

Yellow – possible to make joint Nordic statements

## Section 1 – generic input to SEAC

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| 1.19 | What is or are the process(es) or product(s) PFAS (or an alternative to PFAS) are used in? How and why are they used? | <p>District heating distributes hot water through insulated pipe networks for space heating and domestic hot water. In Finland, district heating supplies approximately 35 TWh annually. Supply temperatures range from 60 to 115°C, depending on the outdoor temperature. Higher temperatures are needed during the coldest times.</p> <p>Heat pumps are a key production technology in district heating. They upgrade low-temperature waste and ambient heat — from sewage, outside air, seawater, industrial processes, and data centers — into high-temperature heat for the network, displacing fossil fuels and other combustion-based heat production.</p> <p>PFAS are primarily used indirectly as part of large-scale heat pump systems supplying heat to networks. Their most important application is in fluorinated refrigerants (HFCs and HFOs) used as working fluids in vapour compression heat pumps. These refrigerants enable efficient heat transfer, compression and heat upgrade from low-temperature sources (e.g. wastewater, air, data centres) to the high temperatures required in district heating grids.</p> <p>PFAS-based refrigerants are used inside sealed components of the heat pump, including compressors, heat exchangers and piping. Their function is to provide thermodynamic performance, stability, non-flammability (in many applications), and compatibility with materials, which are critical for achieving high efficiency, operational reliability and long lifetimes in large-scale installations.</p> |
| 1.20 | Do suitable alternatives exist for this use/application?  | Single choice:<br><br>1. Yes  |

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|      |   | <p>2. No</p> <p>3. I do not know</p> <p>Suitable alternatives are those that are technically and economically feasible, safer for human health and the environment, and available in sufficient quantities.</p>   |
| 1.21 | <p>What is the availability of alternatives for this use/application?</p> <p>Select all options that apply in general for this use/application and provide an explanation of each point in the next question.</p> | <p>1. <b>Alternatives are not available due to insufficient quantities:</b> PFAS-free alternatives are not available in sufficient quantities for this use/application.</p> <p>2. <b>Alternatives are not available because of safety concerns:</b> PFAS-free alternatives are not safer for human health or the environment.</p> <p>3. <b>Alternatives are not available because of technical feasibility:</b> PFAS-free alternatives do not meet the functional requirements for this use/application.</p> <p>4. <b>Alternatives are not available because of economic feasibility:</b> It is not possible to operate profitably using the alternatives.</p> <p>5. <b>None of the above-Alternatives are available:</b> There are suitable alternatives for this use/application. They exist in sufficient quantities, they are safer than PFAS, and they are technically and economically feasible.</p>                |
| 1.22 | Free text limit 3000 characters   | <p>2. <b>Safety:</b> Alternatives to PFAS-based refrigerants (e.g. natural refrigerants such as ammonia, CO<sub>2</sub> or hydrocarbons) introduce new safety risks that can limit substitution potential. These include toxicity (e.g. ammonia), flammability (hydrocarbons), and high operating pressures (CO<sub>2</sub>), which require stricter safety systems, spatial constraints and regulatory compliance and not all safety challenges can be mitigated by technology. In large-scale district heating heat pump installations, high refrigerant charges and integration into residential environments further increase these challenges. As a result, replacing PFAS-based refrigerants will prevent installations in some densely populated cities such as Helsinki. Installation of large amount of i.e. hydrocarbons is not possible close to buildings i.e. underground like many sites currently are.</p> |

