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Non-household actors (EE, NL and PT)

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Contents

Foreword

This report was developed in the framework of the joint Directorate Energy – Joint Research Centre project entitled Societal appreciation of security of energy supply *(SASOS).*

Publications in the series *Societal appreciation of energy security:*

- Volume 1: Value of lost load – households (EE, NL and PT)
- Volume 2: Long-term security (EE, NL and PT)
- Volume 3: Non-residential actors (EE, NL and PT)
- Volume 4: Value of Lost Load - Greece

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Abstract

The availability and continuity of energy supply play a key role in qualifying the energy security of a country. This report explores the meaning of energy security, according to the perceptions and preferences of a broad range of market actors. Making use of interviews and survey data taken in Estonia, the Netherlands and Portugal, the importance of an encompassing set of policy topics/measures is explored and described to investigate the relevance of different dimensions of energy security. The perspectives of residential, industrial and commercial energy users, Distribution System Operators, electricity retailers and producers are analysed rating and ranking the relevance of policy components of energy security.

The study provides a snapshot of potential gaps and discrepancies among the views of different categories of market actors and compares information on their beliefs and preferences with those stated by households and the other market actors. This enables to identify any consensus on the different components of energy security.

1 Introduction

While a plethora of definitions have been provided to analyse theoretically and empirically the concept of energy security, no real consensus has been achieved on a monolithic way to define energy security. Some approaches privilege the analyses of measurable vulnerabilities of physical systems, ignoring a broader set of subjective information used to characterize the concept of energy security (Cherp A. , 2012). However, concerns and social needs have a role in emphasizing the relevance of specific aspects that are more likely to be encompassed is such multidimensional concept. Some key aspects as affordability, availability and continuity of energy supply has been traditionally adopted as the most uncontroversial. The construction of conceptual boundaries is a key issue to operatively support policy and regulatory decisions. One key sector of application is the ex-ante evaluation of benefits from investments in energy infrastructures, which should keep into account in operative and practical terms the social benefits of energy security.

In a series of reports, we investigate the value that societies in various EU member states place on security of energy supply. A first study within this framework provided estimates of the value of unserved energy (Value of Lost Load) for Estonia, the Netherlands and Portugal (Longo, Giaccaria, Bouman, & Efthimiadis, 2018), hereafter 'volume 1'. A second report, ('volume 2') proposed an assessment of the perceived benefits of a long-term strategy for energy security, based on survey data of residential energy users.

This report focus on the way different actors may connect the concept of energy security to specific policy measures. The connection between policy topics is not prescriptive or normative. Results of our observation give a snapshot of what energy security should cover according to the point of view of various actors in the energy sector, while we try to measure the gaps and the convergence of judgements and perceptions.

2 Assessing importance of Energy security topics

It is not straightforward to identify a shared and complete definition of energy security, and "reliable and affordable supply" may not be an exhaustive way to identify the aspects that can be linked to this domain. In the theoretical literature one finds many proposals that have designed methods for the assessment of energy security through a classification of its strategic dimensions, for example through indicators (Kisel, Hamburg, Härm, Leppiman, & Ots, 2016) (Löschel, Moslener, & Rübbelke, 2010) (Kruyt, van Vuuren, de Vries, & Groenemberg, 2009) (Ren & Sovacool, 2014) (Larsen, Osorio, & van Ackere, 2017).

The taxonomy adopted for this study builds upon a stream of literature about the measurement of energy security, the construction of energy security indexes and inter country comparisons (Sovacool, et al., 2012`; Sovacool B. , The methodological challenge of creating a comprehensive energy security index, 2012).

The analysis builds mainly on two sources:

- The survey data from questionnaires to household energy users employed for a previous evaluation of economic damage perceived by blackouts (Longo, Giaccaria, Bouman, & Efthimiadis, 2018)
- A new survey targeting **Distribution System Operators (DSOs), electricity producers and retailers, industrial and commercial consumers and associations of consumers (hereafter 'organizations')** as other relevant actors who have a key role and responsibilities in the retail electricity market. Given the specificity and the small number of related organisations no statistical sampling criteria is applied. For this study we obtained a number of interviews: for 20 organisations in Estonia (EE), 30 in the Netherlands (NL) and 15 in Portugal (PT). An ideal target for this type of analysis would to have all the points of view of all the organisations involved, but is beyond the limits of this research. Results from this segment of energy organisations are given in an aggregated way to protect the anonymity and confidentiality of the single interview data.

We explore the preferences of the above subjects, providing a quantitative representation of:

- The prioritization and importance for energy security of each of the policy topics, in the views of the organizations
- The gap (or convergence) between the perspective of these organizations, and those of the residential energy users.

2.1 Comparing the perspectives of organizations market actors: rating appreciation for energy security dimensions

The indicators we propose in this and in the next section provide some quantitative indexes from two tasks proposed in the questionnaires to the respondents to the surveys: the first use a rating and the second a ranking approach. In the rating exercise the respondent chose for each dimension of energy security an importance level among five options (from extremely unimportant to extremely important). We defined and treat them as ordinal scales.

The participants to a first round of questions on behalf of the organisation they belong to. This first set of questions capture the views of the organization. A second round of question aimed to assess the importance level of the same policy topics by asking the respondents to choose to which extent each issue could be important for the residential consumers of their country. The dimensions are presented as objectives of policy measures. The list includes:

i. to secure supply of oil, gas, coal, and uranium
ii. to promote **trade** in energy products, technologies, and exports
iii. to **minimize depletion** of domestically available energy fuels
iv. to **have stable, predictable, and clear** price signals
v. to have **affordably priced energy services**
vi. to have **small scale, decentralized** energy systems
vii. to have a **low energy intensity** (unit of energy required for unit of economic output)
viii. to conduct **research and development** an new and innovative energy technologies
ix. to assure **equitable access** to energy services to all its citizens
x. to ensure **transparency and participation** in energy permitting, siting and decision making
xi. to inform consumers and promote social and community **education** about energy issues
xii. to minimize the destruction of forests and the degradation of **land** and soil
xiii. to provide available and clean **water**
xiv. to minimize **air pollution**
xv. to minimize the impact of **climate change** (i.e. adaptation)
xvi. to reduce the **greenhouse gas emissions** (i.e. mitigation)

In reporting the results to the rating exercise, we consider that the level "nether important or unimportant" represents a neutral stance, while a positive preference is the sum of the two segments ("somewhat" and "extremely" important).

The following descriptive statistics are used as indicators of the convergence of the preferences of organisations and their perceptions about the concerns of the public opinion

- *From the survey to households:* the share of respondents particularly concerns, agreeing with the statement that a policy component is "extremely important" for the energy security of their country. This is a proxy of the opinion of residential consumers. In reporting the results, we define this share using the term **Public appreciation (PA). Figures 1, 2 and 3 illustrate the frequency of responses obtained respectively for Estonia, the Netherlands and Portugal from the survey to residential energy users.**
- *From the survey to the organisations* we derive two different measures: the first is the importance from the perspective of the organisation, measured by the share of answers assessing the policy component as "extremely important" for the country. In the text we refer to this measure as organisations' appreciation (OA). This is compared with the organisations' opinions about the concerns of the general public. Hence, the share of respondents stating the public opinion will consider as extremely important each policy aspect is defined as Expected appreciation (EA) Some of the experts in the sample of organisations may think that the public opinion disregard or appreciate less (EA lower than OA), some other consider the public opinion having a higher concern of an aspect recognising it as a part of the concept of energy security (EA higher than OA).

The surveys were conducted in EE, NL and PT in 2017 and 2018.

Figure 1. Estonia, Survey data for Households. Rating the importance of measures for energy security, sorted by the values of PA

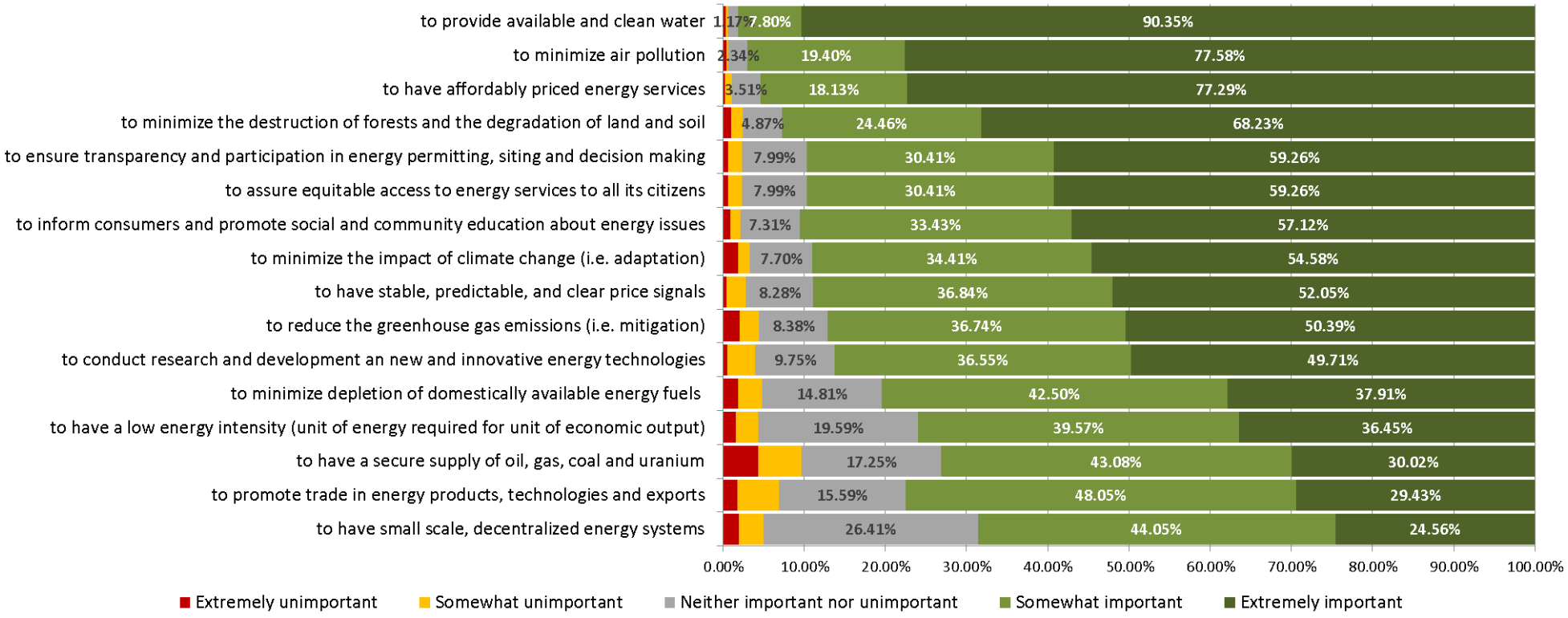


Figure 2. the Netherlands, Survey data for Households. Rating the importance of measures for energy security sorted by the values of PA

