the EU's economic resilience; notes, in this regard, that facilities that extract both geothermal energy and raw materials induce higher employment effects than traditional geothermal plants as well as attract businesses looking to use multiple resource streams;

8. Draws attention to geothermal solutions that are able to store excess wind and solar energy for subsequent use in heating, cooling and power production, and their crucial role in the development of renewable-based energy systems; stresses in this regard the role of inactive mines that are particularly well suited to large scale seasonal thermal storage and long-duration electrical storage; underlines the potential of geothermal energy for grid balancing and auxiliary services due to its high capacity factor, flexibility of supply and dispatchable potential;

9. Stresses that the greatest potential of geothermal energy use in the EU lies in district heating and cooling systems and networks of shallow geothermal installations; highlights that they can provide local, baseload and flexible renewable energy and protection against volatile and rising fossil fuel prices; stresses that geothermal can help

to decarbonising heating and cooling sector that accounts for almost half of the EU's overall final energy consumption and contributes up to 35 % of the EU's greenhouse gas emissions related to energy use; notes the potential and growing need for geothermal district cooling that will be an important element of sustainable adaptation to climate change in cities as warmer temperatures and heat waves are expected to become more frequent;

10. Notes the substantial potential of geothermal heat for industrial processes, in particular for low to medium energy intensive processes (below 200 degrees), representing up to half of industrial heat production in Europe; stresses, in this regard, that developing the use of geothermal heat for this purpose would boost the competitiveness of European companies by providing a reliable and affordable source of heat;

11. Underlines also the potential of geothermal heat in domestic food production, in particular for the production of agricultural products, horticulture, and aquaculture; notes that there are already successful examples of geothermal application in these sectors in different European regions; underlines that the use of geothermal heat will contribute to decarbonisation of these sectors and to more sustainable and environmentally friendly practices, while reducing production costs, high energy costs, price volatility for producers as well as promoting resilience in food systems;

12. Notes the potential of cascaded use, where the same geothermal fluid is used for multiple purposes; stresses the need to foster cross-industry synergies between geothermal and other sectors, including through shared use of sites, infrastructure, data and workforce skills;

13. Considers that the presence of geothermal energy should be taken into account when designating the geographical location of 'net-zero industry valleys' as part of the Net-Zero Industry Act;

Policy recommendations

14. Calls on the Commission to present an EU geothermal strategy giving concrete guidance to Member States and local administrations to accelerate the deployment of geothermal energy in order to decarbonise heating and contribute to the EU's energy independence and to meet the objective of at least tripling the share of energy demand covered by solar heat and geothermal energy by 2030 as announced in the EU Solar Strategy; highlights that 151 businesses and industries called on the Commission in 2022 to prepare a European strategy to unlock the potential of geothermal energy;

15. Stresses that national and EU-wide measures for geothermal energy should be based on an assessment of Europe's geothermal potential, taking into account the diverse geological and climate conditions, and an estimate of the cost-efficiency of deploying geothermal solutions;

16. Calls on the Commission to base the strategy on a comprehensive assessment of the potential of geothermal energy in the shallow, medium, deep, and ultra-deep subsurface across all 27 Member States; notes that this assessment should help identify the potential of geothermal energy for various uses, including but not limited to, district

heating, cooling, industrial processes, food production, heat pumps, electricity generation, and renewable hydrogen and lithium production; notes that this study should also assess the impact of developing geothermal energy on the decarbonisation of the economy, job creation, competitiveness, empowering of consumers, and cost-effectiveness compared to other energy sources;

17. Calls on the Commission to address in the strategy the obstacles for the development of geothermal projects, including cross-borders issues and to provide a guide on best practices in geothermal energy use in the EU for national and local authorities, project developers, and financial institutions;

18. Welcomes the growing awareness of, and support for, geothermal at national level; asks the Member States to follow the example of countries that have developed geothermal roadmaps, targets and dedicated policy measures for geothermal[25]; stresses the need to facilitate the exchange of information about these measures and data to support geothermal policies and to promote existing best practices and knowledge sharing;

