1 March, 2022

Dear Sir/Madam

EGEC response to Geothermal in Ireland consultation

EGEC, the voice of the European geothermal industry, is a not-for-profit association representing the entire value-chain of the industry across 28 countries. It is included on the European Transparency Register number: 11458103335-07 Further information can be found at www.egec.org.

We welcome the focus on geothermal energy and its contribution towards addressing the climate crisis, building an inclusive energy transition and reducing geopolitical risk from fossil energy imports. The policy requires greater focus on specifics to drive th

Our views on the draft statement are:

- **Lack of a target for geothermal energy:** We are concerned there is no mention of a target for geothermal energy deployment in Ireland. A target for geothermal deployment would channel political attention, regulatory focus and private sector capital into the sector.

  This is needed for geothermal and other renewables too, especially those in the heating sector. We urge this to be included in the final strategy or that the Geothermal Advisory Group is tasked to formulate and publish the target as well as supporting implementation measures within 6 months of the launch of policy.

- **Policy objectives:** Specific goals and should be stated in the official policy statement if it is to have a material impact across the sectors where geothermal will have the largest contribution -

  - **Residential, commercial and public buildings:** A mandate is required is required to ensure new and existing buildings replace fossil heating with geothermal systems. Awareness raising and support schemes should also encourage community energy schemes to maximise the speed at which buildings are decarbonised. Local Distribution **Service Operators** should be required to map geothermal heating and cooling community systems.

    Furthermore, **the structure of incentive schemes** is also important. Rebates, subsidies which reduce the price of geothermal systems could be

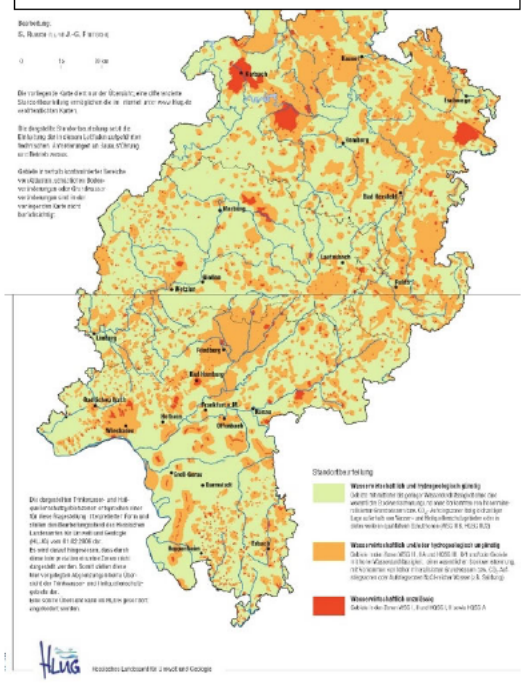
either by upfront subsidies or rebates after purchase will appeal to certain segments of the property-owning market. However, for those who are fuel/heat poor, such schemes do not provide adequate coverage to pay for geothermal, or renewables and even energy savings measures. Therefore, in these instances, the total cost of installation should be covered by national schemes as it is in the national interest to replace fossil consumption. The Italian Eco-Bonus scheme in Italy provides a 110% subsidy, a financial encouragement to rapidly switch to geothermal.

- **Agriculture and food production:** Geothermal in the Netherlands grow rapidly on the back of plans to shift greenhouse and food production from fossils to renewables. Considering the many similarities between the food production and agriculture sectors, direct support for this sector can help stimulate the geothermal industry across Ireland. One of the key innovations in the Netherlands, aside from a national de-risking scheme and awareness raising programme is the focus on **Heat Purchase Agreements** (see below).

- **Legal definition of geothermal energy:** the definition of geothermal energy, as outlined in the Renewable Energy Directive 2018/2001/EC Article 2 is "energy stored in the form of heat beneath the surface of solid earth". This could be applied across the

- **Differentiate between small-scale and large-scale geothermal:** It is essential to provide different regulatory and support frameworks between large-scale (deep) and small-scale (geothermal heat pumps/shallow) geothermal energy because the temperature range, availability and accessibility and significantly different. Geothermal heat pumps can be installed in any location across Ireland. Higher-temperature large-scale geothermal is dependent on geographical locations. In Germany, for example, small-scale geothermal energy is defined as being to depths of 500 meters. Each German Lander (regional authority) make available geological data outlining areas where small-scale geothermal can be applied with a simple notification to the local/regional authority, where a permit is required, and where drilling is not permitted. An example from the Hessen regional authority in Figure 1. We recommend the Irish geological survey produces similar data for each of region in Ireland to facilitate the environmentally safe utilisation of geothermal.

