**Eco Design preparatory Study - Smart Appliances**

**Task 7 Report - Policy options and Scenario Analysis**

**BEAMA Summary – the proposal**

1. For all appliances in scope and covered by existing Energy labelling regulation (EU) 2017/1369, an energy icon should be added on the energy label if the product complies with the criteria for energy smart functionality and possible additional technical requirements for supporting energy efficiency at the user level. Additional information such as the energy consumption in an energy smart mode, or network protocols supported could be added to the label or the product fiche.
2. For all appliances in scope and not covered by an existing Energy Labelling regulation, but covered by an existing Eco-design regulation, the product should have an energy smart icon attached if the product complies with the criteria of ‘energy smart’ functionality and possible additional technical requirements for supporting energy efficiency at the user level.
3. Appliances in scope and not under Energy labelling or Eco-design regulation and within scope (Residential energy storage systems – batteries and EV charging). For inclusion of these products, preparatory studies should be performed for possible inclusion under the Energy Labelling or Eco-design regulations.

*See table on next page for list of products in scope*

This appears to be a voluntary approach in such that manufacturers may label their products if they are compliant with the requirements of the label and after application or registration at an EU central body or with national bodies. Specific mandatory Energy Labelling could be: A smart appliance that is currently covered by an existing Energy labelling regulation, needs to comply with specific criteria for energy smart functionality to be allowed to use the ‘energy smart’ icon on the label. Thereby only appliances meeting these criteria would be allowed on the market with the Energy label for energy smart appliances. However, non-smart appliances would not be banned from the market. There seems a clear appreciation to protect consumer choice in purchasing smart/non-smart appliances.

Self-regulation is not considered any further as this is deemed as too challenging to reach agreement with such a broad range of industry players.

Mandatory options so far as they determine minimum requirements for all products in scope are also not considered any further, as this would block products from the market that are not ‘smart’. Although in the case of battery storage, given its sole purpose is to provide flexibility this may be a policy option following the proposed study.

A vertical approach to delivering measures for energy labelling seems to be favoured. This is to avoid generalising and simplifying the options available through smart functionality if a horizontal measure was applied across all products in scope. Vertical options are often favoured by industry as the regulation can then be adapted to the individual industry product group. In the case of Lot 33 there is the option to have differing functionality for different products. Vertical measures also do not have to be administratively cumbersome and in a lot of cases amendments may be applicable across a number of regulations for different products. But an approach like this would also protect any conflicts with existing eco-design and labelling requirements. Horizontal requirements are identified to maintain some commonality across the scope of products – this is outlined in the second section of the report.

**Potential conflicts with existing eco-design and labelling requirements**

Products selected to be part of the energy smart policy measures (as identified in the table), with existing relevant eco-design and/or energy labelling regulations may need to be investigated regarding confusing or even contradicting provisions that may emerge. The concrete example of Eco-design requirements under Lot 2 for water heaters in used in the report (also outlined in detail by BEAMA in our recent communication to the consultants). The existing regulation may need to be amended in order to avoid confusion of the end consumer as to the implication of the term ‘smart’ or whether other instruments such as q unique label can be a sufficient solution