19. Calls on the Commission to establish a 'geothermal alliance', including Member States, geothermal adoption enablers, industry, the scientific community and civil society that would facilitate the exchange of best practices and to implement the future geothermal strategy;

20. Asks the Commission to explore the potential of geothermal energy to contribute to objectives production of clean hydrogen established in the REPowerEU plan;

Geothermal district heating and cooling

21. Underlines the need to modernise existing heating and cooling networks and build new ones using the potential of geothermal energy; calls on the Commission and the Member States to create strong incentives to support the above and to favour 4th and 5th generation heating and cooling systems; notes that the development of heating and cooling networks is integral to the preparation of comprehensive municipal heating plans, as required by the Energy Efficiency Directive, and is aligned with the objectives of national energy and climate plans; calls on the Commission to provide the Member States with guidelines for the preparation of these plans, including for the assessment of geothermal potential;

22. Welcomes the growing number of projects involving conversion of existing district heating and cooling (DHC) infrastructure into geothermal-based DHC; emphasises in particular the potential of such conversions in Central and Eastern European countries, where they can significantly contribute to decarbonisation policies; stresses that these actions should be broadly supported by the Modernisation, Just Transition and Cohesion Funds; calls for investments supported by the Modernisation Fund, which support the conversion of exiting district heating systems, to always consider the potential for geothermal energy to be supplied to such systems;

[25] Such as the national initiatives launched by Poland (Multi-year Program for the Development of the Use of Geothermal Resources in Poland – 2022), France (National Action Plan on Geothermal Energy – 2023), and Germany (The German Geothermal Energy Strategy 2022).

23. Expresses concern that all too often the development of geothermal projects is prevented or significantly delayed by the lack of developed district heating and cooling networks; stresses the need to ensure coordination between energy companies and local authorities to jointly plan, invest and manage district heating and cooling networks;

24. Draws attention to the fact that some of recent geothermal DHC projects have been implemented with new business models allowing private companies, including utility companies, to build public infrastructure on behalf of local authorities; invites Member States to explore innovative regulatory possibilities to foster the development of geothermal DHC;

25. Highlights the importance of making data available from existing district heating networks, including the level of modernisation and heat demand, to geothermal stakeholders across Europe; underscores that this data is crucial to evaluating the potential of a region and engage with local authorities throughout the initial stages of a project; calls on the Commission to facilitate and coordinate the availability of existing DHC data;

Data availability

26. Notes the lack of easy access to subsurface data is currently an important barrier to de-risking and thereby the fast deployment of geothermal energy projects; underscores that easy and equitable access to subsurface data in Member States is crucial for the project appraisal phase; underlines, furthermore, that this lack of data access prevents scientists from creating the geological models that are essential to predict the potential and yield of geothermal energy in a given subsurface area and are thus crucial in reducing uncertainty for project developers;

27. Urges the Member States and the Commission to explore methods of collecting different types of geological data from public and private entities with a view to organising, systematising and making it available to the public by expanding existing basic geological databases using the digital formats for collection of the data and making it available; notes that this should be achieved in compliance with applicable rules on data protection, on protection of commercially sensitive data, including the protection of trade secrets, and the protection of intellectual property rights, as well as security considerations and, where necessary, include incentives or compensation for data sharing by private entities; expresses opinion that publicly funded geological data needed for geothermal projects (such as those obtained due to public support received for exploratory drilling) should be made available to the public within a short period of time set by the Member State concerned; draws attention to the fact that in some Member States geological data held by private entities is made available free of charge to the public after a certain period of time;

28. Urges the Commission to explore the benefits of and barriers to harmonising national legislation on granting access to subsurface data and the storing of geological data on a centralised portal at the EU level that is freely and easily accessible to all;