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|  |  | <p>3. <b>Technical feasibility:</b> High reliability, continuous operation, long lifetimes, and the ability to deliver temperatures typically over 90 degrees. Based on the experience from our members the replacement options do not fulfil these requirements yet and more experience and time is needed than 18 months to ensure that alternatives are developed enough. Options are currently limited in supplier availability and often cannot consistently achieve the required temperature levels or operational stability in large-scale, high-temperature applications. Some existing installations using alternatives have shown higher failure rates, operational challenges or increased maintenance needs in higher temperatures. This indicates that, while technically possible in specific cases, alternatives do not yet fully meet the performance, reliability and scalability requirements of industrial district heating applications. Availability of alternative solutions remains inadequate for large-scale applications. Helen, one of our members, encountered this challenge firsthand when they invested in a large-scale air-to-water heat pump (approximately 30 MW, costing around 65 M€), utilizing CO<sub>2</sub> as the refrigerant. Following an EU-wide public procurement process, they received an offer from only one supplier. Despite expectations for competitive bidding, only a single supplier submitted an offer. Helen therefore undertook a carefully considered yet significant risk by choosing to invest in this technology, given its pilot-like implementation and the limited number of available suppliers</p> <p>4. <b>Economic feasibility:</b> Switching to alternatives would have significant economic implications. Large-scale heat pumps are capital-intensive assets with long lifetimes, and changing refrigerant technology is not a simple retrofit but typically requires complete replacement of the system, as well as modifications to the production site and safety infrastructure. Helen have experienced this firsthand in their planned investments and currently ongoing investments. For example, the air-to-water heat pump investment mentioned before only proceeded due to receiving national subsidy for emerging technologies. Without the 19 M€ subsidy, they had chosen a PFAS heat pump, since CO<sub>2</sub> options were too expensive. The cost of the heat pump was approximately double the normal industry standard of 1mEUR / 1 MW. In this air-to-water heat pump plant, a tailored suction gas heat exchanger was implemented to enable operation at higher district heating return</p> |
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|      |  | temperatures. Such customization, however, is generally not economically viable under normal conditions, and in this case it was only made possible due to investment support.  |
| 1.23 | How many years would it take to develop alternatives to a stage where they can be implemented for the use/application?               | Numerical (Years: 0 to 20+).<br>5   |
| 1.24 | What is the total annual volume (tonnes) of PFAS used (or imported) for this specific use/application in the EEA?                    | Provide the annual volume (tonnes) for each type of PFAS used (or imported) in the EEA by your organisation, or by the organisations included in your response if reporting for a group. Do not include tonnages used outside the EEA.<br><br>Numerical by type (tonnes/year):<br><br>1. Non-polymeric PFAS<br><br>2. Polymeric PFAS<br><br>3. Fluorinated gases: 661 kg  |
| 1.25 | If PFAS could not be used in this use/application, what would be the most likely impact on organisation(s) covered by your response? | Single choice. When responding on behalf of a group of organisations, choose the option that is most representative of the covered companies.:<br><br>1. Permanent closure of business or parts of it (including relocation outside EU)<br><b>2. Temporary closure of business or parts of it (including relocation outside EU)</b><br><br>3. Continued operations with increased costs or lower quality.<br><br>4. No impact or minor impact |

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| 1.26 | What is the average annual gross profit in euros, based on the past three years, from business operations that depend on this PFAS use/application in the EEA?   | Report a value (numerical €/year) covering all applications you described in the response above. When responding on behalf of multiple companies, report a total value for all concerned companies.<br><br>Jätetään tyhjäksi   |
| 1,27 | If PFAS could not be used in this use/application, how many full-time equivalent (FTE) jobs would be lost in your organisation or the companies covered by your response within the EEA?   | Numerical (FTEs) Consider a situation where PFAS could not be used in this use/application by you or your competitors (including articles imported from outside the EEA). Report a value covering all applications you described in the response above. When responding on behalf of a group of companies, report a total value for all covered companies.<br><br>Tyhjä  |
| 1.28 | Please clarify how you have calculated your responses in the two previous questions above on profits and employment losses.  | We are not able to provide precise estimates for impacts on FTEs or annual gross profit. District heating companies have an obligation to supply heat to customers, and this is achieved through a mix of production technologies, with heat pumps playing an increasingly important role. If PFAS restrictions constrain the use of heat pumps, companies would need to rely on more expensive alternative production methods. This would weaken profitability and financial performance, and could, over time, lead to organisational adjustments, including changes in staffing levels, reduced business activity and, in extreme cases, the discontinuation of operations. |
| 1.29 | If PFAS could not be used in this use/application, what is the magnitude of potential negative impacts on society, e.g. from lack of access or worse quality of products (in addition to impacts on employment and profit losses)? | Single choice:<br><br>1. Very low or none<br><br>2. Low<br><br>3. Moderate<br><br>4. High  |