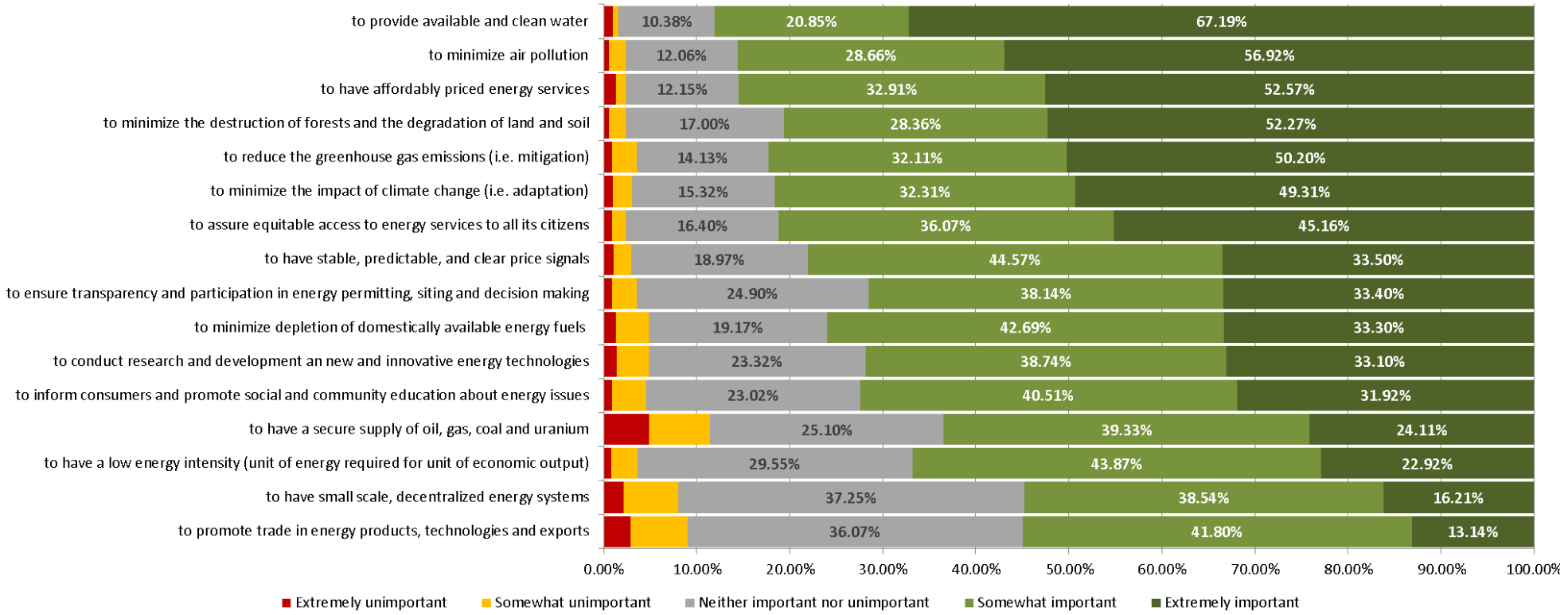
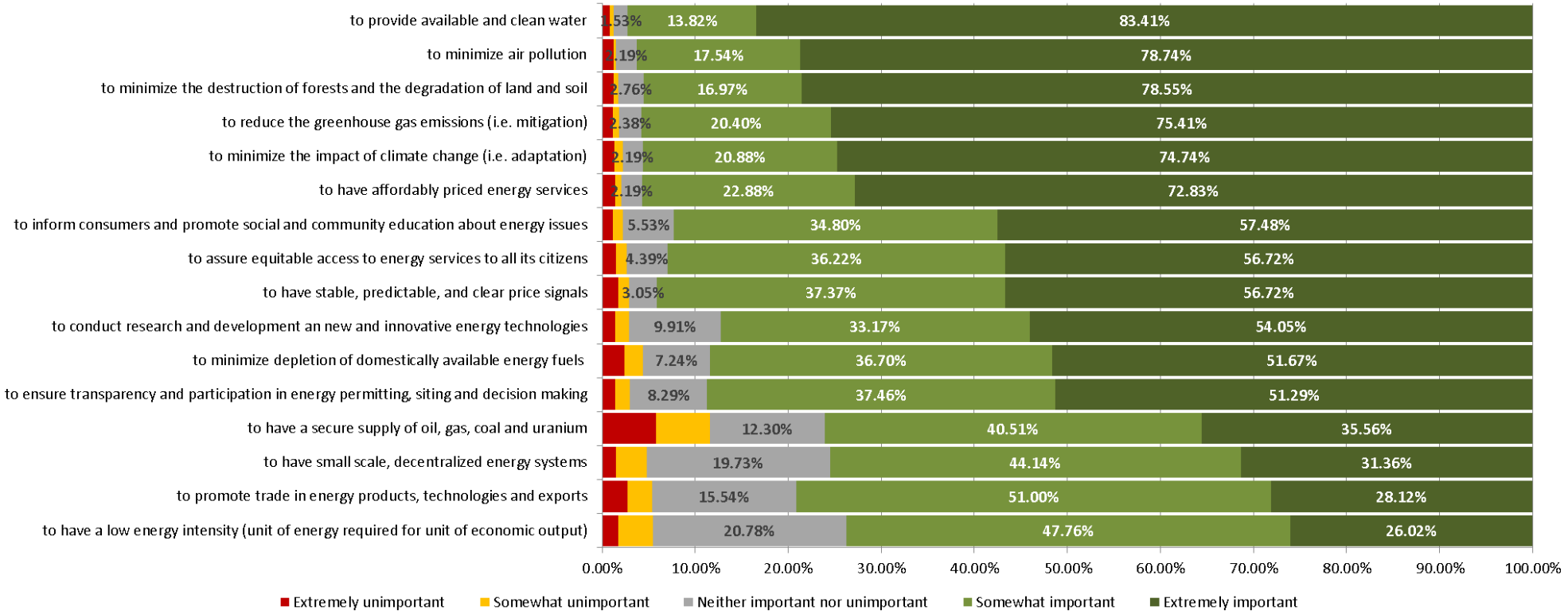


Figure 3. Portugal, Survey data for Households. Rating the importance of measures for energy security sorted by the values of PA

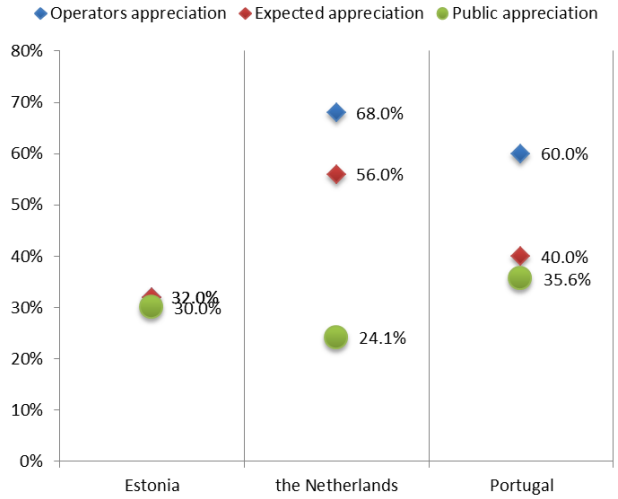


2.1.1 Availability and continuity of fossils and uranium supply

Securing the availability and continuity of traditional fossil fuels as an important element of energy security do not appear to have a similar pattern among the three countries.

In Estonia preferences and expectations converges substantially. The OA scores 32 % and organisations expect (correctly) the households to share the same judgement. EA is then 32 % and the PA share calculated on the households' sample scores 30 %, fitting well the statements and expectations of market actors. The discrepancy of views is more marked for the Netherlands, whereas OA is 68 % and expectation closer to the point of view of organisations (EA is 56 %) while the sample of energy users showed an much lower level of appreciation (24 %). For Portugal the appreciation of the organisations is slightly lower than in the Netherlands, but their expectation better fit the statements of the households. The results from Estonia of a general lower interest for fossil fuel-based security may depend by the high carbon nature of the available indigenous resource (oil shale). Figure 4 presents the values of the different metrics of appreciation and convergence.