29. Stresses that in areas with insufficient subsurface data, governments can play a role in funding geothermal resource mapping and exploratory drilling; welcomes the fact that

some Member States have already taken steps in this direction; calls on the Commission to continue supporting this data collection through relevant projects, such as European Geological Data Infrastructure (EGDI), which aims to create a EU-wide atlas of geothermal resources; highlights the relevance of the Copernicus Land Monitoring Service (CLMS), which can provide reliable land temperature data, which is particularly useful for surface geothermal energy;

30. Emphasises the geothermal potential of repurposing inactive oil and gas wells and mines; calls on the Member States, in cooperation with oil, gas and coal companies, to prepare public inventories and maps, including specifications, of depleted, abandoned and end-of-life hydrocarbon infrastructure that has the potential to be used as a geothermal resource; stresses the need to prioritise funds to carry out detailed studies of the conditions of this infrastructure in order to assess the potential of each site;

31. Expresses its concern about the fragmented nature of statistics on geothermal energy; stresses that it is very difficult to assess deployment of geothermal energy in Europe because of the lack of standards for industry data reporting; calls on the Member States, in cooperation with the industry and the Commission, to overhaul existing statistical data collecting procedures for geothermal and to replicate best practices in the sector by creating standards for industry data reporting;

Funding

32. Reiterates that uncertainty about subsurface resources makes it challenging to secure project funding; notes that the initial project phase, such as the exploration and construction phase, requires a significant amount of upfront costs and major entrepreneurial risks that hinder the investment decision calls on the Member States to explore financial de-risking solutions appropriate to the maturity of their local markets, such as grants, loans that are convertible to grants, state-backed guarantees, exploration insurance and hedging mechanisms, notes examples of risk coverage mechanisms that are backed up not only by public funds but also by contributions from the private sector; notes, in this regard, that an EU financial risk mitigation scheme would be particularly useful for the least mature markets in the geothermal sector; notes the importance of other de-risking measures such as granting easy access to subsurface data, sharing best practices on new types of business models offering synergies between public and private funding;

33. Expresses concern that high upfront drilling and installation costs tend to discourage the selection of geothermal heat pumps (GHPs) in favour of less efficient technological solutions; calls on the Member States to explore possible financial incentives to bridge this gap, including through ‘pay as you save’ (PAYS) financing models; calls on the Commission to address this issue in the upcoming EU heat pump action plan;

34. Stresses that high upfront costs are stunting the growth of geothermal energy, particularly for actors with limited financial resources, making them to favour investments that are more profitable in the short term, but offer lower environmental sustainability; calls on the Commission to take appropriate steps to ensure that geothermal projects are better taken into account when using existing European funds and instruments; asks the Commission to dedicate resources under existing funds to

support exploration, development, modernisation of geothermal projects, particularly based on innovative technologies, and reskilling and upskilling of workers;

Regulatory issues

35. Stresses that faster permitting rules for geothermal, in compliance with existing EU environmental legislation, would facilitate the deployment of geothermal energy projects across the EU; notes that deep geothermal energy projects are currently subject to laws designed for large-scale mining projects, which are difficult to comply with, particularly for smaller-scale geothermal projects; calls therefore on the Member States to review existing mining laws in order to better reflect the specificity of geothermal projects and to develop dedicated permitting rules for geothermal, while taking into account the fact that different geothermal technologies have significantly different impacts and risks for the geology and environment; asks the Commission to provide guidelines to ensure the requisite level of coherence, similar to the approach taken for the regulatory framework supporting CO_2 storage (Directive 2009/31/EC[26]);

36. Draws attention to the fact that in some Member States project assessment deadlines are rooted in the tacit approval principle under clearly defined conditions unless a reply is required by EU or national law; calls on Member States to explore the benefits of, and barriers to, applying this principle to geothermal projects and to consider its introduction in their legislation;