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|      |   | <p>5. Very high</p> <p>6. I do not know</p> <p>Consider other societal impacts than profits or employment and indicate their expected magnitude. Impacts are considered greater, for example, when they affect large populations or significantly reduce quality of life. Do not include information on health and environmental impacts of PFAS itself.</p>   |
| 1.30 | <p>Please explain your response to question above, e.g. by describing the elements leading to your judgement on the magnitude of additional impacts. If possible, provide quantified or monetized estimates of the impacts.</p> | <p>First, there is a risk of slower decarbonisation of heating systems. Large-scale heat pumps are a key solution for utilising excess heat from data centres, wastewater and industry. If their deployment is delayed or limited due to a lack of viable refrigerant alternatives, heat production may shift back to less efficient or higher-emission solutions such as electric boilers or fossil-based peak capacity. This would slow progress towards climate targets and increase overall system emissions.</p> <p>Second, security of heat supply and system reliability could be affected. District heating networks provide critical infrastructure, especially in Nordic countries where they cover a large share of urban heating demand. If alternative technologies are less reliable or cannot deliver required temperatures, this may increase the risk of operational disruptions or require additional backup capacity, reducing overall system robustness.</p> <p>Third, there may be impacts on consumers and quality of life. Higher investment and operating costs would likely be passed on to end users through increased district heating prices. In parallel, reduced availability of efficient heat pump solutions could limit the use of low-cost excess heat sources, further increasing heating costs. In cold climates, even small changes in cost or reliability can have significant welfare implications.</p> <p>Fourth, a ban could lead to stranded assets and inefficient use of resources, as existing heat pump systems are replaced prematurely despite long technical lifetimes. This would increase material use, waste generation and lifecycle emissions.</p> |

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|  |  | <p>Finally, innovation and market development may face short-term setbacks, as limited supplier availability and immature alternative technologies constrain competition and scalability in high-temperature heat pump markets.</p> |
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## Section 2

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| 2.19 | Choose all sectors that are relevant or covered by your responses in this general survey.                         | Multiple choice: You can select as many sectors as you see fit.<br><br>Information provided will apply to all selected sectors unless you specify otherwise in your answers.  |
| 2.20 | Please provide a general description of the use(s) of PFAS (or alternatives) you are providing comments on        | Briefly describe the use(s) of PFAS (or alternatives) in this sector(s). Free text (limit: 2000 characters)<br><br>Same as 1.19   |
| 2.21 | Please provide your comments on section 1.2. SEAC opinion   | Consult the SEAC draft opinion and provide your comments relevant to this specific section of the opinion.<br><br>Free text (limit: 5000 characters)  |
| 2.22 | Please provide your comments on section 2.2. Summary of the opinion   | Free text (limit: 5000 characters)  |
| 2.23 | Please provide your comments on section 3.2. Justification that action is required on a Union-wide level          | Free text (limit: 5000 characters)  |
| 2.24 | Please provide your comments on section 3.3.1 Availability and technical and economic feasibility of alternatives | 1) Not a drop-in substitution (system redesign required)<br><br>Natural refrigerants (e.g., ammonia, CO <sub>2</sub> , propane/isobutane) differ significantly from synthetic refrigerants in molecular weight and thermodynamic properties, meaning they generally cannot be used in existing heat pumps designed for PFAS-based refrigerants. In practice, this implies replacement of equipment and often also major changes to the production site, even if the existing unit has decades of remaining lifetime.<br><br>2) High-temperature delivery (90°C and above) with stability and availability |

