Code of Conduct on energy management related interoperability of Energy Smart Appliances

Content

1. Introduction

The energy supply in the EU is increasingly characterized by a decentralized supply landscape in which local (PV systems), regional (neighbourhoods, communities, DSOs) as well as supraregional supply elements must interlock. In addition, more and more shares of energy generation are being replaced by renewable sources that are dependent on wind and weather. The energy system must be able to deal with this variable supply, amongst others by intelligently exploiting demand side flexibility.

Expectations are that Energy Smart Appliances (ESA) will contribute considerably to demand flexibility of households in the European Union in the near future, depending on the penetration level. This potential needs to be unlocked by EU energy and environmental policies. It is important that the Demand Side Flexibility of ESA is maximised by ensuring interoperability and allowing the participations of the relevant actors.

To help all parties to address the issue of Demand Side Flexibility ESA manufacturers are invited to sign this Code of Conduct. This Code of Conduct sets out the basic principles to be followed by all parties involved in developing and producing ESA, operated in the European Community.

The other relevant actors (like service providers, network operators, energy management system providers, equipment and component manufacturers) are invited to acknowledge this Code of Conduct.

2. Scope

This Code of Conduct covers the following electrical (household) **appliances**:

- White goods: washing machines, tumble driers, washer-driers, dishwashers;
- Heat pumps (delivering heat/cold through air or water), local space heaters, water heaters (electric storage, heat pump storage, electric instantaneous), ventilation;

and the following **use cases** from EN 50631:

- Flexible start for White Goods (or other devices)
- Monitoring of Power Consumption
- Limitation of Power Consumption
- Incentive Table based Power Consumption Management
- Manual operation *(provisioning of necessary information in case of user driven manual operation of ESA)*

Annex 1 provides the mapping of use cases to the appliances. A description of the use cases can be found in Chapter 7 of EN 50631-1.

3. Aim

To increase the number of interoperable ESA that are placed on the EU market.

4. Commitment

Signatories of this Code of Conduct agree to make all reasonable efforts to:

a) Ensure that all new models of connected appliances placed on the Union market as of one year after signing the Code of Conduct have implemented the applicable use cases for the specific ESA according to Annex 1 and Annex 2.

b) Ensure the implementation of a standardised Open Application Programming Interface / Open Communication Protocol like EN50631 to enable the information exchange for the applicable use cases (see point a).

c) Apply state of the art and open security mechanisms for the open communication protocol used (see point b) to: (1) secure the communication, (2) support the installation, administration and configuration (including the assignment of the system roles), (3) ensure proper authorisation for accessing the ESA, and (4) provide the control over the usage of private data.

d) Ensure that all relevant information elements used in the implemented use cases (see point a) as well as in the open protocol (see point b) have a corresponding SAREF representation, fully compliant with the SAREF framework of ontologies according to the technical specification ETSI TS 103 264 (SAREF core) and ETSI TS 103 410 series (SAREF extensions) (see Annex 2).

e) Provide end-users with information on the use cases, including the conditions needed to use them, how to activate them and the benefits.

f) Cooperate with the European Commission and Member States authorities in an annual review of the scope of the Code of Conduct.

g) Publish the Code of Conduct signed form (Annex 5) on the manufacturer website.

h) Indicate the compliance with the Code of Conduct when registering new ESA models in the EPREL database.

Each version of the Code of Conduct, once published, is a standalone document that supersedes all previous versions, and neither refers nor depends on such versions. When a new version of the Code of Conduct comes into force, it is assumed that all signatories will remain signatories for the new version. However, any signatory may withdraw from the Code of Conduct with no penalty.

5. Monitoring and updating

The status of the Code of Conduct will be discussed at least once a year by the signatories, the European Commission, Member States and their representatives, facilitated by the European Commission in order to:

a) Evaluate the level of compliance and the effectiveness of the Code of Conduct in achieving its aim.

b) Evaluate the current Code of Conduct and the need for future developments (such as additional ESA and uses cases) with a view to agreeing actions and/or amendments to the Code of Conduct.