37. Expresses concern that geothermal projects encounter lengthy permitting processes; urges the Member States to create more efficient streamlined and digitalised permitting processes for new geothermal projects and for the expansion of existing facilities, including by creating a one-stop shop – where this has not been done already – for the whole permitting process across authorities and to provide support for local authorities to ensure their workforce is adequately skilled; believes that these one-stop shops should also promote information sharing about funding opportunities collected by the Commission via a centralised portal;

38. Notes the differences between geothermal exploitation in urban and rural settings; draws attention to the specificity of urban geothermal heating projects and calls on the Member States to develop more efficient and streamlined permitting procedures for geothermal heating projects, including facilitating access to urban plots suitable for geothermal plants; calls, therefore, on the Commission to issue recommendations to distribution system operators on the modalities of working with local authorities to establish local heating and cooling plans with a focus on geothermal energy, in order to facilitate the integration of geothermal energy use in both urban management plans and modern approaches to underground space management;

39. Notes that permits for geothermal installations must be made easier for project promoters to expand to cover the extraction of raw materials or the production of hydrogen from existing capacity under the same lease;

[26] Directive 2009/31/EC of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006.

40. Calls on the Commission to issue guidance for permitting agencies on best practices about managing shallow geothermal permitting applications and potential interference with drinking water to accelerate the permitting process while ensuring the full application of environmental standards;

41. Regrets that a life-cycle analysis is being applied to geothermal energy but not to other renewables, which contradicts the technology-neutral approach of the Taxonomy Regulation[27], reduces the considerable potential of geothermal energy as a contribution to decarbonisation, especially in heat supply, and exposes it to unequal competitive conditions to other renewable energy sources; calls, therefore, on the Commission to review the classification of geothermal energy applications in the taxonomy provisions in order to put geothermal on an equal regulatory footing with wind and solar;

42. Stresses that geothermal should have the same regulatory status, including in EU procurement, as already exists for other renewables, and in the Temporary Crisis and Transition Framework, as well as in any subsequent measures;

Workforce, training and skills

43. Expresses its concern over the reported backlogs and delays in the installation of GHPs, the drilling of wells and the granting of the requisite permissions owing to a shortage of qualified staff; highlights that the need for a skilled workforce will further increase in future and urges the Member States, in collaboration with industry and, where appropriate, with trade unions, to step up measures for the skilling and reskilling of specialists for geothermal since having an adequate pool of workers will be critical to meeting the objectives for geothermal deployment;

44. Calls on the Member States to ensure that certification schemes or equivalent qualification schemes are available, particularly for installers of small-scale shallow geothermal systems and heat pumps;

45. Notes that only a limited number of university courses are dedicated to geothermal energy and are of short duration and optional, with the majority of classes offered only covering basic skills; therefore encourages the Member States to cooperate with educational establishments with a view to updating and strengthening degrees dedicated to geothermal energy so as to adequately train the future generations of workers in the sector; welcomes projects supported by Erasmus+ to remedy the lack of qualified junior graduates in the geothermal energy value chain, such as the Geo3En programme, which aims to lay the foundations for a future Erasmus Mundus Master's degree in geothermal engineering; underlines, that the geothermal industry needs to raise awareness among students, and teaching staff about the geothermal sector and the career opportunities it offers;

Technology development

46. Stresses that while the EU is the leader in geothermal research and development, high-value patents, publications and manufacturing, support measures for next-generation

[27] Regulation (EU) 2020/852 of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088.

geothermal technologies are needed at European and national level in order to maintain this position, particularly in geothermal storage and industrial applications;

47 Notes that investment in research and development (R&D) in the geothermal energy field has received considerably less funding than other sectors, with only two projects on geothermal energy being supported so far by the Innovation Fund; calls, therefore, on the Commission to support investments in R&D in geothermal technologies, such as, the development of reliable pump technology and new drilling techniques;