Figure 1 – Permitting traffic light system in Hessen, Germany



- **Incentives and financial support:** The draft policy does not outline workable incentive schemes. The experience with wind and solar demonstrates that geothermal

will not reach its potential without government support to incentivize development and use. There are three main areas we ask DECC to consider.

- **Fuel/electricity prices:** For GHPs/shallow geothermal heat projects at any scale, Irish developers and customers need support to offset the higher social and environmental levees in electricity prices compared to natural gas and oil. For example, if the electricity price is 3 times greater than the equivalent fossil fuel cost, then the heat pump system needs to have a coefficient of performance of at least 3 to offset. This appears to be unfair bias to fossil fuels if part of the price difference are taxes/levies distributed into electricity but not gas. Other countries have redistributed the levies or give credits to users consuming electricity in heat pumps. Carbon pricing mechanisms may be an alternative to level the playing field.

- **Exploration risk underwriting:** As the draft policy acknowledges, drilling to reduce risk and uncertainty in resource presence and quality is expensive, particularly in a very immature drilling market like Ireland. Developers will need support in bringing the drilling supply chain up to speed and to support early data collection. In the Netherlands this cover takes the form of a government-backed insurance scheme. Alternative is the ability to have written off exploration capital as a tax deductible.

- **Project capital support:** We strongly believe that at scale deployment of larger shallow geothermal projects and in due course deeper geothermal projects will lead cost performance improvement in drilling and facility capex. However, for the development of initial projects developers and consumers would benefit and will probably need support in the form for example of capital loans at a lower cost of capital than commercial funds can provide because of perceived residual resource risk and project execution risk at the industry matures. Such industrial loans or other financially support can be dedicated to projects and scaled proportionately to balance risk and reward.

- **Industry knowledge, capability & competency and technology development:** As rightly pointed out by the draft policy the industry will need support in both setting standards for competency and accreditation to these standards. But the industry, or rather technical colleges, universities, trade associations and other institutions will need support to put together educational and training plans to deliver these competencies. The collateral benefits are new jobs. The regulator itself will need to a phased resource and capability plan so that any installed process is supported by competent people. The draft policy also points to the need for a deliberate effort to improve our collective knowledge of the subsurface. We agree but encourage the DECC to take an holistic approach to this for example by:

    - Matching resource mapping and further government drilling with heat demand analysis;
    - Supporting developers in their exploration risk reduction efforts; and
    - Putting equal bias to the support of engineering technology development such the role of heat networks in distributed energy solutions and the social sciences aspects of the energy transition.

- **Incentives and financial support in other Member States:** These are ideas on the steps taken in other Member States which could be replicated in the final policy statement:

    - **Financial driven growth:** Bulgaria has less geothermal energy installed than Ireland. However, the country took a strategic decision a) significantly reduce reliance on imported fossil energy; b) use climate and energy policy to establish a new industrial sector; and c) to make it attractive to global private investors. It's national Resilience & Recovery Plan includes €100 million to support all types of geothermal energy. Regulations are to be revised to update mining, environmental, water and energy laws to accommodate geothermal energy and a (part) state-owned entity will oversee investments to underwrite their risk and therefore make investments more cost-effective.

    - **Poland:** The country has allocated €6 million for geothermal energy in its Resilience & Recovery Plan. A national roadmap is to be launched this year to coordinate expansion of its rapidly growing geothermal heat pump (shallow) market as well as integrate large-scale (deep) geothermal into existing district heating and cooling systems into an industrial strategy.

    - **Sector specific driven growth:** The geothermal market in Netherlands started by addressing the concerns of the greenhouse food production sector. The state underwrote part of the risk for geothermal deployment in greenhouses as well as supporting low temperature geothermal heat networks from abandoned coal mines, of which the system in Heerlen is the exemplar.