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|  |  | <p>District heating grids in the Nordics commonly require 90°C and above, and the requirement is not just peak temperature but stable delivery, continuous operation, and high availability. Reported experience with large-scale natural-refrigerant solutions in high-temperature grids includes regular breakdowns, high maintenance costs, and difficulty delivering required temperatures.</p> <p>3) Reliability requirements vs. current maturity of alternatives</p> <p>Large DH heat pumps are expected to run as critical infrastructure: high reliability, long lifetimes, continuous operation, and typically &gt;90°C capability. Current replacement options are described as not yet fulfilling these requirements, with higher failure rates and operational challenges in higher-temperature applications based on real life usage hence more time to develop the heat pumps is needed.</p> <p>4) Safety-driven design constraints (charge, location, and plant layout)</p> <p>Natural refrigerants can trigger constraints that are not only “building safety” issues: high refrigerant concentrations may be constrained by other safety standards and other spaces than buildings as well.</p> <p>For flammable alternatives (e.g., hydrocarbons), large charge sizes can be problematic, and it has been highlighted that installing large quantities close to buildings or in underground sites can be infeasible — which limits new installations and substitution particularly in dense urban settings.</p> <p>For natural refrigerants in enclosed spaces, emergency ventilation and related safety infrastructure are required, and this can be particularly challenging and costly in constrained existing sites if even possible.</p> <p>5) Limited supplier availability and long qualification/testing cycles</p> <p>There is currently a very limited number of suppliers able to provide natural-refrigerant heat pumps that can meet the high temperatures and unit sizes required in most DH networks, and new models require rigorous testing before broad adoption. This slows scale-up and increases project risk.</p> <p>6) Timing: alternatives not ready for large-scale roll-out in the near term</p> |
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|      |  | <p>Ongoing development work exists for ammonia/CO<sub>2</sub>/propane/isobutane solutions, they are not expected to be ready for large-scale market roll-out within the 18 months period for these high-temperature DH applications. A further important constraint is the long development and investment cycle of district heating and large-scale heat pump projects. These projects typically involve multi-year planning, permitting, procurement and construction phases, followed by decades of operation. Investment decisions are made based on long-term technical and regulatory certainty, and projects are often highly site-specific and integrated into existing infrastructure.</p> <p>Rapid regulatory changes, such as short transition periods for PFAS restrictions, are therefore particularly challenging. The timeframe is not aligned with the reality of project development cycles: technology selection, supplier contracting and system design decisions are locked in early and cannot be easily changed without significant delays, redesign costs and investment uncertainty.</p> <p>We support SEAC's position that the PFAS restriction should complement the F-gas Regulation. The F-gas phase-down already incentivizes transition to natural refrigerants. An additional restriction exceeding the F-gas timeline would create regulatory uncertainty discouraging heat pump deployment — contrary to REPowerEU objectives. The derogation should be aligned with the current F-gas schedule.</p> |
| 2.25 | Please provide your comments on section 3.4.1. Regulatory risk management options other than restriction | Free text (limit: 5000 characters)  |
| 2.26 | Please provide your comments on section 3.4.2.1. Effectiveness in reducing the identified risk(s)        | Free text (limit: 5000 characters)  |