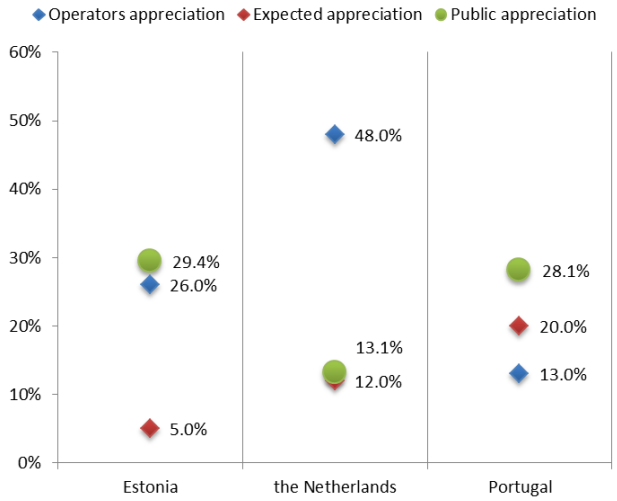
Figure 4, Appreciation and convergence metrics for dimension (i) security of supply of fossil-based energy sources



2.1.2 Trade of energy products, technologies and exports

The measures improving this dimension are emphasised less by organisations in EE and PT, more in NL. Organisations seem to under evaluate the public opinion on this matter in EE, but the score PA is on the contrary even higher than the one of the organizations. NL exhibits a higher appreciation of the organisations that correctly expect the public opinion to be less caring for this aspect. Data from PT shows a totally different view, with organisations stating appreciation that is lower than the effective and the expected from the public opinion (see Figure 5).

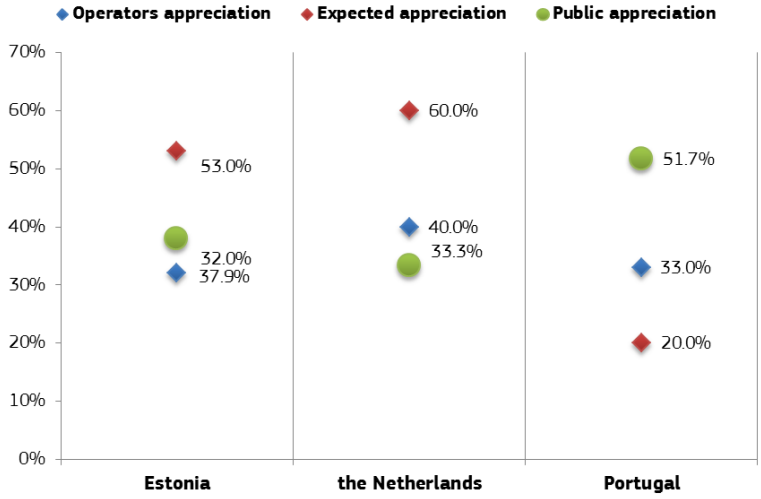
Figure 5. Appreciation and convergence metrics for (ii) trade measures



2.1.3 Depletion of indigenous resources

This dimension may entail both postponing to the future the use of resources to have them in case of shortages, and as well can be intended as a part of a broader goal of enhancing the local sustainability, also from an environmental perspective. Estonian and Dutch organizations overestimate the appreciation from the public opinion. In both cases the views from the sample of organizations and of the households do not exhibit a large discrepancy. In the case of PT the divergence in appreciation is substantial: 52 % of households stated as extremely important to minimize depletion of indigenous resources, while the organizations (33 %) expect public opinion to have even a lower concern for the topic (see Figure 6).

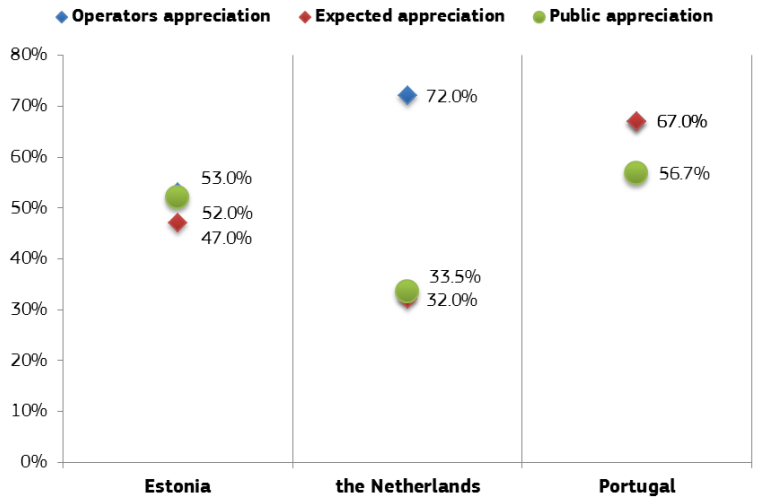
Figure 6. Appreciation indexes for component (iii) depletion of indigenous resources



2.1.4 Market adequacy (price stability and clear price signals)

Organizations in the three countries confirm as expected a high level of appreciation, matching approximately the expectation and the empirical evidence collected by households. A more evident discrepancy is visible from the Dutch results, which show the general perception to be (much) lower than the OA, but correctly expected by organizations. The diffusion and maturity of competitive markets in NL for both electricity and gas suggests that users enjoying very high standards in the adequacy of energy markets can the market adequacy as a spontaneous pre-condition to be taken as granted, and not something to be further consolidated or maintained. On the contrary, in EE and PT the convergence is high and the appreciation as well, scoring "extremely important" for more than the 50 % of the observed responses (Figure 7).

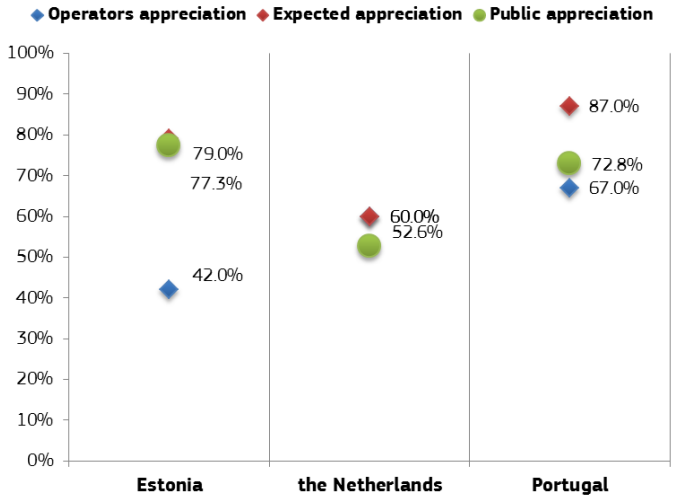
Figure 7. Appreciation and convergence for (iv) market adequacy



2.1.5 Affordability of energy services

This aspect enters as a core dimension within the concept of energy security, and the empirical observation in the three countries seem to confirm it. Figure 8 suggests how organisations as producers and retailer interested in profit maximisation may have interest in minimisation of costs but not putting, as final consumers, emphasis on low and affordable prices.

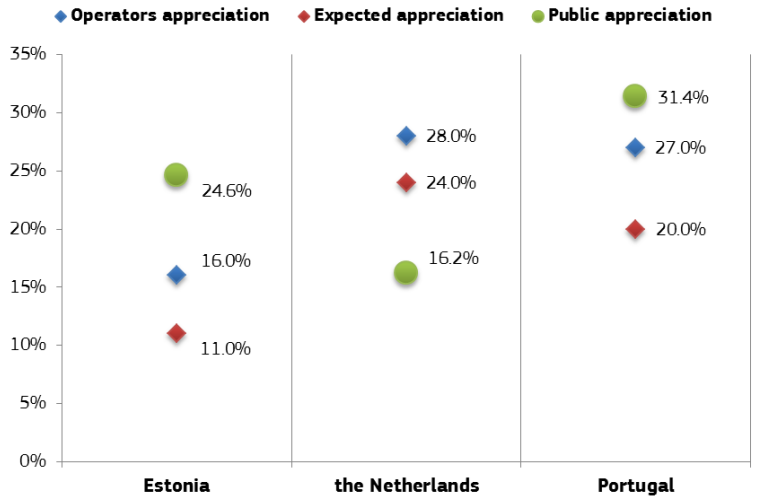
Figure 8 Values of indexes of appreciation for (v) affordability of energy services



2.1.6 Decentralisation of energy systems

In all these three countries decentralisation is not seen as an important feature of a secure energy system (Figure 9).

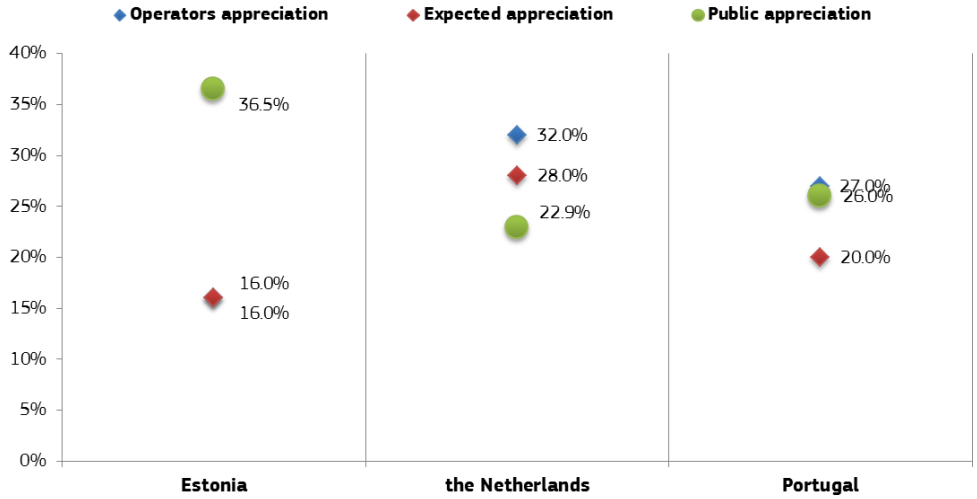
Figure 9. Values of indexes of appreciation for (vi) decentralisation



2.1.7 Rating lowering energy intensity of GDP

Economies which rely more on energy for production should consider its security as more important. The energy intensity of GDP, an indicator of efficiency, may suggest that the interaction between security and efficiency is strong in the pretences and expectations. However, this is not corroborated by the empirical data, which shows that such an interaction is relevant only for a moderate share of respondents (Figure 10).