48. Underlines, in particular, the importance of underground pumped hydroelectric and thermal storage projects; calls on the Commission and the Member States to support R&D in these solutions and to implement large-scale pilot plants; asks for broader support for these projects, particularly those developed on a basis of decommissioned mines and quarries that can be converted into water reservoirs, in calls of EU Innovation Fund and Horizon Europe framework, since this solution can be a vital piece in development of decarbonised electricity systems;

49. Highlights that some Member States have expressed concerns over the lack of conformity of some imported heat pumps to their declared energy efficiency status; stresses that third-party conformity assessment (instead of self-declaration) should be discussed as part of the revision of the ecodesign energy labelling rules;

Territories in transition

50. Stresses that the exploitation of geothermal potential, in particular for district heating, is one of the natural resources that can contribute to a just energy transition in the affected areas by offsetting job losses, as mines and other extractive facilities close, eradicating energy poverty, and strengthening the self-sufficiency of local communities and their administrations by reducing their dependence on energy imports;

51. Regrets that the potential of repurposing for geothermal applications of depleted, abandoned and end-of-life hydrocarbon reservoirs as well as oil and gas wells is not being fully tapped;

52. Draws attention to existing repurposing projects in decommissioned mines, where applied cavern thermal energy storage technology is able to provide heating or cooling; notes the development of projects which plan to use oil reservoirs for geothermal energy storage; takes note of ongoing projects to repurpose decommissioned oil and gas wells for geothermal applications, thereby greatly reducing exploration risks and drilling costs;

53. Notes that many of these projects are being implemented by the fossil-fuel industry, which sees them as an opportunity to be part of the energy transition, and that there is a need for an even stronger, early involvement of this industry in exploring the potential for geothermal; stresses that early assessment of resources, while the mines are still accessible, ensures the more efficient development of their alternative use; notes that due consideration should be given to the liability regime;

54. Calls on the Member States to make use of existing European funding opportunities to support the re-skilling of the workforce in transition areas, with a view to capitalising on the jobs arising from geothermal projects; notes that oil and gas industry skills can be applied to and be highly valuable for the geothermal sector; stresses, therefore, the need to attract and support relevant workers to the geothermal sector, including by the creation of incentives and training programmes;

55 Draws attention to the specific needs of the outermost regions to develop renewable energy sources in line with their geographical, geological and meteorological characteristics; points out that, due to their geographical remoteness, these regions are not connected to European energy grids; notes that a large proportion of the outermost regions are volcanic territories, presenting high potential for the production of both surface and deep geothermal energy; underlines the essential role that geothermal energy can play in these regions to guarantee their energy autonomy;

Visibility and public acceptance

56. Draws attention to the online mapping of existing geothermal installations in a given city or region as a good practice that can raise the visibility of geothermal solutions and help support public and private investment decisions;

57. Notes that public acceptance remains a challenge for geothermal projects, particularly on the basis of environmental concerns such as the possible interference with ground water, non-condensable gas emissions, over-exploitation of water resources, and seismic activity; recalls the importance of maintaining high environmental and scientific standards throughout all stages of geothermal energy projects and of taking a sustainable life-cycle assessment approach; stresses that strict observance of these requirements, transparency of the investment, greater stakeholder engagement, and involvement of local communities in the planning and implementation phases can serve as an efficient way of addressing public concerns and overcoming distrust; calls on the Commission, in cooperation with the geothermal industry and Member States, to develop guidelines and best practices for cooperation between project promoters and local authorities and communities in order to build trust, foster support and create mutually beneficial relationships;

International cooperation

58. Stresses the need to share best practices, technological know-how, results of research and innovation on geothermal technologies with partner countries and organisations that have already developed deep and surface geothermal energy on a larger scale or are in process of implementing ambitious plans to rapidly grow the geothermal energy sector;

59. Highlights the importance of inclusion of geothermal energy in the cooperation agenda with developing countries in a view of transfer of environmentally sound technologies, knowledge sharing and capacity building to meet growing energy demand;

°

° °

60. Instructs its President to forward this resolution to the Council and the Commission.

EXPLANATORY STATEMENT

Geothermal energy has a tremendous potential in Europe across all Member States. Although geothermal development dates back more than a century, it still occupies a niche market compared to other energy sources. The development of geothermal energy is hindered largely by limited knowledge about existing technologies and their potential, particularly for shallow geothermal, among policy makers, local authorities, economic actors and the general public. Other challenges are of financial, legal and technical nature.