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| 2.27 | Please provide your comments on section 3.4.2.2.1. Socio-economic analysis: Approach | <p>SEAC's assessment approach, as well as the underlying dossier, does not sufficiently account for the specific characteristics of district heating and large-scale industrial heat pump applications.</p> <p>First, the analysis remains too generic and does not adequately distinguish between different types of heat pump applications. Industrial, large-scale heat pumps connected to district heating networks differ fundamentally from residential or small commercial heat pumps in terms of scale, operating conditions, temperature requirements, safety constraints and integration into critical infrastructure. Treating these applications as broadly comparable leads to an underestimation of both the technical and economic challenges associated with substitution.</p> <p>Second, the analysis does not sufficiently reflect differences between district heating systems across countries. In Nordic countries, district heating systems operate at significantly higher temperatures (typically 90°C and above), rely heavily on large-scale centralized production, and are deeply integrated into urban energy systems. These characteristics impose stricter technical and reliability requirements than in lower-temperature or more decentralized systems found elsewhere. A uniform assessment framework therefore fails to capture the real constraints faced in these high-temperature environments, where suitable alternatives are currently limited.</p> <p>Third, the approach does not fully recognize that district heating is critical infrastructure, where operational reliability, safety, and continuity of supply are paramount. This creates a much lower tolerance for technological risk compared to smaller-scale or individual building-level solutions. The current analysis does not sufficiently reflect the implications of this for technology choices and transition timelines.</p> <p>Finally, even existing regulation, such as the F-gas framework, does not fully differentiate between industrial and residential applications or between different system requirements. This lack of differentiation appears to be carried over into the PFAS assessment, further reinforcing a one-size-fits-all approach. As a result, the analysis does not go deep enough in assessing real substitution potential in high-temperature, large-scale industrial applications.</p> |
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|      |  | <p>Overall, a more granular and application-specific assessment would be required to properly evaluate the feasibility and impacts of substituting PFAS in district heating heat pump systems.</p>  |
| 2.28 | <p>Please provide your comments on section 3.4.2.2.2. Socio-economic analysis: Costs</p> | <p>Substitution costs for replacing PFAS-based refrigerants in district heating heat pumps are currently not quantified in a comprehensive way. There is no published total-cost-of-ownership comparison for large-scale systems (&gt;5 MW) that reflects real operating conditions. Existing analyses do not capture several important cost categories, some of which may be substantial or even prohibitive. This lack of quantified evidence should not be interpreted as an indication that costs are low; rather, it reflects that they have not yet been fully assessed. Consequently, it is not possible to conclude that substitution costs are manageable without a complete and system-level cost evaluation.</p> <p>Significant additional cost drivers arise from safety and technical requirements associated with natural refrigerants. For ammonia (R717), toxicity necessitates exclusion zones, gas detection systems, emergency ventilation, and detailed emergency response planning. In urban environments, these requirements can force relocation of installations or redesign of plant layouts, leading to additional land use and infrastructure costs. Similar challenges arise for hydrocarbons due to flammability, which imposes strict limitations on refrigerant charge sizes and plant configuration.</p> <p>For CO<sub>2</sub> (R744), technical constraints further increase costs. Transcritical systems require low return temperatures, typically below 40°C, whereas many district heating networks operate at return temperatures of 50–70°C. Achieving compatibility may require extensive network modifications, such as hydraulic separation, upgrades to substations, or, in some cases, partial redesign of the network. In addition, the high operating pressures of CO<sub>2</sub> systems lead to more complex equipment and significantly higher investment costs. This is something that Helen has demonstrated 1. in the beforementioned project and in a separate smaller project. The challenge related to district heating return temperatures can technically be mitigated, but only with additional complexity. One example is a project where a roughly 1.5 MW air-to-water heat pump plant was planned by Helen. During market consultations, suppliers proposed both PFAS-based and CO<sub>2</sub>-based solutions. In all CO<sub>2</sub>-based options, the solution included a separate booster heat pump installed upstream of the main unit, with the purpose of lowering the return temperature to meet the operating</p> |

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|      |  | <p>requirements of the CO<sub>2</sub> system. Alternatively, excess heat could have been rejected to the ambient air, but this would result in wasted energy. In practice, this illustrates that CO<sub>2</sub> heat pumps require tailored system configurations to function in district heating networks.</p> <p>Such customization increases significantly the system complexity and capital costs, reducing overall economic viability. It also indicates that the technology is not yet fully mature and still requires further development to become competitive with PFAS-based solutions in large-scale district heating applications.</p> <p>In addition to substitution costs, the assessment should include the risk of stranded assets. District heating heat pump installations are long-lived investments, often designed to operate for several decades. If PFAS restrictions prevent servicing or refilling of existing systems before the end of their technical lifetime, operators may be forced to prematurely replace fully functional assets. This results in direct economic losses and can also lead to indirect costs, such as reverting to less efficient or higher-emission heat production methods. These economic and environmental impacts should be explicitly included in any comprehensive cost assessment.</p> <p>SEAC has however considered the costs related to the full ban of substance use which has been identified to be very high. Finnish Energy agrees on this finding.</p> |
| 2.29 | Please provide your comments on section 3.4.2.2.3. Socio-economic analysis: Benefits               | Free text (limit: 5000 characters)   |
| 2.30 | Please provide your comments on section 3.4.2.2.4. Socio-economic analysis: Other relevant impacts | SEAC's assessment should weigh the environmental cost of delayed heat pump deployment against the benefit of phasing out HFO refrigerants. For large urban district heating heat pumps where natural alternatives face documented barriers, the balance favors a time-limited derogation allowing continued deployment while alternatives mature.  |