***Table showing the Ecodesign and Energy Labelling coverage for appliances in scope of the policy options proposed***

|  |  |  |  |
| --- | --- | --- | --- |
| **Group** | **Energy smart appliance** | **Energy Labelling coverage** | **Eco-design coverage** |
| **Periodical appliances** | Dishwashers | Household dishwashers are covered by Reg No. 1059/2010 | Household dishwashers are covered by Reg No. 1016/2010 |
|  | Washing machines | Household washing machines are covered by Reg No. 1061/2010 | Household washing machines are covered by Reg.No 1015/2010 |
|  | Tumble dryers, with or without heat pump | Household tumble dryers are covered by Reg No. 392/2012 | Household tumble dryers are covered by Reg No. 932/2012 |
| **Energy storing appliances** | Electric storage water heaters (continuously heating storage) | Electric water heaters with rated heat output <70kw and hot water storage tank <500 litres with back-up immersion heater are covered by Reg No. 812/2013 | Electric water heaters with rated heat output <400kW and hotwater storage tank <2000litres with back-up immersion heater are covered by Reg No. 814/2013 |
| **Residential cooling and heating (heat pump based)** | HVAC cooling, with thermal storage | Air conditioner with rated capacity of <12kW are covered by Reg No.626/2011 | Air conditioner with rated capacity of <12kW are covered by Reg No. 206/2012 |
|  | HVAC heating, no storage | Air conditioner with rated capacity of <12kW are covered by Reg No 626/2011  Heat pump space heaters with rated heat output <70kW are covered by Reg No. 811/2013 | Air conditioner with rated capacity of <12kW are covered by Reg No 206/2012  Heat pump space heaters with a rated heat output <40kW are covered by Reg No. 813/2013 |
|  | HVAC heating, with thermal storage | Air conditioner with rated capacity of <12kW are covered by Reg NO.626/2011  Heat pump space heaters with a rated heat output<70kW are covered by Reg No. 811/2013 | Air conditioner with rated capacity of <12kW are covered by Reg No. 206/2012  Heat pump space heaters with a rated heat output <40kW are covered by Reg No. 813/2013 |
|  | Household refrigerating appliances | Electric mains-operated household refrigerating appliances with a storage volume between 10 and 1 500 litres are covered by Reg No 1060/2010 | Electric mains-operated household refrigerating appliances with a storage volume up to 1 500 litres are covered by Reg No. 643/2009 |
| **Tertiary cooling and heating (heat pump based)** | HVAC cooling, no storage | Not covered by Energy labelling | Cooling products with a rated cooling capacity <2MW are covered by Reg No. 2016/2281 |
|  | HVAC cooling, with thermal storage |
|  | HVAC heating, no storage | Air heating products with a rated heating capacity <1MW are covered by Reg No. 2016/2281 |
|  | HVAC heating, with thermal storage |
|  | Professional refrigeration | Professional refrigerated storage cabinets are covered by Reg No 2015/1094 | Professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers are covered by Regulation No.2015/1095 |
| **Joule based tertiary and residential cooling and heating** | Electric radiators, no inertia | No covered by Energy Labelling | Electric local space heaters <50kW for domestic <120kW for commercial are covered by Reg No. 2015/1188 |
|  | Electric radiators, with inertia | Not covered by Energy Labelling | Electric local space heaters <50kW for domestic, <120kW for commercial are covered by Reg No 2015/1188 |
|  | Boilers | Electric boiler space heaters and boiler combination heaters are covered by Reg No 811/2013 Electric water heaters with rated heat output <70kW are covered by Reg No 812/2013 | Electric boiler space heaters and boiler combination heaters are covered by Reg NO 813/2013 Electric water heaters with rated heat output <70kW are covered by Reg No. 814/2013 |
| **Residential energy storage systems** | Home batteries | Not covered by Energy Labelling | Not covered by Eco-design |
|  | Electric vehicle chargers | Not covered by Energy Labelling | Not covered by Eco-design |

**Potential requirements for harmonised standards to support regulation and policy options**

Eco-design and energy labelling regulations usual are accompanied by harmonised EU standards for the measurement method. This could come as a standardisation request from the commission.

Labelling options will ensure that specification and definitions used by manufacturers for energy smart functionality and interoperability are harmonised.

Any energy smart icon on a label will need to also protect other names for similar energy functions (e.g. smart appliance, DR ready, DSF capable), allowed the use of all these terms as long as appliances meet and comply with requirements.

Further information is provided on this and the potential; requirement for standardisation in the section covering interoperability.

**What is ‘energy smart’**

The term now used, refers to appliances which are capable of adapting their energy consumption pattern as a response to external stimuli (e.g. price signal, control signal) will be called ‘energy smart appliances). This replaces term Demand Side Flexibility (DSF) previously used in the task reports.

**Impact assessment of the policy options Vs do nothing (BAU)**

There are some interesting results when looking at the value of benefits from ‘energy smart’ appliances, per enabled appliance, per year if participating in day ahead electricity markets (ranges from €106 in 2020 and €46 in 2030 (table 6 p20). The benefit to the consumer can be seen to reduce over time as the saturation of the market increases (saturation effect), while the absolute value to the system increases.