The draft report does not focus on presentation of available technologies and their application – taking into account already existing reports prepared by industry itself, as well as by the EU Clean Technologies Observatory or IRENA. The text is concentrated on policy recommendations. It is important to note that while new technologies significantly expanded the areas of cost-efficient application of geothermal solutions, nevertheless existing differences in geological and climate conditions between Member States are the reason why the costs of deployment of similar projects differ due to, for example, the need for deeper drills, usage of geothermal heat pumps (GHPs) and associated infrastructure. These differences therefore should be taken into account in formulating any policy solutions.

One of the most important challenges for geothermal is the lack of sufficient geothermal resource mapping. Industry calls for a solution to ensure that all subsurface data is collected in one place (including data on location of decommissioned oil and gas wells) and made available for the public. Practices on data sharing largely diverge across Member States. In some Member States proprietary subsurface data are not generally made available. In others, only government-funded geological data is made public. There are countries where companies share available subsurface data with relevant government bodies, which later use them for publicly available reports on geothermal potential. In all cases, however there is a vital role for Member States to provide services of collecting geological data, organising, systemising it and making data available in cooperation with companies who own data. In some Member States, with insufficient subsurface data, governments themselves could fund the resource mapping and exploration drilling in order to establish national atlas on geothermal potential. This should be supported by European funding in view of creating an EU-wide atlas of geothermal potential.

Unfortunately, the assessment of deployment of geothermal energy in Europe is very difficult due to the lack of standards for industry data reporting. Therefore, it is difficult to understand whether particular regions are advanced in deployment of geothermal and to which extent EU funding was used for these purposes. In the EU databases geothermal is categorised as “other renewables” where it is aggregated with hydro projects. National and EU authorities agree that there is a mismatch in reported data and, generally, the deployed geothermal is underestimated. While power generation is quite well documented, there is a problem in reporting on heating and cooling. These fragmented values and the lack of common standards lead to an underrepresentation of the geothermal industry in the energy market, with detrimental effects for the industry. High-quality data lead to favourable political support, help setting ambitious energy targets and enhance policy assistance. From an economic perspective, it promotes an increase in geothermal projects, marketability, competitiveness,

and financial support from governments. Therefore, it is necessary to identify best practices among Member States and to replicate them. Meetings held by the Commission on heating and cooling accountability should be the first step into this direction.

Geothermal installations are characterised by low operational expenditures but high capital investment, primarily due to the high cost and risk of exploration drilling. Explorers can also come across imperfect wells — failure rates range from less than 10 percent in Hungary and Germany to 30 percent in the Netherlands, according to Rystad. Market financiers generally are unwilling to carry these early-stage risks and costs, while municipalities that often foot the bill, as they are usually in charge of local district heating, feel skittish about suffering potential losses. These subsurface resource risks and associated financial costs represent one of the major barriers for geothermal project developers. Government policies that lower risks are therefore crucial to incentivise private sector financial investment. De-risking instruments can take many forms and be designed according to the overall maturity of the market. There are already good examples of such instruments in some Member States. In August, the European Commission approved under EU state aid rules a French aid scheme to set up a guarantee fund for deep geothermal operations.

Complex and incomplete regulations fragmented between Member States, and long and complex authorisation slow down geothermal deployment. While the revised Renewable Energy Directive simplifying the permitting rules is a step in a good direction, it covers only surface projects, such as heat pumps, and leaves aside subsurface activities. Particularly, problems exist with the mining law, which was designed for large mining activities and not for projects of smaller scale, such as geothermal. Its complexity in combination with the often not streamlined authorisation process have adverse economic implications for the development of projects and investment decisions. There is therefore an urgent need for Member States to revise and simplify mining laws or to develop dedicated permitting rules for geothermal.