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| 2.31 | Please provide your comments on section 3.4.2.2.5 Socio-economic analysis: Proportionality | <p>We agree with SEAC's conclusion that a full PFAS ban without use-specific derogations is likely not proportionate, and that a general ban combined with tailored, time-limited derogations represents the correct framework. However, due to the enormous scope of the restriction, analysis carried out has not been detailed enough and details have been missed regarding large scale heat pumps.</p> <p>SEAC's proportionality assessment should weigh the environmental cost of delayed heat pump deployment against the benefit of phasing out HFO refrigerants. For large urban district heating heat pumps where natural alternatives face documented barriers, the balance favors a time-limited derogation allowing continued deployment while alternatives mature.</p> <p>For residential and small commercial heat pumps, the transition to natural refrigerants such as propane (R290) is already well advanced and appears broadly proportionate. However, for large-scale, high-temperature heat pumps used in district heating (&gt;1 MW, supply temperatures above 80°C), the situation is fundamentally different and requires a more differentiated assessment.</p> <p>Natural refrigerants such as ammonia (R717), CO<sub>2</sub> (R744) and hydrocarbons are technically feasible in certain configurations, but their operational track record at large scale and high temperatures remains limited. Ammonia systems are well established at moderate temperatures but face practical limitations at around 90°C in single-stage configurations. Achieving higher temperatures (e.g. 95–120°C) typically requires multi-stage or hybrid systems, increasing system complexity, capital costs and maintenance requirements. In addition, ammonia's toxicity imposes siting and safety constraints that restrict its use in dense urban areas, where district heating demand is highest.</p> <p>CO<sub>2</sub> systems can reach high temperatures but rely on transcritical operation, which requires low return temperatures (typically below 40°C) to achieve acceptable efficiency. This is incompatible with many existing district heating networks, where return temperatures are significantly higher. Adapting networks to lower return temperatures would require extensive and costly modifications, including substation upgrades and hydraulic redesign. Furthermore, CO<sub>2</sub> systems operate at very high pressures, requiring specialized components and expertise that are not yet broadly available at scale.</p> |
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|      |   | <p>Hydrocarbon-based systems (e.g. propane, butane) face limitations due to flammability, which restricts allowable refrigerant charge sizes and constrains plant design, particularly in large installations. While higher temperatures may be achieved in cascade configurations, large-scale operational experience remains limited.</p> <p>In contrast, certain fluorinated refrigerants can deliver high temperatures with proven reliability, moderate pressures and fewer safety constraints, enabling deployment at scale under demanding district heating conditions.</p> <p>SEAC’s proportionality assessment does not sufficiently reflect these differences. The current analytical approach groups together fundamentally different applications by following a categorization that does not distinguish between small-scale residential units and large-scale industrial heat pumps. As a result, a 5 kW residential system is effectively assessed under the same framework as a 20 MW district heating installation delivering heat to thousands of users, despite significant differences in technical requirements, system integration and risk tolerance.</p> <p>In addition, the analysis does not sufficiently account for variation in district heating systems across countries. In particular, high-temperature networks typical in Nordic countries impose more stringent requirements on heat pump performance and reliability than lower-temperature systems elsewhere. This heterogeneity is not adequately reflected in the assessment.</p> <p>Even the existing F-gas regulatory framework does not fully capture these distinctions, and this limitation appears to be carried over into the PFAS assessment. As a result, the analysis does not go deep enough in evaluating substitution feasibility for high-temperature, large-scale applications.</p> |
| 2.32 | Please provide your comments on section 3.4.2.3. Practicality, including enforceability | Due to the broad scope of the proposed restriction, guidance should be provided to all stakeholders needing to comply with the proposed restriction. Additionally, particular attention should also be paid to a clear understanding of what applications are or are not covered by potential derogations. For practicality reasons, the reporting requirements should follow the F-gas regulation with industrial heat pumps. Reporting  |

