Ecodesign Lot 33 Preparatory study Smart appliances*
Task 7 – Policy and scenario analysis

Task 7 – Technical requirements

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"Delivering a New Deal for Energy Consumers"
Some extracts ...

COM(2015) 339 final, 15.7.2015

» “give consumers a wide choice of action”
» “the choice on participating in demand response must always stay with the consumer”
» “standards and interoperability are important also for the in-home communication between a smart appliance and energy management systems so that demand-response-ready, in-home equipment can be easy to install and operate. Industry needs to finalise and apply such standards quickly and should be supported in this”
Part II: Functional requirements

“Delivering a New Deal for Energy Consumers”
Some extracts ...

» “the data collection and processing party in the context of smart metering systems or other services empowering consumers to act should provide direct access to these data to the customer and any third party designated by the consumer”

» “for value-added services, only third parties authorised by the consumer must have access to consumer's consumption and billing data”

» “making sure smart home appliances and components are fully interoperable and easy to use ... with the recommended functionalities to maximise their benefit to consumers”
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Part II: Functional requirements

7.8.1 The user should have the possibility to enable and disable the energy smart functionality in the user settings - horizontal
The energy smart functionality is disabled by default - horizontal

» Enabling energy smart functionality requires manual interaction or confirmation from the user;

» Also if an energy manager or other service provider is automatically detected
The user always has the possibility to overrule an external energy smart command - horizontal

However, this is no protection against obligations in a contract with an external party
The smart appliance should fall back to standalone operation when the energy smart functionality fails - horizontal

- Standalone operation = operation as if energy smart functionality is disabled

- Generic horizontal principle, but returns in the specific requirements regarding the appliance behavior i.f.o. the instruction set
A smart appliance should have a minimum amount of flexibility - **vertical**

- Level playing field and avoidance of free riding
- Guarantee to user regarding minimum added value
7.8.5 A smart appliance should have a minimum amount of flexibility - **vertical**

**Periodical appliances (cat I):**

» program deadline of up to **at least 24h** in the future
7.8.5 A smart appliance should have a minimum amount of flexibility - vertical

Thermal appliances with internal flexibility (cat IIa):

» the amount of flexibility can be expressed as the amount of energy between upper and lower comfort limit

» TBD per appliance type (including test procedure)
A smart appliance should have a minimum amount of flexibility - *vertical*

**Thermal appliances without internal flexibility (cat IIb):**

- a “reference” setup will be defined per appliance type
- in the “reference” setup the same approach as in category Ila will be used
A smart appliance should have a flexibility quantification functionality - vertical

**What?**
- indicate current status
- indicate the flexibility in the (near) future

**Why?**
- planning purposes

**Why vertical?**
- the type of flexibility is very different in appliance categories
A smart appliance should have a flexibility quantification functionality - vertical

Periodical appliances: 3 situations

- **SCHEDULED**
  - flexibility = program + interruptibility + program deadline

- **ON**
  - flexibility = program + interruptibility + program deadline + current status in program

- **OFF**
  - flexibility = NONE

Program deadline
Current status in program
User configuration time
A smart appliance should have a flexibility quantification functionality - **vertical**

**Thermal appliances: power flexibility graph**

- $P_{\text{nominal}}$
- $T_{\text{max}}$
- $T_{\text{target}}$
- $T_{\text{min}}$
A smart appliance should have a flexibility quantification functionality - **vertical**

**Thermal appliances: power flexibility graph**

- $P_{\text{nominal}}$
- $T_{\text{max}}$
- $T_{\text{target}}$
- $T_{\text{min}}$
A smart appliance should have a flexibility quantification functionality - *vertical*

**Thermal appliances: power flexibility graph**

- $P_{\text{nominal}}$
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A smart appliance should have a flexibility quantification functionality - vertical

Thermal appliances: power flexibility graph
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A smart appliance should have a flexibility quantification functionality - vertical

Thermal appliances: power flexibility graph

- $P_{\text{nominal}}$
- $T_{\text{max}}$
- $T_{\text{target}}$
- $T_{\text{min}}$
A smart appliance should have a settlement support functionality - horizontal

What?
» settlement = validation/verification of reaction of an appliance on an external command

Why?
» eases verification of contractual obligations between consumer and external partner
A smart appliance should have a settlement support functionality - horizontal

Why via the smart meter was not the recommendation?
A smart appliance should have a settlement support functionality - horizontal

Why via the smart meter was not the recommendation?