    - **Regulatory organisation:** Iceland established a geothermal authority to manage all applications for large-scale geothermal power and heating projects. In Northern Ireland, a Geothermal Committee has been established to develop geothermal energy.

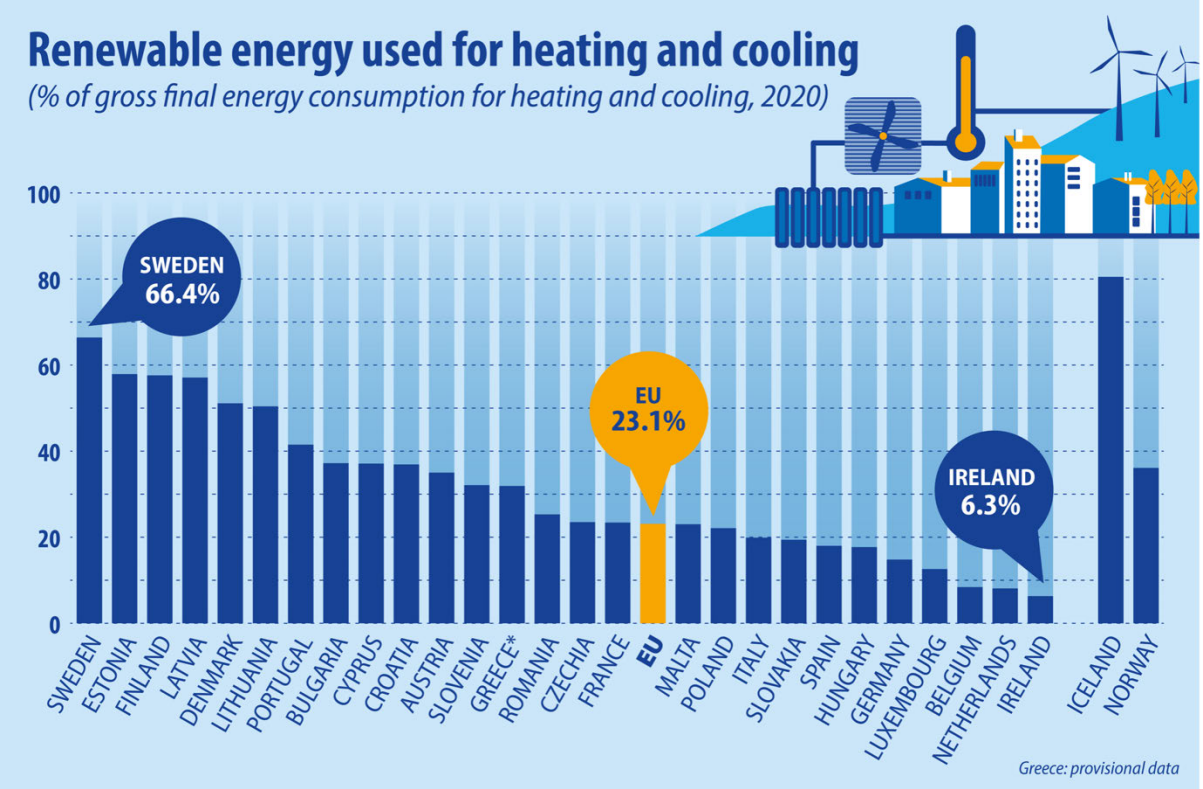
    - **Business model innovation:** In France, local authority liability laws were amended to establish the delivery of public services by a private entity - *délégation de service public* – which allowed utilities to build geothermal district heating schemes. It enabled the Cachan geothermal district heating system, which provides renewable heating to 10,000 households, to be built in only two years as the utility – Engie – was able to take on the risk of building the system.

    These approaches should also be incorporated into Ireland's geothermal strategy to complement a national target.