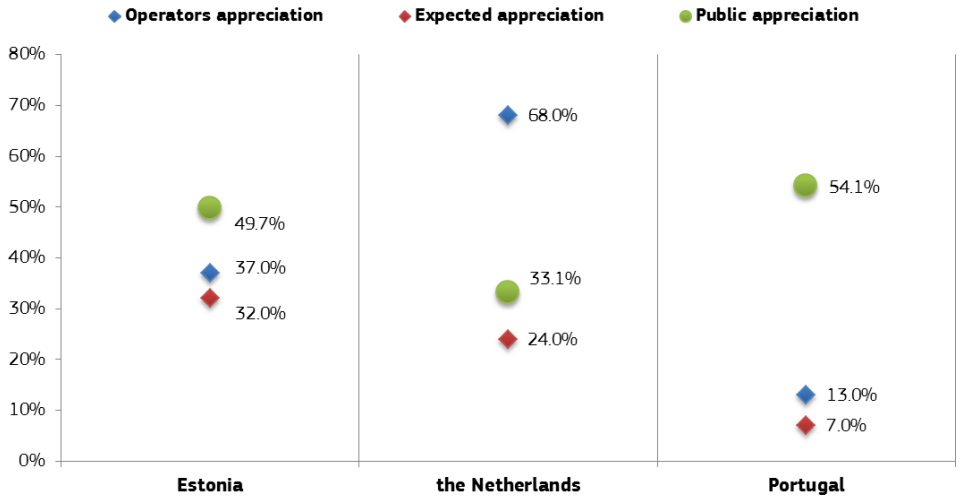
Figure 10. Values of indexes of appreciation of (vii) the reduction of energy intensity



2.1.8 Rating research and development

Research and development is one aspect on which the appreciation stated by the respondents in the survey to the households, and the Expected appreciation of the organisations clearly diverge (Figure 11).

Figure 11. Values of indexes of appreciation for (viii) research and development

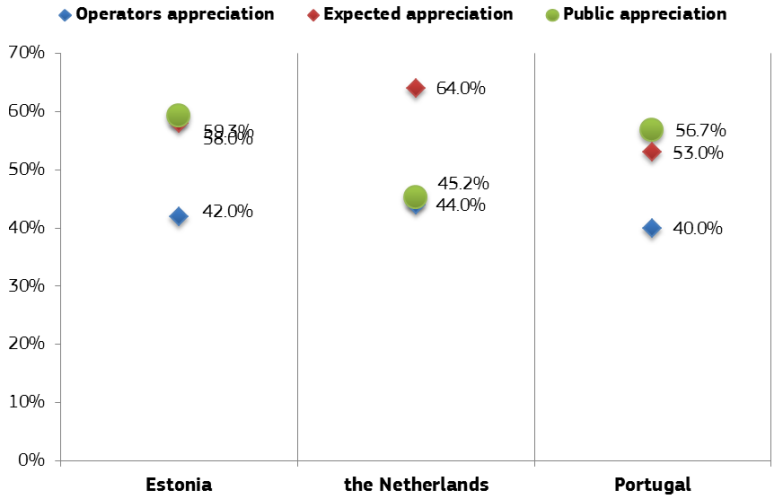


2.1.9 Rating equitable access

A secure access to the energy market meant for respondent also reduced inequalities, and the reduction of potential fuel poverty.

The organisations share exhibit lower values of the index, but their expectations on the public opinion well fit the appreciation level declared by households (Figure 7).

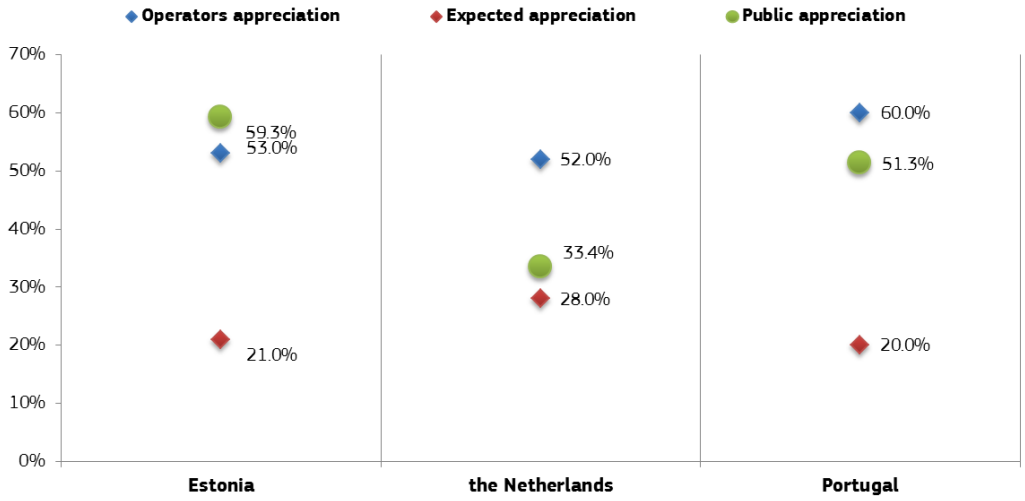
Figure 12. Values of indexes of appreciation for equitable access to the market



2.1.10 Rating transparency and participation

This more institutional dimension refers to the democratisation of energy planning and investment as a part of security. Organisations in the three countries seem very interested in this component and underestimate the appreciation it has for the general public, substantially in the cases of EE and PT, more moderately for NL. Figure 13 shows how the index OA and PA tend to converge more for EE and PT, but not for NL. However, a possible explanation is that the level of participatory processes in NL is already (considered) very high, thus, perhaps the respondents see no need to further increase it.

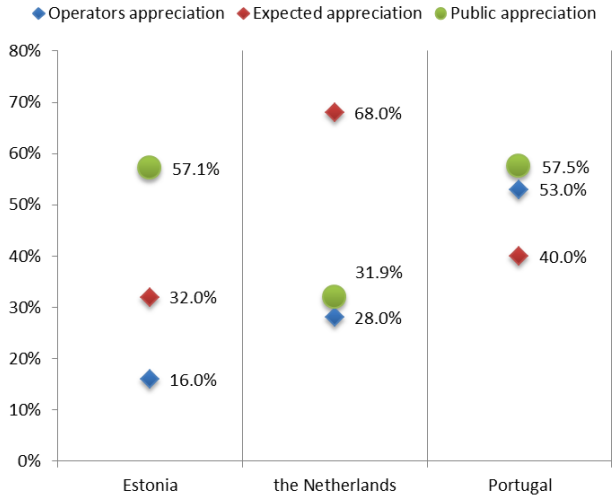
Figure 13. Values of indexes of appreciation for transparency and participation



2.1.11 Information and education campaigns over energy topics

The baseline representing the public opinion and the appreciation of energy market actors are converging more the Netherlands and in Portugal, than in Estonia (see details in figure 14). The appreciation is lowest in the Netherlands, while non-residential energy users expect on the contrary to be very high values.

Figure 14. Values of indexes of appreciation for the component (xi), education and information measures



2.1.12 Environmental and climate dimensions

The survey data suggest that respondents have acknowledged both the local and the global environmental dimension as relevant for energy security. The implications on natural resources as forest and land, water, air shows high scores of the PA index, more markedly in the case of Portugal and Estonia (Figure 15).

The pressures and the quality and availability of water resources is stated as "extremely important" by the 90% of the Estonian sample. This may be related to the specific energy mix of the country, having water as a production factor used for the production of the main indigenous energy source: oil shale. The values for this component can be found in Figure 16.

Air pollution is as well awarded by respondents with a high value of the appreciation indexes, confirmed also by a notable convergence (Figure 17).

As well as the global implication of measures for energy security the respondents have recognised with higher level the mitigation (i.e. the measures reducing emissions) and surprisingly, also the adaptation measures exhibit similar values of the appreciation and of the convergence.

Figure 15. Values of indexes for minimisation of pressures on forests, land and soil