Heat pumps and geothermal energy technologies are categorised as strategic net zero technologies by Net Zero Industry Act. While the EU is leading in R&D and manufacturing of geothermal technologies and has a reliant supply chain, funding support measures are needed for the next-generation geothermal technologies in order to uphold the forerunner position, particularly in geothermal storage, industrial applications and geothermal lithium. In this context, it is important to note the recent award of an EUR 91,6 million grant from the European Innovation Fund to Eavor’s next-generation geothermal project.

Year 2022 witnessed the largest ever volume of GHP sales within the EU, with over 141,300 new systems installed. At the same time, some Member States reported worrying statements about the low-quality of and the lack of conformity with declared energy efficiency of a large number of imported heat pumps. Some of them are considering establishing the pre-approved lists of models that would qualify for co-financing from existing national support programmes; others call for more stringent market surveillance. Third party conformity assessment, instead of current self-declaration, should be discussed under revision of Ecodesign ENER lot 1.

However, completion of planned projects and development of new ones will not be possible without sufficient numbers of qualified workforce. It is quite concerning that the already increased demand for geothermal could not be fully met due to the lack of capacity: some

components were not delivered in time, skilled workers were not available as much as required and public administrations and licensing authorities were often overwhelmed and understaffed by the increasing demand. Therefore, in order to keep the pace of geothermal development, to meet the objective stated in the EU Solar Energy Strategy about tripling energy demand covered by geothermal, there is an urgency to invest in skilling and reskilling the workforce for geothermal. Geo3En program - projects supported by Erasmus+ that aims to remedy the lack of qualified junior graduates in the geothermal energy value chain, and that lays the foundation for a future Erasmus Mundus Master's degree in geothermal engineering, is one of the needed initiatives. Particular efforts should be put on reskilling existing specialists from hydrocarbon industries taking into account both the potential of geothermal for the just transition and that oil and gas industry skills can be easily applied to geothermal sector;

Geothermal energy is vital not only for the energy transition, but for the just transition. The potential of geothermal development using the infrastructure formerly used by hydrocarbon industry is not yet fully tapped by the Member States. There are several successful projects across Europe where decommissioned coal mines were repurposed for geothermal heating and cooling. Recent Hunosa project in Asturia transformed the old coal colliery into the largest geothermal district heating in Spain. There are promising works on the use of decommissioned oil and gas wells for geothermal applications, some of them carried out by hydrocarbon companies themselves. There is a need for dedicated policies, legal and support framework and specific actions that would enable and advance the transition from fossil fuel-producing regions to sustainable growth, through geothermal energy use.

Geothermal is a constant “24-7” form of energy with fixed costs and the highest capacity factor. Geothermal installations do not require critical raw materials to the extent of other renewable technologies, and all major investments are local. Compared to other renewable resources, geothermal typically requires much less land and can be easier integrated into the landscape. Despite these benefits geothermal meets certain social barriers. One of the social barriers of geothermal energy is the lack of awareness and knowledge among the general public, policymakers, local authorities and financial institutions. Geothermal energy is often perceived as a niche technology that is expensive, complex or suitable to territories with very rare particular geological qualities. Geothermal energy also faces competition from other renewable or conventional sources of energy that may have more established markets, policies or subsidies. To overcome this barrier, geothermal advocates together with Member States need to increase the visibility and credibility of geothermal energy, by showcasing its benefits, costs, and performance, and by engaging with relevant stakeholders and communities. There is a growing national awareness towards supporting geothermal - a number of Member States, such as France, Poland, Ireland, have developed roadmaps, targets, and dedicated policy measures to support geothermal.