We fully support the following aspects of the proposal:

- The establishment of the **Geothermal Advisory Group**. It must have a transparent mandate to explore all forms of geothermal, regulations, business models and demand creation to advance geothermal deployment across Ireland and deliver on the EU's 1.1 annual percentage point increase in renewable heating and cooling capacity as outlined in Article 23 of the Renewable Energy Directive (2018/2001/EC) and to deliver commitments outlined in the National Energy and Climate Plan. This should help to address the low levels of investment in renewable heating and cooling, which puts Ireland as the worst performer across the EU, as highlighted in Figure 2. The

Figure 2 – Shares of renewable energy used for heating and cooling



Source: Eurostat

- **Public engagement** is key to advancing geothermal, other renewables and building renovations. This should also be extended towards industry, agriculture and farming sectors as well as rural areas. Promoting best practises for corporate and local authority **Heat Purchase Agreements (HPAs)** is key to driving the market for geothermal heat networks, using GHPs as well as potentially geothermal district heating systems. HPAs are required to support investment in infrastructure connecting renewable heat to consumers. They are often long-term purchase agreements (about 10 years or more) which allow a project developer to derisk their initial investment and potentially add to their network over time.

- **Public awareness raising:** We support the elements of the work that look to inform all stakeholders. It should also it ensures that it delivers the information the public need to demonstrated that the very low risk geothermal is one of the lowest impact (e.g. GHP/shallow Closed-Loop etc), cleanest forms of energy available and not only focus on the higher risk approaches to geothermal that are only used in very specific circumstances and may be limited in their deployment in Ireland.

- **Geothermal Energy Resources:** The statement "Until recently, using this terminology, traditional volcanic geothermal resources have been termed high enthalpy, and any other resources termed low enthalpy. Recent re-thinking of this classification has also introduced "very low enthalpy" and "mid enthalpy" resources." is not accurate. In fact Ireland is a good example where all the geothermal usage is from low to mid-enthalpy shallow resources. This statement is only accurate for deep resources. See Figure 3 on the Archetypes. Globally shallow geothermal has been used

since 1945[3]. Since the mid-1970s France has been installing on average over 10,000 units a year, peaking in the early 1980's at over 50,000. Shallow geothermal in low enthalpy environments has, and can have, a material impact on decarbonising heat. Ensuring that the distinction between shallow (ground source heat) and deep (earth source heat) is essential for a balanced policy approach.

There is also an important distinction between the geothermal resource that is available and the temperature that a process requires. Figure 3.1 implies that a subsurface temperature of, for example, over 60C is required for building heating. This is not accurate. The use of heat pumps with geothermal heat greatly reduces the required subsurface temperature needed. 60C for a building can be delivered from 14C water using heat pumps. Also cooling is neglected in the diagram. Again with geothermal heat as an energy source for a heat pump, geothermal energy can and is used in Ireland and overseas for cooling.

- **Geothermal Systems**: The geological and technological characterization of the different types of geothermal project that *could* be delivered is a very useful framework for policy (page 20). We need to add a number of attributes to the framework to make these archetypes most distinct. Depth of geothermal resource and the footprint of the developed subsurface resource relative to the surface user facility are critical. A depth threshold needs to be applied distinguish shallow from deep geothermal as the former can be deployed at pace and scale now, whereas the latter is more about exploration, resource delineation and technology development. We propose a depth threshold of 500 m similar to other EU countries. An explicit characterisation of the archetypes will help link the necessary regulatory processes and controls.- See Figure 5. We also suggest that output temperature and the use of the energy (heat or electricity) are important distinguishing factors.

Figure 3 - Energy Geothermal Project Archetypes

	Resource Uncertainty	**Investment scale**	**Operations Risk**
Shallow	Low	Low	Low
Deep	High	High	Medium

Why 500m?

On resource uncertainty, for example at 200m a 20% difference in geothermal gradient from 3C/100m to 2.4C/100m would reduce the expected temperature from 16C to 14.8C, assuming a 10C surface temperature. This would have minor impact on the design of a geothermal system. At 3km the difference in geothermal gradient would result in either 100C or 82C, resulting in significant difference in system design.

Well construction cost for less than 200 are less than €100/m, while those for wells deeper than 1000m are greater than €1,000/m.

The construction of deep wells, greater than 500m have additional operation considerations, e.g. pore pressure, that involve additional regulation.