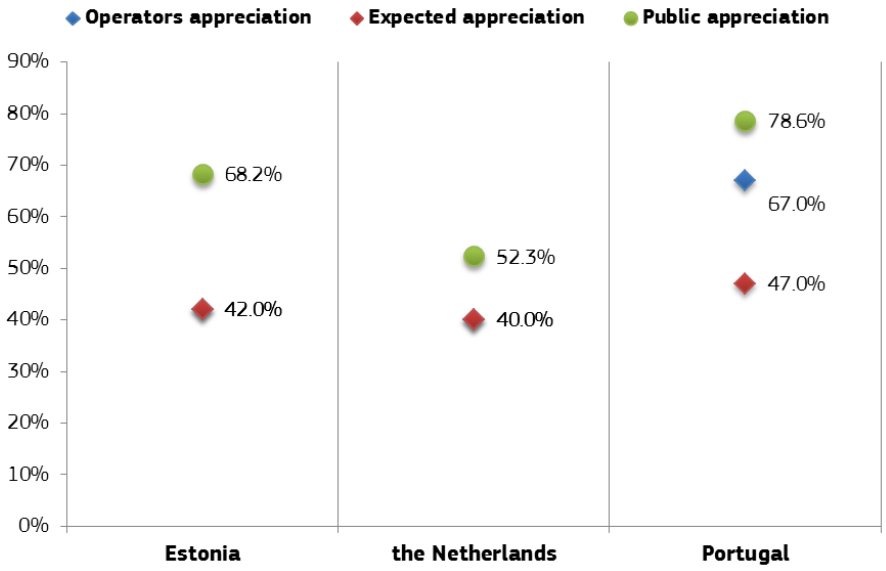


Figure 16. Values of indexes for minimisation of pressures on water resources

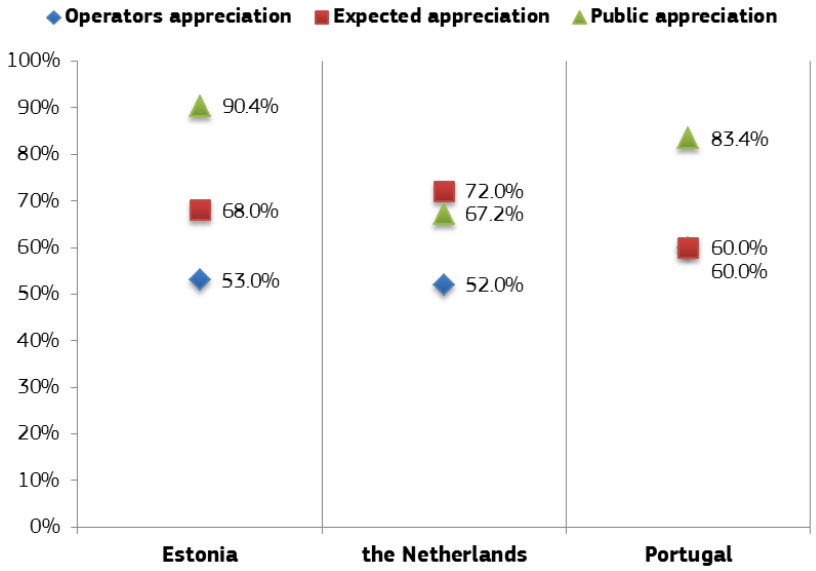


Figure 17. Values of indexes for minimisation of air pollution

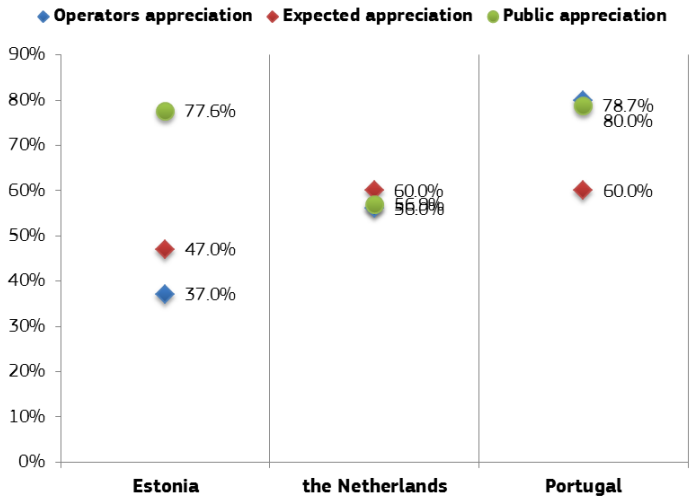


Figure 18. Values of indexes for adaptation measures

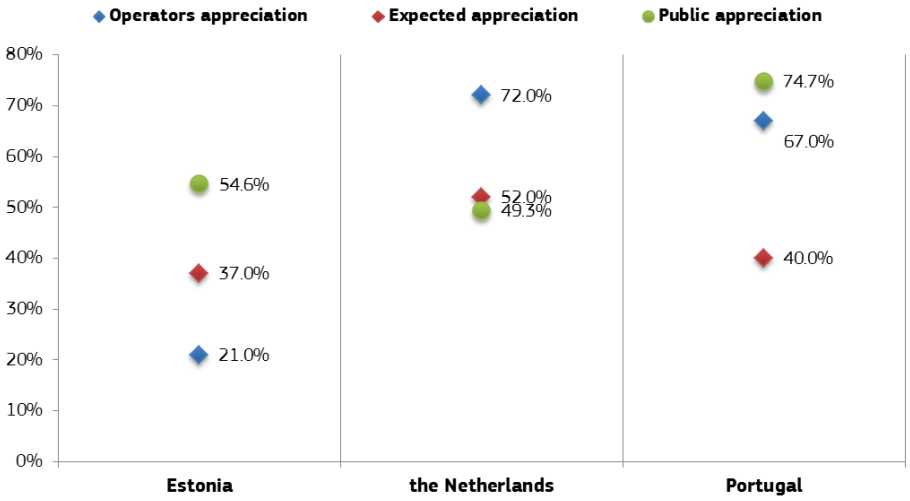
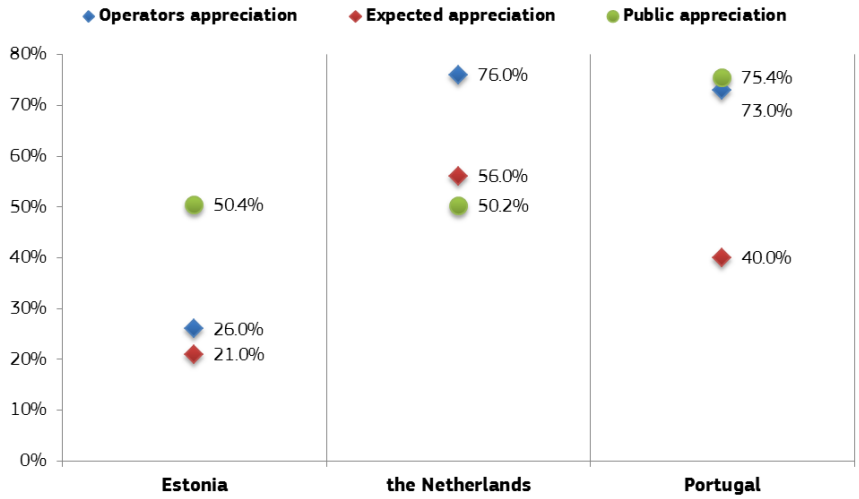


Figure 19. Values of indexes for mitigation measures



2.2 Ranking exercise

The rating exercise allowed respondents to assess each component independently from another. Policy design and choices in real operative conditions impose trade-offs and prioritisation of alternative options. Therefore, the ranking exercise gives a snapshot of what the respondent would choose of really had to restrict to priorities, the appreciation to a narrower set of policy topics to improve the energy security of their country. The same format has been developed and used in previous country-wide comparative studies (Ren & Sovacool, 2014; Sovacool, et al., 2012`). Each component, in the survey data from households, is associated to a frequency in the ranking that is reported by the figure 20 for Estonia, figure 21 for the Netherlands, and figure 22 for Portugal. The comparative overview among the preferences of households, non-residential actors in the energy market (and their expectations) is then presented in table 1, 2 and 3 for the three countries.

Table 1. The most chosen components of energy security, ranking exercise for Estonia

	Ranking Operators	Ranking households	Expectations of operators
1	to have **affordably priced energy services**	to have **affordably priced energy services**	to ensure **transparency and participation** in energy permitting, siting and decision making
2	to **have stable, predictable, and clear** price signals	to **have stable, predictable, and clear** price signals	to assure **equitable access** to energy services to all its citizens
3	to conduct **research and development** an new and innovative energy technologies	to assure **equitable access** to energy services to all its citizens	to conduct **research and development** an new and innovative energy technologies
4	to secure supply **of oil, gas, coal, and uranium**	to secure supply **of oil, gas, coal, and uranium**	to minimize the destruction of forests and the degradation of **land** and soil
5	to ensure **transparency and participation** in energy permitting, siting and decision making	to have a **low energy intensity** (unit of energy required for unit of economic output)	to minimize the impact of **climate change** (i.e. adaptation)

Table 2. The most chosen components of energy security, ranking exercise for the Netherlands

	Ranking Operators	Ranking households	Expectations of operators
1	to minimize the impact of **climate change** (i.e. adaptation)	to have **affordably priced energy services**	to ensure **transparency and participation** in energy permitting, siting and decision making
2	to secure supply **of oil, gas, coal, and uranium**	to provide available and clean **water**	to assure **equitable access** to energy services to all its citizens
3	to **have stable, predictable, and clear** price signals	to assure **equitable access** to energy services to all its citizens	to promote **trade** in energy products, technologies, and exports
4	to have **affordably priced energy services**	to minimize **air pollution**	to minimize the destruction of forests and the degradation of **land** and soil
5	to conduct **research and development** an new and innovative energy technologies	to minimize the impact of **climate change** (i.e. adaptation)	to minimize the impact of **climate change** (i.e. adaptation)

Table 3. The most chosen components of energy security, ranking exercise for Portugal

	Ranking Operators	Ranking households	Expectations of operators
1	to have **affordably priced energy services**	to have **affordably priced energy services**	to ensure **transparency and participation** in energy permitting, siting and decision making
2	to **have stable, predictable, and clear** price signals	to provide available and clean **water**	to assure **equitable access** to energy services to all its citizens
3	to ensure **transparency and participation** in energy permitting, siting and decision making	to **have stable, predictable, and clear** price signals	to minimize the destruction of forests and the degradation of **land** and soil
4	to inform consumers and promote social and community **education** about energy issues	to reduce the **greenhouse gas emissions** (i.e. mitigation)	to reduce the **greenhouse gas emissions** (i.e. mitigation)
5	to reduce the **greenhouse gas emissions** (i.e. mitigation)	to secure supply of oil, gas, coal, and uranium	to have **small scale, decentralized** energy systems

The first column in the three tables shows the choices of the group of energy organisations.

For EE the organisations' group stresses the importance of the affordability and market adequacy (first two most chosen options). This result converges with the choices of the sample of households. The expectation of the organisations about the concerns of the public opinion stressed the relevance of ensuring transparency and participation in energy permitting, siting and decision making, and assuring equitable access to energy services to all the citizens. The equitable access component is indeed in the selection of the households, but surprisingly the energy users selected the securitisation of supply of fossil fuels, putting it at the fourth place exactly as the organisations. The research and development topic is highlighted by energy organisations in EE and not confirmed by the households' sample.