Annexes

Annex 1 - Mapping of use cases to Energy Smart Appliances

	Flexible start for White Goods	Monitoring of Power Consumption	Limitation of Power-Consumption	Incentive Table based Power Consumption Management	Manual operation
White goods					
• **washing machines, tumble driers, washer-driers, dishwashers**	M	O	O	n/a	M
Heating, cooling, and ventilation appliances					
• **heat pumps (delivering heat/cold through air or water)**	n/a	M	M	M	M
• **local space heaters**	n/a	M	M	M	M
• **water heaters (electric storage, heat pump storage, electric instantaneous)**	n/a	M	M	M	M
• **ventilation**	n/a	M	M	n/a	M

M: mandatory; O: optional, n/a: not applicable

Table A1.1. Mapping of use cases to white goods and heating/cooling/ventilation appliances

Annex 2 - Use Cases, minimal core data elements and SAREF / SAREF4x representation

Note:

The use cases and core data elements are described in EN50631-1. The SAREF and SAREF4ENER representations are described in detail in ETSI TS 103 264 and ETSI TS 103 410-1.

1. Use Case: Flexible Start for White Goods

The Flexible Start use case offers flexibility by programming the Energy Smart White Good to get the work done between the **earliest start time**, e.g. 11:00 am and a **latest end time**, e.g., 8:00 pm. The Energy Manager evaluates the overall situation at home and then chooses the best **start time** for the Energy Smart White Good.

While the Energy Smart White Good has not yet started, the Energy Manager can change its start time at any time. To be able to find optimal start times for the Energy Smart White Good, the Energy Manager needs to know it's expected "power sequence" (time-dependent power consumption) with constraints such as its **earliest start time**, **latest end time**, and **interrupt options (pausable, stoppable)**.

The Energy Smart White Good may also offer the Energy Manager to select an alternative power sequence like an Eco mode with longer runtime but reduced power consumption or a fast mode with higher consumption in a shorter runtime.

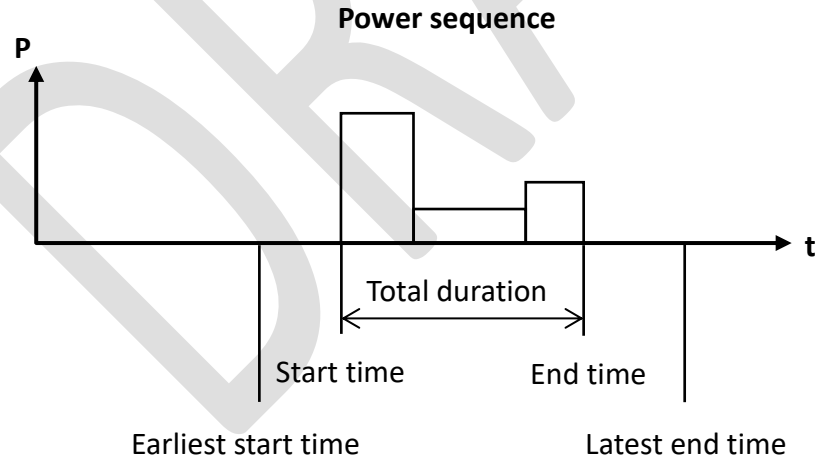

Figure A2.1. Properties of a scheduled power sequence

106 The *Flexible Start* use case requires following core data elements:

Core data elements:	**Description**	**SAREF triple representation**
Alternatives of Powersequences	Allows more than 1 powersequence	?powerSequence <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/PowerSequence> .
sequenceId	Each power sequence includes	?powerSequence <https://saref.etsi.org/saref4ener/sequenceID> ?sequenceID .
state	An information about actual status	?powerSequence <https://saref.etsi.org/core/hasState> ?state .
activeSlotNumber	Which slot is the actual one right now	?powerSequence <https://saref.etsi.org/saref4ener/activeSlotNumber> ?activeSlotNumber .
sequenceRemoteControllable	Is the sequence remote controllable by the Energy Manager or is the power sequence only informative, e.g. manual operation	?powerSequence <https://saref.etsi.org/saref4ener/sequenceRemoteControllable> ?sequenceRemoteControllable .
startTime	Actual start time of the power sequence	?powerSequence <https://saref.etsi.org/saref4ener/StartTime> ?startTime .
endTime	Actual end time of the power sequence	?powerSequence <https://saref.etsi.org/saref4ener/EndTime> ?endTime .
earliestStartTime	Earliest start time	?powerSequence <https://saref.etsi.org/saref4ener/EarliestStartTime> ?earliestStartTime .
latestEndTime	Latest end time	?powerSequence <https://saref.etsi.org/saref4ener/LatestEndTime> ?latestEndTime .
isPausable	Allowed to be paused by the Energy Manager during runtime, e.g. interrupt heating phase	?powerSequence <https://saref.etsi.org/saref4ener/isPausable> ?isPausable .
isStoppable	Allowed to be stopped by the Energy Manager during runtime	?powerSequence <https://saref.etsi.org/saref4ener/isStoppable> ?isStoppable .
valueSource	Measured, empirical, …	?powerSequence <https://saref.etsi.org/saref4ener/valueSource> ?valueSource .
powerTimeSlots	No of slots, each representing a specific demand in a phase of the runtime like pre-washing, heating, …	?powerSequence <https://saref.etsi.org/core/consistsOf> ?slot_1 . ?slot_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/Slot> .
slotId	Each slot includes	?slot_1 <https://saref.etsi.org/saref4ener/slotNumber> ?slotNumber_1 .
defaultDuration	Duration of the slot	?slot_1 <https://saref.etsi.org/saref4ener/DefaultDuration> ?defaultDuration_1 .