Energy smart appliances should be able to function without the presence of a Smart Meter
A smart appliance should have a settlement support functionality - horizontal

**Recommendation:**

» Appliance records its historical power consumption in memory

» Optionally, records received instructions

» Format, resolution, accuracy and time scale TBD

» Based on measurements or based on estimate as long as within specification
A smart appliance should make energy consumption data available to the user - horizontal

- Energy smart functionality requires the collection of appliance energy consumption data (see, e.g., req. 7.8.7)
- Low cost to make this available to the user
- Can stimulate the user to take energy efficiency measures
- Although not strictly related to energy smartness;
  - energy efficiency is main goal of the Ecodesign Directive;
  - in line with the ‘Delivering a New Deal for Energy Consumers’ communication;
  - added value even when the appliance is not used smart.
A smart appliance should have a maximum surplus energy consumption - **vertical**

- Potential surplus energy consumption:
  - Standby losses due to extra communication and processing fall under Ecodesign process dealing with standby losses; not further discussed
  - Shifting energy may result in operating points deviating from the most energy efficient ones
    - From system point justified by increased share RES
    - From user point justified by flexibility revenues
    - But: requirements needed to avoid unjustified and/or unexpected excessive losses
A smart appliance should have a maximum surplus energy consumption - vertical

- Option 1: information requirement
- Option 2: maximum surplus energy consumption
- Option 3: user configurable maximum surplus energy consumption limit
- Option 4: conservative default value for configurable maximum surplus energy consumption limit

Recommendation: option 4
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The communication interface should have “resource discovery” functionality - horizontal

- To discover devices in a network providing specific functionality
- E.g., Bonjour/zeroconf, SSDP, DIAL, ...

- Requirement: energy smart appliances must support one or several of an agreed on list of resource discovery protocols

- Resource discovery protocols typically operate in local networks
  - Extension to cloud based discovery is a technical gap that should be addressed
The communication interface of a smart appliance should support a common data model:

- i.e., the data model of the appliance’s application protocol can be mapped one-to-one to the reference ontology in a standardized way;
- the common data model must support all actions/instructions and responses/events defined in the requirements;
- an appliance must support the actions/instructions and responses/events specific for the type of appliance (vertical);
- the appliance may offer additional data models.

A candidate for such reference ontology is SAREF/SAREF4ENER
The communication interface should support a common data model and application protocol - horizontal

- Options for the application protocol used over the direct flexibility interface:
  - Option 1: support at least one specific standardized application protocol
  - Option 2: support at least one standardized application protocol selected from list of standardized application protocols
  - Option 3: may use any application protocol

- Option 1 is recommended: best guarantee for the user to achieve interoperability

- The appliance may offer additional application protocols
The communication interface should support a common data model and application protocol - horizontal

A possible way forward:

- The adoption of data model and application protocol proposal from the industry itself, within a TBD timeframe

- In case no consensus can be achieved in the defined timeframe, the data model and application protocol can be subject of a standardization mandate
The communication interface should support cybersecurity and privacy requirements for connected devices - horizontal

» Cyber security and data protection is broader IoT topic

» The E.C. is reviewing the cybersecurity strategy to strengthen Europe’s resilience: see actions defined in communication COM(2017) 228 final of 10.5.2017

» Energy smart appliances must therefore comply with the prevailing EU cyber security and data protection legislation
The communication interface should support an upgradability functionality - horizontal

- Appliances have a typical lifetime length that surpasses that of software manifold.

- It is required that the software of those appliances can be remotely updated to prevent avoidable and early decommissioning of appliances due to outdated software.

- Improves cybersecurity: allows patching of security vulnerabilities
The communication interface should support communication with local and external energy management systems - horizontal

The energy smart appliance can receive instructions from both:
- local energy management system
- external party (cloud model)

Both option must be supported:
- The appliance must be able to communicate with a local controller without making use of the public internet
- The direct flexibility interface of the appliance must be accessible from the internet
  - E.g., via the manufacturers cloud platform or via cloud enabled resource discovery

Energy smart appliances should be able to receive instructions from a controller inside and outside the customer home network
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The smart appliance should have a direct flexibility interface - horizontal

Direct flexibility interface: \textbf{MANDATORY}

Indirect flexibility interface: \textbf{OPTIONAL}

Internal measurement interface: \textbf{OUT of SCOPE}
Part IV: Interface requirements

7.10.3 The direct flexibility interface should support a minimum instruction set - vertical

Periodical appliances:

1. start command
2. pause command
3. resume command
4. get flexibility status command
5. get historical power consumption data
6. user interaction warning
Part IV: Interface requirements

7.10.3 The direct flexibility interface should support a minimum instruction set - vertical

Thermal appliances:

1. set power command
2. resume normal
3. resume normal + user interaction warning
4. get flexibility status command
5. get historical power consumption data

Graph showing time, power, and temperature with key points indicating the different states and commands.
7.10.4

In case the smart appliance supports an indirect flexibility interface, it should comply with minimum interoperability requirements - vertical

- indirect flexibility interface (variable prices) is optional
- standardized common price format, aligned with smart meter format(s)
- support for variety of tariff structures:
  - hourly day-ahead
  - time-of-use
  - consumption blocks
  - flat rate

Direct flexibility interface: MANDATORY
Indirect flexibility interface: OPTIONAL
Internal measurement interface: OUT of SCOPE
Part IV: Interface requirements

7.10.5 In case the smart appliance supports an indirect flexibility interface, the appliance should make optimal use of price variability - vertical

» Ensure for consumers that the appliance is capable of scheduling the power consumption for lower overall cost
» only possible in vertical approach for different appliance groups
» technical details still TBD
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The energy smart functionality should be explained in the technical documentation - horizontal

- detailed explanation of the implemented functions
- explain impact of energy smart functionality on comfort and energy efficiency
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We would like to hear from you. Thank you for your input!