Geothermal development may also face resistance from local residents who fear the negative impacts of noise, traffic, or environmental hazards such as water contamination, seismic activity or harmful emissions. To address this barrier, geothermal developers need to respect and consult with the affected parties, and to seek their consent and participation in the planning and implementation of geothermal projects.

ANNEX: ENTITIES OR PERSONS
FROM WHOM THE RAPPORTEUR HAS RECEIVED INPUT

Pursuant to Article 8 of Annex I to the Rules of Procedure, the rapporteur declares that he has received input from the following entities or persons in the preparation of the report, until the adoption thereof in committee:

Entity and/or person
European Geothermal Energy Council
Enel
Engie
Daikin
Baker Hughes
PGE
Orlen
Polish Geothermal Society
Green Therma
Vulcan Energy
ZeroGeo Energy

INFORMATION ON ADOPTION IN COMMITTEE RESPONSIBLE

Date adopted	7.12.2023
Result of final vote	+: 51 –: 0 0: 2
Members present for the final vote	Nicola Beer, Hildegard Bentele, Vasile Blaga, Michael Bloss, Marc Botenga, Martin Buschmann, Jerzy Buzek, Maria da Graça Carvalho, Josianne Cutajar, Nicola Danti, Marie Dauchy, Martina Dlabajová, Christian Ehler, Valter Flego, Niels Fuglsang, Nicolás González Casares, Henrike Hahn, Ivo Hristov, Ivars Ijabs, Romana Jerković, Seán Kelly, Izabela-Helena Kloc, Andrius Kubilius, Miapetra Kumpula-Natri, Iskra Mihaylova, Angelika Niebler, Niklas Nienaß, Johan Nissinen, Mikuláš Peksa, Tsvetelina Penkova, Morten Petersen, Markus Pieper, Manuela Ripa, Robert Roos, Sara Skyttedal, Riho Terras, Pernille Weiss, Carlos Zorrinho
Substitutes present for the final vote	Andrus Ansip, Laura Ballarín Cereza, Cornelia Ernst, Alexis Georgoulis, Ladislav Ilčić, Elena Kountoura, Alin Mituța, Günther Sidl, Jordi Solé, Susana Solís Pérez
Substitutes under Rule 209(7) present for the final vote	Alexander Alexandrov Yordanov, Jonás Fernández, Virginie Joron, Radan Kanev, Karin Karlsbro

FINAL VOTE BY ROLL CALL IN COMMITTEE RESPONSIBLE

51	+
ECR	Ladislav Ilčić, Izabela-Helena Kloc, Johan Nissinen, Robert Roos
ID	Marie Dauchy, Virginie Joron
NI	Martin Buschmann, Alexis Georgoulis
PPE	Alexander Alexandrov Yordanov, Hildegard Bentele, Vasile Blaga, Jerzy Buzek, Maria da Graça Carvalho, Christian Ehler, Radan Kanev, Seán Kelly, Andrius Kubilius, Angelika Niebler, Markus Pieper, Sara Skyttedal, Riho Terras, Pernille Weiss
Renew	Andrus Ansip, Nicola Beer, Nicola Danti, Martina Dlabajová, Valter Flego, Ivars Ijabs, Karin Karlsbro, Iskra Mihaylova, Alin Mituța, Morten Petersen, Susana Solís Pérez
S&D	Laura Ballarín Cereza, Josianne Cutajar, Jonás Fernández, Niels Fuglsang, Nicolás González Casares, Ivo Hristov, Romana Jerković, Miapetra Kumpula-Natri, Tsvetelina Penkova, Günther Sidl, Carlos Zorrinho
The Left	Cornelia Ernst, Elena Kountoura
Verts/ALE	Michael Bloss, Henrike Hahn, Niklas Nienaß, Mikuláš Peksa, Jordi Solé

0	-

2	0
The Left	Marc Botenga
Verts/ALE	Manuela Ripa

Key to symbols:
+ : in favour
- : against
0 : abstention