powerMin	Min power consumption, if applicable	?slot_1 <https://saref.etsi.org/core/consistsOf> ?powerMin_1 . ?powerMin_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/PowerMin> . ?powerMin_1 <https://saref.etsi.org/core/relatesToMeasurement> ?measurementMin_1 . ?measurementMin_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/core/Measurement> . ?measurementMin_1 <https://saref.etsi.org/core/isMeasuredIn> <http://www.ontology-of-units-of-measure.org/resource/om-2/watt> . ?measurementMin_1 <https://saref.etsi.org/core/hasValue> ?valueMin_1 .
power	Typical consumption of the slot	?slot_1 <https://saref.etsi.org/core/consistsOf> ?power_1 . ?power_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/Power> . ?power_1 <https://saref.etsi.org/core/relatesToMeasurement> ?measurement_1 . ?measurement_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/core/Measurement> . ?measurement_1 <https://saref.etsi.org/core/isMeasuredIn> http://www.ontology-of-units-of-measure.org/resource/om-2/watt . ?measurementExpectedValu_1 <https://saref.etsi.org/core/hasValue> ?value_1 .
powerMax	Max power consumption, if applicable	?slot_1 <https://saref.etsi.org/core/consistsOf> ?powerMax_1 . ?powerMax_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/PowerMax> . ?powerMax_1 <https://saref.etsi.org/core/relatesToMeasurement> ?measurementMax_1 . ?measurementMax_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/core/Measurement> . ?measurementMax_1 <https://saref.etsi.org/core/isMeasuredIn> <http://www.ontology-of-units-of-measure.org/resource/om-2/watt> . ?measurementMax_1 <https://saref.etsi.org/core/hasValue> ?valueMax_1 .

Table A2.1 Mapping of Flexible Start use case with SAREF triples.

2. Use Case: Monitoring of Power Consumption

   To be filled (Description + Table A2.2)

3. Use Case: Limitation of Power Consumption

   To be filled (Description + Table A2.3)

4. Use Case: Incentive Table based Power Consumption Management

   To be filled (Description + Table A2.4)

5. Use Case: Manual operation (provisioning of necessary information in case of user driven manual operation of ESA)

   To be filled (Description + Table A2.5)

Annex 3 - Example of SAREF4x triples with protocol SPINE-IoT (informative)

As an example, for the use case Flexible start for white goods, equipped with real data, the following table maps the SPINE IoT data model/protocol (EN50631-3-1 and EN50631-4-1) with the corresponding SAREF and SAREF4ENER triples.