Figure 20. Estonia, Survey data to households. Ranking measures of energy security (count of respondents by importance level)

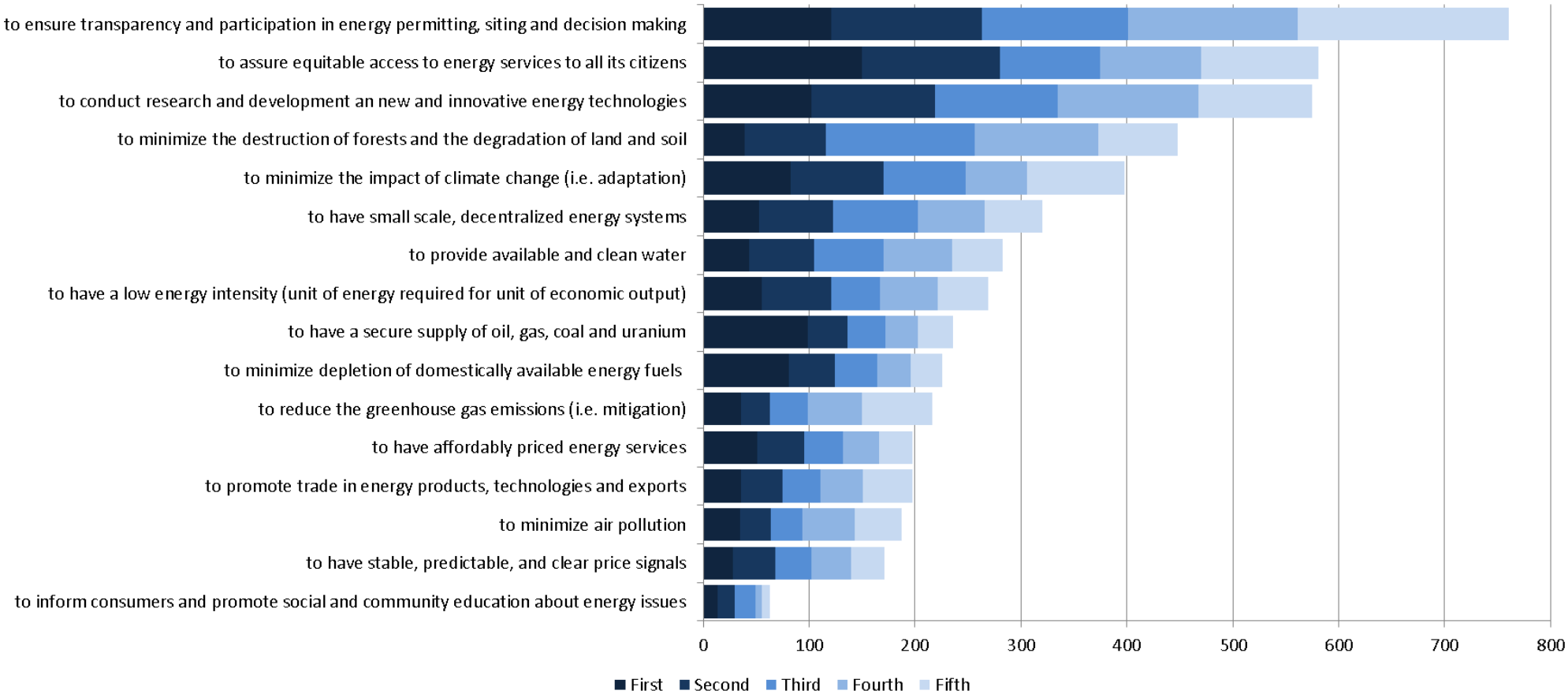
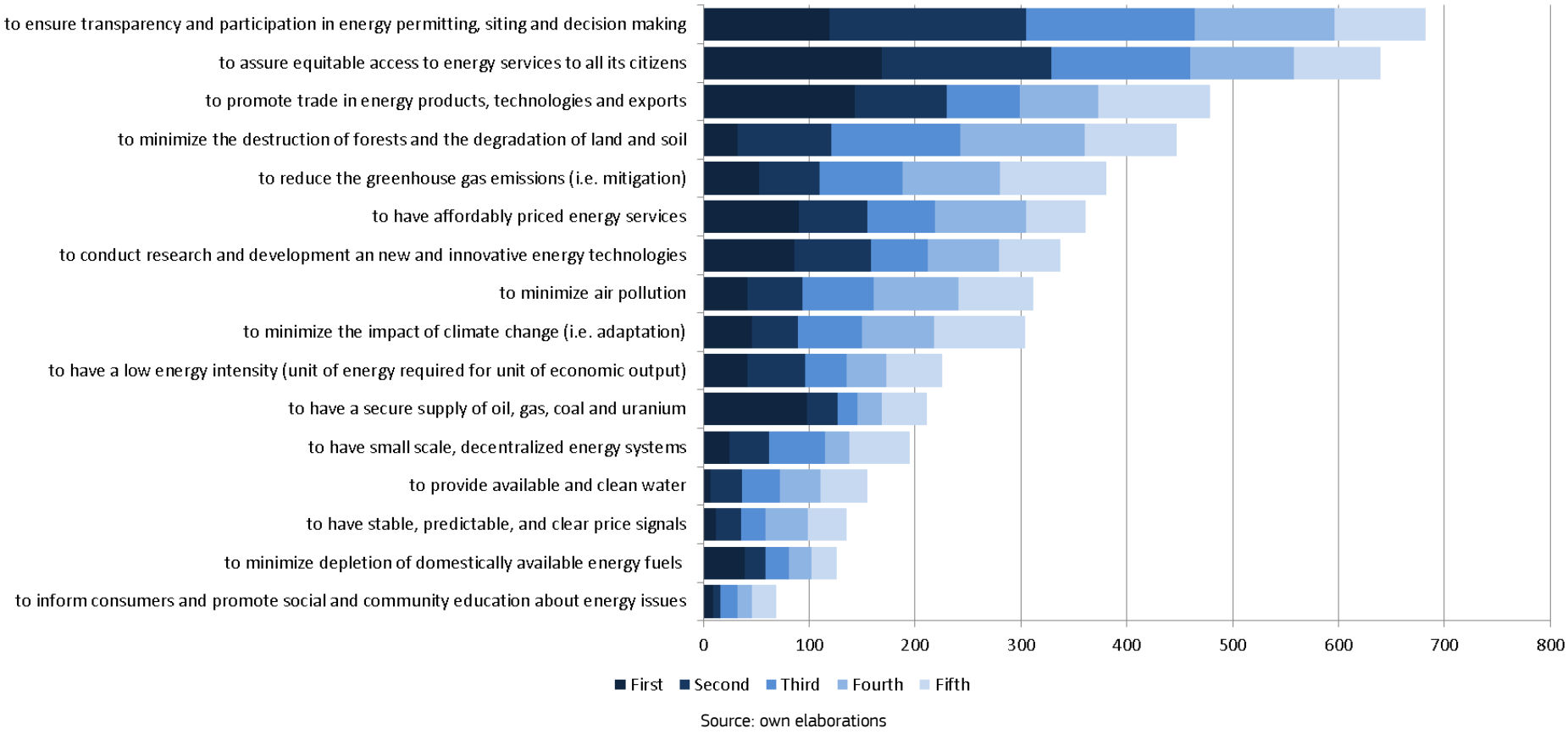
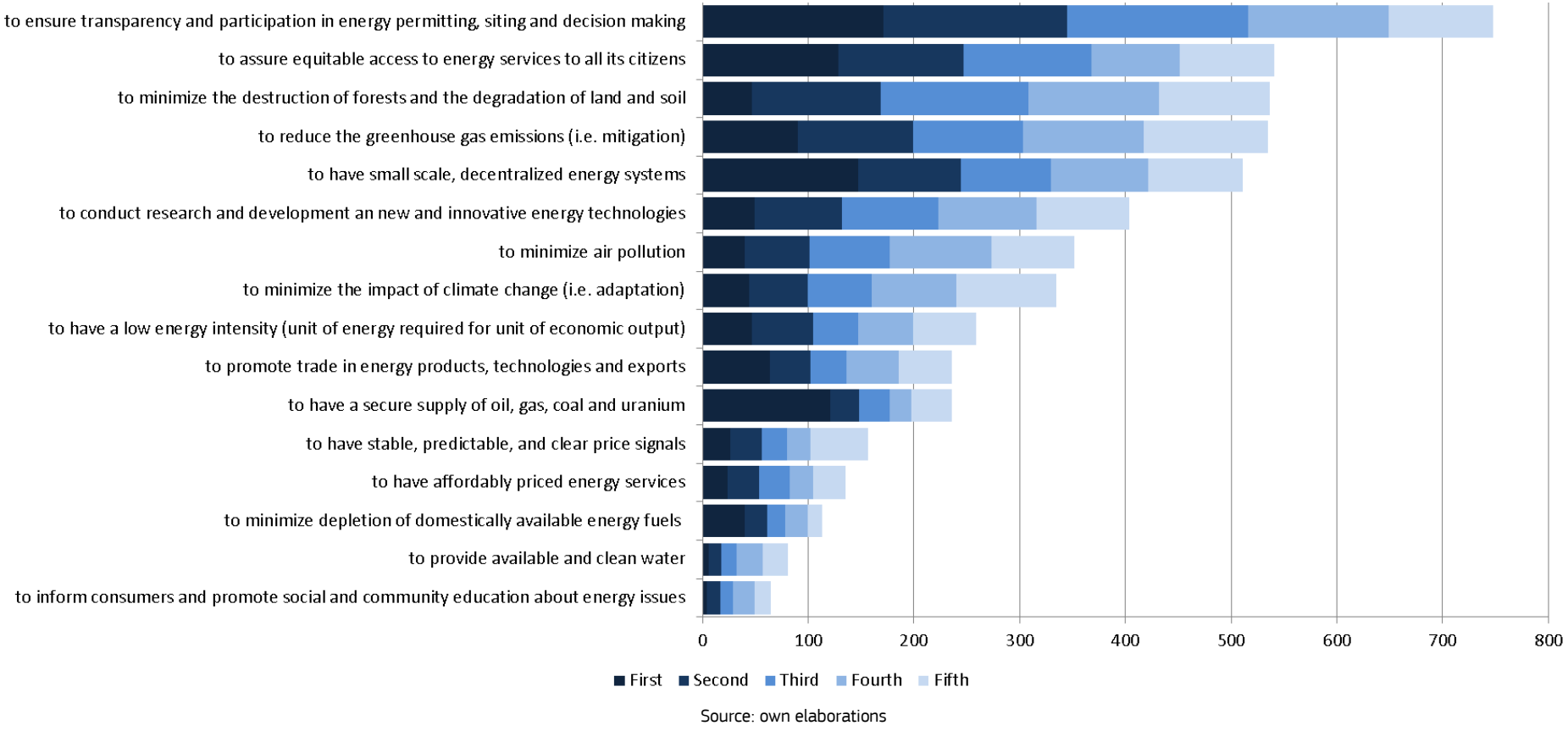