While there is no exact answer, 500m enables a simple permitting model for the current shallow geothermal systems to deploy, enables appropriate licensing of deep geothermal to account for resource uncertainty and investment scale and distinguishes the resources so that appropriate incentivisation can be done.

Figure 4 - Energy Geothermal Project Archetypes

	Resource density	Water Impact	Operational Risk
Closed	Low	Low	Low
Open	High	Moderate	Moderate

Closed systems are low risk, however access the resource more slowly (conduction is slow relative to fluid flow). They have low impact on water and low operational risks.

Both styles of systems can be deployed at any depth.

Open systems produce water from the ground and need to have the water production and any reinjection regulated.

Big v Small

Geothermal systems are energy systems. As stated in 2.1.2. the approach that ensures that the resource is managed appropriately is a "net energy/yield by area". This is particularly important in high yield closed-loop systems where energy is extracted through conduction and heat replenishment is crucial for long term sustainability. A simple capacity threshold (70kW or otherwise) is therefore inappropriate as it neglects (and may actively discourage) cooling and heat storage. It also potentially enables excessive storage of heat in the subsurface. Without recognition of heat-input for the purpose of storage/cooling, coupled with a lack of consideration for the size of the affected area (100 hectares treated the same a 1 hectare), the Draft Statement does not appropriately reflect how geothermal, particularly shallow geothermal is currently being utilised in Ireland.

We support the proposal that 0.1 kW/m2 of net energy usage (heating as energy extraction and cooling/storage as energy input) be used as a standard measure of regulatory threshold. This would consider the impact of a 10 kW single shallow borehole (e.g. 150 metres deep) and scaled appropriately for the footprint of the installation. Under such classifications, shallow, closed loop systems would only be subject to planning permission and not licensing. Similarly, open-loop systems would be subject to local water regulations as well as planning permission.

Using the IKEA Ballymun geothermal installation as an example, based on a total of 158 drilled boreholes of ~120 metres each over an area of approximately 0.126 km^2, this system would be subject only to planning permission. If, theoretically, the IKEA system was installed in a smaller area and/or had to drill deeper (wells greater than 100m) with the same requirements, the installed system may extend beyond the scope of planning permission and therefore be subject to additional licensing under the proposed Geothermal Energy Exploration Licence (GEEL).

- **Geothermal Projects and Regulation:** EGEC fully supports the statement that "Geothermal energy projects will have to be delivered in full compliance with all environmental protection law, including the public's rights to information and participation in decision making processes in line with the Aarhus Convention."

The risk-based approach to the level of regulation required is the right approach and the examples provide (page 21) are resonant. The distinction between closed and open loop and between shallow and deep are important. Closed loop, with no interaction between wellbore fluids and rock clearly has a lower risk profile than open loop. Shallow systems, which can be easily (and have been) deployed to depths of 600 m with the subsurface footprint of the user facility do not need to be subject to licensing and leasing. We offer further commentary to the Project Archetypes to match risk types and potential severity with the projects in Figure 5.

Appropriate licensing is essential for the development of geothermal resources. This gives the developer of the resource security of tenure and enables investment. Today in Ireland over 99.9% of geothermal deployments are shallow (less than 500m) and are progressing with no licensing approach. The current proposed policy would shut down that industry for any scale today. The policy needs to support the local development of heating and cooling for the local buildings where they are using the heat close to surface (shallow systems), rather than use a model that is based in exploration for scarce resources (oil, metals). There is a fundamental need to define "shallow" and "deep" as these classifications are generally linked to vastly differing levels of investment requirements. Countries with high enthalpy ranges at shallow depth, such as Italy, would require additional parameters in these definitions, however, Ireland is a low-mid enthalpy environment, with a largely homogenous shallow environment. As such, it is envisioned that Ireland's geothermal resources be subject to an 'Irish geological approach'. Therefore, defining a broad classification for shallow (<500 metres) and deep (>500 metres) resources would be suitable in this context. The following is proposed and outlined in Figure 5:

- **Small-scale (shallow systems)** (using the German definition of less than 500m).
  - All systems must be registered.
  - Residential systems are only subject to planning regulation.
  - Systems larger than small residential, but not exceeding 0.1kW/m2, require registration and energy use reporting. In the case of open systems, the appropriate planning regulations and water usage regulations apply.
  - Energy use of >0.1 kw/m2 requires the project to be licensed by the new Geothermal Authority.