Some appliances in scope stand out as providing continued value to the system and consumers even as saturation levels of ‘smart functionality’ in the market reach 100%, these include (electric storage water heaters (night storage), tertiary cooling – compressor defrost and HVAC cooling no storage/with thermal storage). This also implies other sources of flexibility (e.g industrial demand response) could also capture this value by offering flexibility with the same characteristics as those reviewed in this study for domestic. Arguably this therefore poses a significant market opportunity over the long term for these appliances as they provide continued system and importantly consumer value.

The review also demonstrates how types of flexibility (day ahead, grid congestion, ancillary services etc) and associated parameters of appliances (seasonality, day-night pattern, and shifting potential) significantly affect the value achieved. Therefore policy makers should carefully consider this when assessing which group of smart appliances to specifically support, as more benefit may be achieved from different appliances depending on the type of flexibility applied in the market and how this is delivered.

Ultimately the value that can be achieved from smart appliances in flexibility markets will be country or even regionally dependant. E.g. for regions with high penetrations of PV and heat pumps, the value of demand side flexibility for grid congestion management can be larger than the value for day ahead or imbalance markets, depending on the local situation.

**Cost assumptions**

These will be depending on a range of factors - how many products for energy smart functionality in that series are produced, and the existing features etc.

* A networked appliance only needing software modifications, testing, documentation etc 5-10€
* A non-networked appliance also needing a network connectivity module 10-20€

These costs are very much the upper bands, as some other studies revealed addition costs of only €1.70 and €3.30.

As an outlet industry reported that adding demand response to thermodynamic appliances (heat pumps and air conditioning) would raise the retail price between €100 and 200 including software adaptation and development, installation, intervention etc. Although this cost does include some R&D.

Costs will depend on a mandatory or non-mandatory approach and therefore the market penetration.

**Product categories and analysis**

Section 7.4 looks at reviewing the product categories and the full analysis in the whole preparatory study on the degree of flexibility that can be achieved. Table 7 (p34) is very useful in this case to summarise how the products in scope have been analysed.

**Thermal appliances** stand out as having high potential, for heating and cooling. However they pick up on the fact that for a lot of HVAC appliances controllers are separate to the appliance, in the example given a heat pump.



Here the controller, heat pump and flexibility of the thermal mass of the building are situated in different system components. The 3 core properties for ‘smartness’ are therefore spread cover different components which makes a clean definition of a thermal energy smart appliance challenging and complicates this in terms of the policy requirements for HVAC equipment.

They consider HVAC equipment with internal controller and flexibility (refrigeration continuous storage water heaters fit into this category). Electric radiators with inertia, residential heat pumps with thermal storage, non-residential heat pump with thermal storage, residential air conditioner with thermal storage and non-residential air conditioners with thermal storage also fit under this category under the condition that the controller is included as well (not always the case).

Since the study focuses on a single functional unit with all components delivered together, it is not possible to consider smart appliances which do not contain a controller implementing a flexibility interface. In the HVAC sector, however, the approach is quite often component-based instead of product-based: this means that several components (e.g. heat pump, controller, different room units.…) are combined according to the needs to the customer to create a working system. Although overall system can be ‘smart’, it is not possible to define requirements on an individual components basis. In general the approach in Eco-design is focuses on ‘products and has limitations in handling (component based) systems.

The **Energy Storage system** market also faces the same challenges as this is a component based market (typically battery pack, battery management system and inverter). The difference with this appliance is its core function is to provide flexibility therefore mandatory, **minimum requirements for residential energy storage systems should be further investigated.** Due to the infancy of the market the policy options are not considered further in this study but as with EV charging will require additional work. This should however look at relying on the requirement already previously developed within Lot 33 and any horizontal requirements transferred to this product. They expect a lot of inspiration will come from how the HVAC market is handled following this study.

EV charging while part of a home battery system, is categorised separately because the battery is not part of the charging system itself, and the main purpose of the battery is for mobility. Again this is a component based system.