Figure 21. The Netherlands, Survey data to households. Ranking measures of energy security (count of respondents by importance level)



Source: own elaborations

Figure 22. Portugal, Survey data to households. Ranking measures of energy security (count of respondents by importance level)



Source: own elaborations

The organisations in EE expected households to have explicitly prioritised environmental implications of energy security, while the households did not addressed in the ranking result any explicit environmental policy topic, but rather the reduction of the energy intensity of GDP.

Organisations in NL have prioritised as policy component of energy security the adaptation measures to future climatic changes (first), then the securitisation of supply of fossils, then market adequacy and availability, closing with research and development as most important policy topics. If we look the expected view of the final energy users and their actual choices, we find convergence in the emphasis given to adaptation measures to minimise the impact of climate change. We find also convergence in the interest for ensuring equitable access to energy services to all the citizens. Differently from the expectations of organisations, households prioritised two environmental components, i.e water quality and availability, and minimisation of air pollution.

Also for PT, the results show that the ranking of priorities by the organisations includes affordability (first), market adequacy (second), transparency and participation, informative and educational communication campaigns (fourth) and the reduction of emissions of greenhouse gases. Both the market related aspects are found also in the actual results found on the households' sample. Moreover, the most significative divergence among choices of organisations and energy users is that the latter emphasise the role of securing supply of oil, gas and uranium, while the organisations expect the public opinion to be concerned mainly with the institutional aspect (transparency and equitable access) and with the decentralisation of energy system, while this does not enter in the ranking of the residential energy users.

2.3 Suggestions by organisations

In the interviews, the participants have been asked to highlight priorities for energy security policies through open ended questions. This unstructured approach leaves room for putting under the "umbrella" of energy security any proposal, beyond our pre-defined taxonomy. Some answers of these open ended questions are provided in the following paragraphs (verbatim).

2.3.1 NL energy organisations

The following issues have emerged from the responses to the open question on how to address priorities and suggestions for policy measures relevant for energy security:

- *Reducing the usage of fossil fuels. This included (or implies) a reducing of plastic pollution, since plastics are made out of fossil fuels.*
- Predictability from the government; disrupts the market.
- Explicit delivery of electricity
- *Reducing the usage of fossil fuels; that is the primary objective, other objectives (such as improving air and water quality) are derived from this one. (1st)*
- *Reducing the amount and complexity of regulations (1st)*
- *Creating a level-playing field in the gas market (Gasterra has a monopoly in the gas market) (2nd)*
- *Integration of renewables and smart grid: everyone produces energy from solarpanels and delivers this to the net to get it back later. This is difficult due to the fact that the surplus has to be stored and only has to be used during a shortage*
- *Sustainable energy production*
- *Green energy; working with biomass. (gas retailers)*
- *We expect consumers to be concerned with how can they make a transition to renewable energy resources in their own house?*
- *Legislation: politics should stimulate cooperation between organisations involved in the energy transition, this is not done enough at the moment. (1st)*
- *Production and use of energy as close to eachother as possible*
- *Gasunie thinks that climate change, air pollution and greenhouse emissions are one category. (Gas DSO)*

2.3.2 NL Consumers' associations and Industrial consumers

- *An energy transition is required. This transition cannot be organised and financed solely by the industry. Given the huge importance for our society and the long time horizon for this transition, there is a role for society and politics to manage this transition and come up with arrangements on how to finance it.*
- *Addressing the risk of fluctuation of energy supply (by 2 different organisations)*
- *Addressing the adequacy of the electricity network, it is of vital importance*
- *Stability and predictability of governmental positions on subsidisations (2 organisations)*
- *Stimulate the renewable energy market through subsidies*
- *Incentives to green energy*
- *Investing in the quality and quantity of the energy infrastructure (electricity and gas). This is of vital importance, given that the demand for (and transportation of) electricity will only increase in the next few years.*
- *Security as safety (protection from accidents*

2.3.3 EE Industrial consumers

- *Self-production is sensitive to the perceived profitability to be obtained through the installation of renewable energy technologies due or the presence of subsidies*
- *Reduction of the market power of EDP.*
- *Alternative systems to get emergency power. This is not available, there is no technology.*
- The availability of electricity in dispersed settlements could be better, the connection making is expensive. In the future, environmental issues will be even more important: there should be no personal well, no heating with firewood (pollutes the air).
- *It is important for renewable energy to be more affordable in order to be contributed by producers.*
- *Unplug the Russian electricity system*
- *The EU should take climate zones into account and, on this basis, set taxes (Southern European countries are in a better position than us).*
- *Privatization of company "Elektrilevi" would improve the network services market. This would increase efficiency and, in conclusion, perhaps a cheaper price.*
- *We have good connections between countries, and Elering has also done a good job of informing that the average person knows what Estlink is.*
- *Russia's gas deliveries are such a dimension (this is compensated by the presence of the Lithuanian LNG terminal).*
- *Stable fiscal policy*
- *The transition to biofuels, its role in our energy balance*
- *Environmental aspects*
- *Secure reserves, secure connections*
- *Energy transfer quality*
- *In the future, the subject of energy labels will become important; The fact that end-users start to generate energy themselves makes the systems more uncertain (parallel production takes place).*
- *The most important distribution network stability for us is: to ensure a high-quality network; It is also important for us that we can honestly, transparently to negotiate with the energy dealers, market openness.*

- *Bureaucracy could be less when you want to put a large amount of solar panels.*
- *Since there are no reserves in Estonia for the production of fossil fuels, the supply of fuels risk should be managed. Currently, Estonia only has a minimum stock of reserves.*

2.3.4 EE energy organisations

- Electricity It is important for us to ensure the stability of gas supplies. Also, the fact that there should be an electricity network of equal quality, it will affect the conditions of competition.
- *Developing a renewable energy portfolio is an important topic for the future.*
- *The list here is missing links between countries - ESTLink 1 and 2, we have connections with Latvia and Lithuania. We have reliable and secure connections between countries. From this page there are missing energy tax policies and subsidies for renewable energy. Today, solar panels shipped from China are subject to high taxes.*
- *For Estonia, the most important thing is for us to have a long-term energy security plan and a plan to implement it; a stable investment environment for its implementation, including regulations, so that they do not change and are not unclear. Year 2024 will shut 600 MW, but which is a replacement investment, or 1/3 of the electricity generation capacity.*

3 Conclusions

The report investigated the appreciation of energy security starting from perceptions and concerns expressed by residential households and organisations in the electricity and gas markets in three EU countries, Estonia, the Netherlands and Portugal.

Two surveys were conducted to provide data that may be limited in their statistical representativeness, but provide insights when defining what the societal components understand by the term *energy security,* and what is the relevance of some of its components.

As a general conclusion of the study, the core of market aspects (reinforcing the affordability of energy sources and the good functioning of energy markets) is appreciated with a large convergence consensus by energy users and also by market organisations, in for all the three countries.

Besides affordability, despite with minor consensus, also securing the availability of supply of fossil fuels remains in the set of policy topics perceived as fundamental for energy security.

Also, the promotion of innovation through research and development is embedded in the components perceived as relevant to secure the energy system. More unexpected results that emerged from the analysis concern institutional factors. Assuring an equitable access to energy services for all the citizens has been pointed out in the responses to the surveys, that suggest that issues as energy poverty or inequalities are perceived as bringing insecurity to the energy users. Also transparency and participation regarding and energy decision, as a need of democratisation, is highlighted as a crucial policy topic to be addressed by energy security strategies.

A set of environmental implications of energy security policies has been also raised as a point by both organisations and by the residential consumers. Beyond the interest for mitigation measures, the survey shows a high perceived importance also of adaptation measures (more for Estonia and the Netherlands).

Organisations also provided a series of open comments and suggestion that cover a wide range of topics related to energy security and this can improve the understanding of the national context highlighting the peculiarities and the constraints under which they operate.

For all the three countries, the results highlight that the expectations of energy organisations about what the public opinion think about energy security issues do not necessarily match the preferences. This mismatch is an interesting and challenging issue to be analysed through systematic quantitative approaches. It could offer support in informing the actual design of policies and strategies, highlighting the areas of divergence and the gaps between general awareness and techno-economic assessment of policy measures associated to the field of energy security.

The study suggests as well that the public opinion is well aware about the interactions among different policy domains. Respondents prioritised the reduction of the energy intensity of the GDP, the protection of local environmental resources and/or stimulus to adaptation/mitigation of climate change impacts are unlikely to consider these issues in relationship, and not as self-contained and embedded in the domain of energy security.