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|      |   | <p>requirements should be proportional to the likelihood and amount of PFAS that the applications leak based on the previous measurements.</p> <p>Large-scale district heating heat pump projects typically require several years from initial concept to commissioning, often in the range of five to eight years. Refrigerant selection is made early in the design phase, well before the equipment is placed on the market. If restrictions take effect within a short transition period, projects already in planning or procurement may no longer be viable, even though significant investments and commitments have already been made.</p> <p>To avoid this outcome, the regulatory framework should reflect the realities of project development by recognising key decision points in the investment cycle. In particular, it would be important to consider criteria such as the date of design commitment or equipment order, rather than relying solely on the date of placing on the market. Without such provisions, there is a high risk that ongoing projects will be disrupted or stranded despite having made technology choices in good faith under the prevailing rules.</p> |
| 2.33 | Please provide your comments on section 3.4.2.4. Monitorability       | <p>Free text (limit: 5000 characters)</p> <p>The current monitoring within F-gas regulation is sufficient in terms of fluorinated gases. Any additional reporting should be avoided.</p>  |
| 2.34 | Please provide your comments on section 3.4.3. Conclusion whether the | <p>From the perspective of the fluorinated gas use in industrial and professionally maintained heat pumps (with low leakages), the proposed EU-wide measure is not needed considering also the aspects of F-gas regulation</p>  |

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|      | suggested restriction is the most appropriate EU-wide measure: (i) PFAS definition  | and the potential risks and socio-economic impacts caused by the use of alternatives and considering the risks of leakages. Approach with more intention considering the leakages and their impact on human health would have been more appropriate.  |
| 2.35 | Please provide your comments on section 3.4.3. Conclusion whether the suggested restriction is the most appropriate EU-wide measure: (ii) Exclusion of PFAS from the scope        | Exclusions are needed with this approach. Sectoral approach is good though even deeper analysis would have been needed under heat pumps particularly industrial heat pumps.<br><br><i>“Scope of the restriction is too broad”</i> : SEAC notes that these comments refer to the breadth of applications covered by the proposed restriction. SEAC does not agree with these comments since the risks associated with the use of PFAS is not linked to specific applications, but to the use of PFAS across sectors and applications. With a blanket ban and sector specific analysis it is very easy to overlook details relevant to the stakeholders and specific countries. Substance use with very low likelihood and impact on human health and nature is on the same line that use cases with big impacts on human health. |
| 2.36 | Please provide your comments on section 3.4.3. Conclusion whether the suggested restriction is the most appropriate EU-wide measure: (iii) Conditions on the proposed restriction | Free text (limit: 5000 characters)<br><br>Scope of the proposed restriction:<br><br>Concentration limits:<br><br>General 18-month transition period: Too short for industrial heat pump projects such as district heating projects. With proposed derogations it is ok assuming district heat supplying heat pumps are classified as industrial heat pumps.<br><br>Recycling of fluorinated gases: Should be aligned with F-gas regulation<br><br>Derogations: Finnish Energy welcomes the proposed derogation for industrial heat pumps which district heating supplying heat pumps should belong to. Derogations are needed due to immature markets for larger units, safety concerns in some locations and long lasting project times as explained in earlier answers.   |
| 2.37 | Please provide your comments on section 3.4.3. Conclusion whether the   | Free text (limit: 1000 characters)  |

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|      | suggested restriction is the most appropriate EU-wide measure: (iv)<br>Reporting requirements  | Reporting requirements should consider already existing reporting requirements such as the F-gas regulation. Any additional reporting should be avoided. Regarding the F-gases no “potential” emission reporting should take place. Reporting should be at a reasonable level considering the risks associated with leakages. For large-scale heat pumps (>1 MW) used in district heating and industrial applications, operators using fluorinated refrigerants (HFCs/HFOs) are already subject to comprehensive reporting obligations under the F-gas Regulation (EU) 2024/573, Article 26, including annual reporting via the F-gas Portal and independent auditor verification above 1 000 t CO <sub>2</sub> eq. |
| 2.38 | Please give an indication of the costs related to the reporting requirements.  | <p>Single choice:</p> <ol style="list-style-type: none"> <li>1. Very low or none</li> <li>2. Low</li> <li>3. Moderate</li> <li>4. High</li> <li>5. Very high</li> <li>6. I do not know</li> </ol> <p>Provide an estimate of the magnitude of the costs for the implementation of the reporting requirements, from very low when the impacts are estimated to be insignificant to very high when they may result in a decision to discontinue your business activities.</p>  |
| 2.39 | Please provide your comments on section 3.4.3. Conclusion whether the suggested restriction is the most appropriate EU-wide measure: (v)<br>Site-specific PFAS management plan | Free text (limit: 1000 characters)  |