- **Large-scale (deep Systems)** For depths of over 500 metres the licensing of acreage per an Exploration/Production approach may be more appropriate, as a greater footprint would encourage more activity for the development of the resource.

- **Outline Regulatory Framework:** We agree that having a regulatory framework for both shallow and deep geothermal is useful in reducing uncertainty for developers. We would urge the DECC to appreciate that any process needs to be designed carefully and resourced properly in order to be beneficial to everyone. We strongly agree with the four points of content for regulatory framework (page 23) but propose that there needs to be a fifth on targets for geothermal use and a sixth under the broad topic of broad policy incentives and safeguards to provide support for developers taking resource and project risk and to help customers choose geothermal heat over fossil fuels.

- **Ownership of Geothermal Energy:** We understand why the Minister for DECC should be the office which has the authority regulate ownership (page 25), but the relationship to other departments, such as SEAI needs to be mapped. For shallow geothermal systems, which have a narrow subsurface footprint typically not greater than the surface building and associated areas, we do not see the need for regulation of ownership through leasing. Only open loop systems have sufficient risk profile to warrant additional controls, and this can be based on existing rules for water abstraction. For deep geothermal systems, licensing and leasing may be appropriate, but should considered in terms of projects intending the use the resource, rather than similar to oil and gas exploration.

- **Heat volume guarantee, thresholds and lease terms:** We believe that the heat volume guarantee (page 25) is not a workable solution – too difficult to predict, measure and assure. Similarly, the use of a KW threshold (page 26) is not workable except for distinguishing single domestic ground source heat pumps. We propose an energy use/unit area approach for the reasons stated above for shallow systems. For deep geothermal projects we would instead propose that an area and depth considerations be included the licensing and leasing of outlined projects with defined use of the energy perhaps with heads up indication of customer commitment. Signposting to committed projects, at least the intention, helps to avoid "gold rush" claimers taking exploration leases with the intention of holding facility owners and others to ransom on the resource (monopsony, page 26). In Exhibit A we have added some commentary to the risk characterization of the project archetypes to illustrate our viewpoint on when leases, licenses and associated process should apply.

- **Environmental Protection and Geothermal Energy:** We support the statements made. It is worth noting that the archetypes should play a role in the level of oversight required as they have different environmental footprints. Aligned with how we consider different forms of geothermal (shallow/deep, closed/open, big/small) we have proposed a different archetype approach in Figure 5.

Figure 5 – Proposed archetypes

	Type	Definition	System type	Use	Authority
Closed-loop (GHP/Shallow)	Residential – single or low density.	low-yield energy for residential heating & cooling	Small ground-sourced heat pumps	Heating and cooling (heat pumps)	Per Building requirements

	Low-mid Net Energy	<0.1 kW/m2 Net energy usage	- Large ground-sourced heat pumps.	Heating, Cooling and Storage Agriculture, Commercial, Districts, Public Service & Industry	Per Building requirements
	High Net Energy	>0.1 kW/m2 Net energy usage	Advanced Geothermal System	Heat and/or electricity power generation	Permit application which would be awarded by GSRO
Open-loop (GHP/Shallow)	Residential – single or low density.	low-yield energy for residential heating and cooling	Small ground-sourced heat pumps; Standing-column well	Heating and cooling (heat pumps)	Per Building requirements & water authority
	Low-mid Energy	<0.1 kW/m2 Net energy usage	-Ground-sourced heat pumps; Standing-column well -Hydrothermal - Direct Use; Large ground-source heat pump	Heating & Cooling in Agriculture, Commercial, Districts, Public Service and Industry	Local planning regulator & water authority
	High Energy	>0.1 kW/m2 Net energy usage	Hydrothermal electricity generation; Enhanced geothermal systems	Heat and/or electricity power generation	Permit application which would be awarded by GSRO
Deep System Open/Closed	Mid-High Energy	All net energy levels	Commercial and Industrial	Heating, Cooling, Storage and Electricity.	License for exploration and production