Bibliography

Sovacool, B. K., Mukherjee, I., Drupady, I. M., & D'Agostino, A. L. (2011). Evaluating energy security performance from 1990 to 2010 for eighteen countries. *Energy*, 5846-5853.

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics, 95*(9-10), 1082-1095.

Cherp, A. (2012). Defining energy security takes more than asking around. *Energy Policy*(48), 841-842.

Cherp, A., & Jewell, J. (2014). The concept of energy security: Beyond the four As. *Energy Policy*(75), 415-421.

Kisel, E., Hamburg, A., Härm, M., Leppiman, A., & Ots, M. (2016). Concept for Energy Security Matrix. *Energy Policy, 95*, 1-9.

Kruyt, B., van Vuuren, D. P., de Vries, H., & Groenemberg, H. (2009). Indicators for energy security. *Energy Policy, 37*(6), 2166-2181.

Larsen, E. R., Osorio, S., & van Ackere, A. (2017). A framework to evaluate security of supply in the electricity sector. *Renewable and Sustainable Energy Reviews*(79), 646-655.

Longo, A., Giaccaria, S., Bouman, T., & Efthimiadis, T. (2018). *The appreciation of security of electricity supply: a multi-country assessment of the Value of Lost Load (VoLL) for residential consumers.* EUR XXXX EN.

Löschel, A., Moslener, U., & Rübbelke, D. T. (2010). Indicators of energy security in industrialised countries. *Energy Policy, 38*(4), 1665-1671.

Ren, J., & Sovacool, B. K. (2014). Quantifying, measuring, and strategizing energy security: Determining the most meaningful dimensions and metrics. *Energy Policy*, 838-849.

Sovacool, B. (2012). The methodological challenge of creating a comprehensive energy security index. *Energy Policy*, 835-840.

Sovacool, B., Valentine, S. V., Bambawale, M. J., Brown, M. A., de Fatima Cardoso, T., Nurbek, S., et al. (2012`). Exploring propositions about perceptions of energy security: An international survey. *Environmental Science and Policy*, 44-64.

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Annexes

Questionnaire for online survey A for Estonia, Netherlands and Portugal

Section A: the company

The organization you work for is a

1. DSO of electricity
2. DSO of gas
3. Electricity retailer
4. Gas retailer
5. Consumers 'association
6. Other organization_____

Section B: Energy security

Please respond to the following trying to express the view of your organization.

Thinking about energy security for your country of residence in the next five years you, how important it is <u>for the organization you work in</u>

	Extremely unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Extremely important
1. ...To have a **secure supply of oil, gas, coal and uranium**	1	2	3	4	5
2. ...To promote **trade** in energy products, technologies, and exports	1	2	3	4	5
3. ...to **minimize depletion** of domestically available energy fuels	1	2	3	4	5
4. ...to **have stable, predictable, and clear** price signals	1	2	3	4	5
5. ...to have **affordably priced energy services**	1	2	3	4	5
6. ...to have **small scale, decentralized** energy systems	1	2	3	4	5
7. ...to have a **low energy intensity** (unit of energy required for unit of economic output)	1	2	3	4	5
8. ...to conduct **research and development** an new and innovative energy technologies	1	2	3	4	5
9. ...to assure **equitable access** to energy services to all its citizens	1	2	3	4	5
10. ...to ensure **transparency and participation** in energy permitting, siting and decision making	1	2	3	4	5
11. ...to inform consumers and promote social and community **education** about energy issues	1	2	3	4	5
12. ...to minimize the destruction of forests and the degradation of **land** and soil	1	2	3	4	5
13. ...to provide available and clean **water**	1	2	3	4	5
14. ...to minimize **air pollution**	1	2	3	4	5
15. ...To minimize the impact of **climate change** (i.e. adaptation)	1	2	3	4	5
16. ...to reduce the **greenhouse gas emissions** (i.e. mitigation)	1	2	3	4	5

17. Given the sixteen dimensions of energy security discussed here, select the five that you think are the most important for your country of residence, and rank them from 1 (the most important) to 5 (5th most important), without allowing for ties. Please rank only 5 dimensions

☐	Secure supply of oil, gas, coal, and uranium	☐	Equitable access
☐	Bolstering trade	☐	Transparency and participation in siting and decision making
☐	Minimizing rate of depletion	☐	Education and information
☐	Predictable and clear price signals	☐	Preservation of land
☐	Affordably priced energy services	☐	Availability and quality of water
☐	Decentralization and small scale supply	☐	Minimal air pollution
☐	Low energy intensity	☐	Responding to climate change (adaptation)
☐	Research and development	☐	Reducing greenhouse gas emission (mitigation)

18. Did we miss any dimension that your organization considers important for the energy security of your country of residence in the next five years? Please enter below: _____
_____
_____

19. If you did provide an answer, when you think about energy security for your country of residence in the next five years, how important is the above dimension?

    1. Extremely important

    2. Somewhat important

    3. Neither important nor unimportant

    4. Somewhat unimportant

    5. Extremely unimportant

Now please try answering the same question providing what could be the view of the general population of your country

Thinking about energy security for your country of residence in the next five years you, how important it is <u>for the public opinion</u>

	Extremely unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Extremely important
20. ...To have a **secure supply of oil, gas, coal and uranium**	1	2	3	4	5
21. ...To promote **trade** in energy products, technologies, and exports	1	2	3	4	5
22. ...to **minimize depletion** of domestically available energy fuels	1	2	3	4	5
23. ...to **have stable, predictable, and clear** price signals	1	2	3	4	5
24. ...to have **affordably priced energy services**	1	2	3	4	5
25. ...to have **small scale, decentralized** energy systems	1	2	3	4	5
26. ...to have a **low energy intensity** (unit of energy required for unit of economic output)	1	2	3	4	5
27. ...to conduct **research and development** an new and innovative energy technologies	1	2	3	4	5
28. ...to assure **equitable access** to energy services to all its citizens	1	2	3	4	5
29. ...to ensure **transparency and participation** in energy permitting, siting and decision making	1	2	3	4	5
30. ...to inform consumers and promote social and community **education** about energy issues	1	2	3	4	5
31. ...to minimize the destruction of forests and the degradation of **land** and soil	1	2	3	4	5
32. ...to provide available and clean **water**	1	2	3	4	5
33. ...to minimize **air pollution**	1	2	3	4	5
34. ...To minimize the impact of **climate change** (i.e. adaptation)	1	2	3	4	5
35. ...to reduce the **greenhouse gas emissions** (i.e. mitigation)	1	2	3	4	5

36. Given the sixteen dimensions of energy security discussed here, select the five that you think are the most important for your country of residence, and rank them from 1 (the most important) to 5 (5th most important), without allowing for ties. Please rank only 5 dimensions

☐	Secure supply of oil, gas, coal, and uranium	☐	Equitable access
☐	Bolstering trade	☐	Transparency and participation in siting and decision making
☐	Minimizing rate of depletion	☐	Education and information
☐	Predictable and clear price signals	☐	Preservation of land
☐	Affordably priced energy services	☐	Availability and quality of water
☐	Decentralization and small scale supply	☐	Minimal air pollution
☐	Low energy intensity	☐	Responding to climate change (adaptation)
☐	Research and development	☐	Reducing greenhouse gas emission (mitigation)

37. Did we miss any dimension that your organization considers important for the energy security of your country of residence in the next five years? Please enter below:
_____
_____
_____

38. If you did provide an answer, when you think about energy security for your country of residence in the next five years, how important s the above dimension?

1. Extremely important

2. Somewhat important

3. Neither important nor unimportant

4. Somewhat unimportant

5. Extremely unimportant

39. Can you provide an assessment of the average monthly consumption of electricity of the organization you work in? _____kWh

40. What was your organizations' average electricity bill for the last 12 month period? €_____

41. Has your organization experienced any sudden increase on electricity prices due to a shortage of production or a failure of the network?

Yes □ No □

42. Is your organization equipped with any electricity generator for auto production?

Yes □ No □

43. How important is having access to a reliable electricity supply for your organization?

1. Extremely important

2. Somewhat important

3. Neither important nor unimportant

4. Somewhat unimportant

5. Extremely unimportant

44. In case of interruption of the supply of electricity to your organization, which additional sources are available and operative in your organization?

□ Generators for autoproduction of electricity

□ UPS (uninterruptible power supply) systems applied to computers

□ UPS and backups applied to other machineries (please, specify) _____

□ Protection for data losses

□ Other (please specify)_____

□ Nothing

45. Could you provide an assessment of how much the company spent for providing the options selected in the previous question?

□ Purchase _____ Euro

□ Annual operating and maintenance costs _____Euro

In this section, we present some hypothetical scenarios of power outages and ask you to assess the financial damage that is most likely to occur to your organization.

46. Scenario 1: Weekday, unplanned power outage lasting 1 hour, starting at 10am and finishing at 11am.

a) What is the monetary loss to your organization? €_____

b) What is the value added lost over that day in percentage, between 0% and 100%?_____%

47. Scenario 2: Weekday, unplanned power outage lasting 6 hours, starting at 10am and finishing at 4pm.

c) What is the monetary loss to your organization? €_____

d) What is the value added lost over that day in percentage, between 0% and 100%?_____%

48. Scenario 3: Weekday, unplanned power outage lasting 12 hours, starting at 10am and finishing at 10pm.

    e) What is the monetary loss to your organization? €_____

    f) What is the value added lost over that day in percentage, between 0% and 100%?_____%

49. Scenario 4: Weekday, unplanned power outage lasting 24 hours, starting at 10am and finishing at 10pm.

    g) What is the monetary loss to your organization? €_____

    h) What is the value added lost over that day in percentage, between 0% and 100%?_____%

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