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| 2.40 | Please give an indication of the costs related to the implementation of a site-specific PFAS management plan | <p>Single choice:</p> <ol style="list-style-type: none"><li>1. Very low or none</li><li>2. Low</li><li>3. Moderate</li><li>4. High</li><li>5. Very high</li><li>6. I do not know</li></ol> <p>Provide an estimate of the costs for implementing a PFAS management plan. Use the scale from very low (minimal impact) to very high (may result in a decision to discontinue business activities).</p>         |
| 2.41 | Please give an indication of the costs related to monitoring of PFAS emissions at industrial sites           | <p>Single choice:</p> <ol style="list-style-type: none"><li>1. Very low or none</li><li>2. Low</li><li>3. Moderate</li><li>4. High</li><li>5. Very high</li><li>6. I do not know</li></ol> <p>Provide an estimate of the costs for monitoring of emissions at industrial sites. Use the scale from very low (minimal impact) to very high (may result in a decision to discontinue business activities).</p> |

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| 2.42 | Please provide your comments on section 3.5.2. Uncertainties evaluated by SEAC | <p>Free text (limit: 5000 characters)</p> <p>SEAC recognises that there are gaps in the available data on substitution costs, but the analysis does not assess the likely direction or magnitude of these uncertainties. For large-scale district heating heat pumps, the missing cost elements are not neutral; they consistently point toward higher overall costs for natural refrigerant solutions compared to HFO-based systems.</p> <p>A number of relevant cost drivers are not captured. These include safety and regulatory compliance requirements for large refrigerant charges, explosion protection measures, exclusion zones for ammonia, and broader land-use constraints. These factors can significantly increase both capital and operating costs, particularly in urban environments, yet they are not reflected in the current cost assessment.</p> <p>In addition, the use of CO<sub>2</sub> systems may require substantial adaptations to existing district heating networks. Many networks operate with return temperatures around 50–70°C, whereas CO<sub>2</sub> systems typically require much lower return temperatures to function efficiently. Achieving this can involve costly measures such as hydraulic separation, substation upgrades, or even more fundamental network redesign. These system-level costs are not included in the analysis.</p> <p>Taken together, these factors suggest that uncertainty in the cost assessment is not balanced. The available evidence indicates that actual costs are more likely to be significantly higher than currently assumed, rather than lower.</p> <p>There is also uncertainty regarding the maturity of the relevant technologies. While large-scale, high-temperature heat pumps are emerging on the market, the segment above approximately 10 MW and 90°C remains at an early stage of commercial development. The supplier base for natural refrigerant solutions at these scales and temperatures is limited, and long-term operational performance over full asset lifetimes has not yet been demonstrated. This should be treated as material uncertainty in the assessment.</p> <p>Importantly, the consequences of underestimating uncertainty in this segment are more severe than in many other applications. In most cases, underestimating substitution challenges results in higher-than-</p> |
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|  |  | <p>expected compliance costs. In the case of district heating heat pumps, however, it can lead to delayed or cancelled investments, which in turn prolongs reliance on less efficient heat production methods. This creates a situation where regulatory uncertainty directly slows down decarbonisation.</p> <p>Given these considerations, it would be appropriate to carry out a dedicated uncertainty assessment for large-scale, high-temperature heat pump applications. This segment should be evaluated separately from residential and smaller commercial systems, where technologies are more mature and substitution pathways are already well established.</p> |
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