**Demand response use cases**

Section 7.5 looks at the range of DR use cases that could be applied for appliances in scope. This also includes a number of examples from different countries where this use case has been applied:

1. **Explicit demand response** use case – the smart appliance communicates its flexibility status (availability, flexibility, ..) to an external party (grid operator, supplier, flexibility provider,…) the smart appliance allows the external party to switch ON/OFF or modulate the electricity consumption / production within certain (comfort) limits.
2. **Implicit demand response** use case - the appliance received variable electricity price information from an external party (grid operator or supplier). Within the comfort boundaries, the smart appliance decides itself to reduce/ increase electricity consumption or production in order to minimise the electricity consumption cost or to maximise the electricity production fee.
3. **Local optimal energy consumption** use case – the appliance tries to make optimal use of the locally produced energy (e.g. from PV panels, micro CHP). A local controller has access to local measurements (e.g. net consumption, PV production via smart meter) and can decide at which moment in time it is beneficial to reduce/ increase electricity consumption. The smart appliance communicates its flexibility status (availability, flexibility…) to the controller which can decide to switch ON/OFF or modulate the electricity consumption of the appliance. Here there is no interaction with an external party.

*NOTE for BEAMA connected homes group – here they specifically reference the measurement of PV production via smart metering. A project is ongoing in the connected homes group to look at how this data may be obtained by a ‘controller/ CAD’ in the UK SMETs system. Important this is clarified now we are considering appliance use cases at this detail and associated policy options.*

1. **Standalone demand response** use case – the appliance has built-in functionality to measure a grid parameter, typically voltage and/or frequency. When the specified grid parameter exceeds a certain value, the smart appliance adapts it electricity consumption/ production in a way which is beneficial for the grid.

**Smart Appliance interfaces and associated architectures**

The ability for appliances to operate in a flexibility market across a range of evolving business cases is something that has been raised as an important concern, therefore the scope of the policy recommendations will be on interface requirements ONLY not on specific business case/ use case interoperability.

The report Section 7.5.4 considers the different types of interface architecture, for bi-directional communication, uni-directional communication (e.g. of price data) and internal measurement and communication (e.g. voltage measurement and appliance response).

This is a useful section in understanding the interface requirements that would be considered under any measure for Eco-design and Energy labelling, also the placement of the CAD and smart metering system in the architectures.

This section concludes to suggest that any interface needs to be versatile enough to support multiple business cases. And direct flexibility provides a good building block for this versatility as other architectures (with external controllers indirect coms ..) can be implemented with this. See the main report for further explanation. **Therefore the direct flexibility interface is considered an appropriate topic for policy requirements.**



**Interoperability**

Although connectivity of appliances for comfort and remote control reasons is beyond the scope of the study, the market trend shows that different in house communication technologies do not restrict streamlining all communication via the IP protocol (evolving cases where the control is by means of remote access via a smart phone, via the cloud). **This reasoning will be used to focus in the policy recommendations on a common data model and NOT on a common or a list of common combination protocols (Zigbee, knx, ZWave etc).** This seems agreeable with BEAMAs position and should ensure that regardless of protocol used appliances can communicate with each other and will accommodate innovation in software available.

HEMs, CEMs (this is similar to the UK CAD), BACs and smart meters are out of scope. However, they should be interoperable. It is recommended therefore that interoperability with CEMS and HEMS and metering systems are accounted for during the development of a common data model for energy smart appliances. They make note of the lack of existing standards for CEMs and HEMS and BAS and the broad diversity of smart standard meter implementation and this could be a limiting factor. However, the recommendation seems to imply standardising at the appliance level should attempt to break the ‘chicken and egg’ discussion around what should be implemented/ standardised first.

**To speed up the uptake of demand response from the energy smart appliances and avoid possible barriers related to the roll-out of smart meters, and CEM/HEM, the recommendation is that individual appliances should be able to participate in demand response services without the presence of a CEM/ HEM or a smart meter.**

Supporting a common data model means that the application protocol provided at the communication interface makes use of a data model that complies with imposed reference ontology. A compliant data model can be mapped one-to-one to the reference ontology. A candidate for a reference ontology for a common data model is SAREF/ SAREF4ENER. The mapping of a specific data model to the reference ontology should be standardised. Compliance test should be part of the performance standards.

To best guarantee interoperability for customers a single data model and single standardised application protocol must be supported.

It is proposed that this could be proposed by industry within a determined time frame, however if this is not achievable it could be the subject of a standardisation mandate.

**Technical requirements**

Part 11 of the report covers technical requirements (options) for a smart appliances. And looking at how these may vary across the different appliance categories. Here they look at the functional, interoperability, interface and information requirements for the appliance categories and where some horizontal measure can be identified.

Members are recommended to read this section and check the assumptions made against their product categories.

The data model standardised needs to support all the technical requirements outlined in this section of the report.