SPINE IoT power sequence in Jason	SAREF triple representation
# Alternatives of Powersequences	?powerSequence <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/PowerSequence> .
sequenceId: 1	?powerSequence <https://saref.etsi.org/saref4ener/sequenceID> ?sequenceID “1”^^xsd:unsignedInt .
state: scheduled	?powerSequence <https://saref.etsi.org/core/hasState> ?state “scheduled”^^ xsd:string .
activeSlotNumber: 0	?powerSequence <https://saref.etsi.org/saref4ener/activeSlotNumber> ?activeSlotNumber “0”^^xsd:unsignedInt .
sequenceRemoteControllable: true	?powerSequence <https://saref.etsi.org/saref4ener/sequenceRemoteControllable> ?sequenceR emoteControllable “True”^^xsd:boolean .
startTime: "2021-06-24T12:00:00Z"	?powerSequence <https://saref.etsi.org/saref4ener/StartTime> ?startTime “2021-06-24T12:00:00Z”^^xsd:dateTime .
endTime: "2021-06-24T13:40:00Z"	?powerSequence <https://saref.etsi.org/saref4ener/EndTime> ?endTime “2021-06-24T13:40:00Z”^^xsd:dateTime .
earliestStartTime: "2021-06-24T06:20:00Z"	?powerSequence <https://saref.etsi.org/saref4ener/EarliestStartTime> ?earliestStartTime “2021-06-24T06:20:00Z”^^xsd:dateTime .
latestEndTime: "2021-06-24T19:00:00Z"	?powerSequence <https://saref.etsi.org/saref4ener/LatestEndTime> ?latestEndTime “2021-06-24T19:00:00Z”^^xsd:dateTime .
isPausable: false	?powerSequence <https://saref.etsi.org/saref4ener/isPausable> ?isPausable “False”^^xsd:boolean .
isStoppable: false	?powerSequence <https://saref.etsi.org/saref4ener/isStoppable> ?isStoppable “False”^^xsd:boolean .
valueSource: ”empiricalValue”	?powerSequence <https://saref.etsi.org/saref4ener/valueSource> ?valueSource “empiricalValue”^^xsd:string .
powerTimeSlots	?powerSequence <https://saref.etsi.org/core/consistsOf> ?slot_1 . ?slot_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/Slot> .
slotId: 1	?slot_1 <https://saref.etsi.org/saref4ener/slotNumber> ?slotNumber_1 “1”^^xsd:unsignedInt .

		defaultDuration: "00:23:00"	?slot_1 <https://saref.etsi.org/saref4ener/DefaultDuration> ?defaultDuration_1 “00:23:00”^^xsd:duration .
		powerMin: 1800	?slot_1 <https://saref.etsi.org/core/consistsOf> ?powerMin_1 . ?powerMin_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/PowerMin> . ?powerMin_1 <https://saref.etsi.org/core/relatesToMeasurement> ?measurementMin_1 . ?measurementMin_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/core/Measurement> . ?measurementMin_1 <https://saref.etsi.org/core/isMeasuredIn> <http://www.ontology-of-units-of-measure.org/resource/om-2/watt> . ?measurementMin_1 <https://saref.etsi.org/core/hasValue> ?valueMin_1 “1800”^^xsd:unsignedInt .
		power: 2000	?slot_1 <https://saref.etsi.org/core/consistsOf> ?power_1 . ?power_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/Power> . ?power_1 <https://saref.etsi.org/core/relatesToMeasurement> ?measurement_1 . ?measurement_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/core/Measurement> . ?measurement_1 <https://saref.etsi.org/core/isMeasuredIn> http://www.ontology-of-units-of-measure.org/resource/om-2/watt . ?measurement_1 <https://saref.etsi.org/core/hasValue> ?value_1 “2000”^^xsd:unsignedInt .
		powerMax:2500	?slot_1 <https://saref.etsi.org/core/consistsOf> ?powerMax_1 . ?powerMax_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/saref4ener/PowerMax> . ?powerMax_1 <https://saref.etsi.org/core/relatesToMeasurement> ?measurementMax_1 . ?measurementMax_1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <https://saref.etsi.org/core/Measurement> . ?measurementMax_1 <https://saref.etsi.org/core/isMeasuredIn> <http://www.ontology-of-units-of-measure.org/resource/om-2/watt> . ?measurementMax_1 <https://saref.etsi.org/core/hasValue> ?valueMax_1 “2500”^^xsd:unsignedInt .

125 Table A3.1. Mapping of SPINE IoT protocol to SAREF triples.

Annex 4 - Aim of Interoperability (informative)

To enable users to buy ESA from manufacturer A and replace them at any time without any restrictions with an equivalent appliance from manufacturer B, ESA must be interoperable to enable exchangeability. This requires common use cases and common information exchange. In order for current and future systems to be able to communicate with each other, common semantics are required with regard to the information that must be exchanged between the individual actuators in an interoperable manner.

This Code of Conduct therefore references the Smart Grid Architecture Model (SGAM) layer model of the Smart Grid Coordination Group (EU mandate M490, 2012 and 2014) and specifically the layers: “High Level Use Cases” (sublayer of the “Business Layer”), the “Functional Layer” and the “Information Layer”. This means that this Code of Conduct focusses on available and proven use cases from a selection of standards like EN 50631 and the definition of information necessary to execute these use cases. This information is described in a human readable and semantically interoperable way in an ontology.

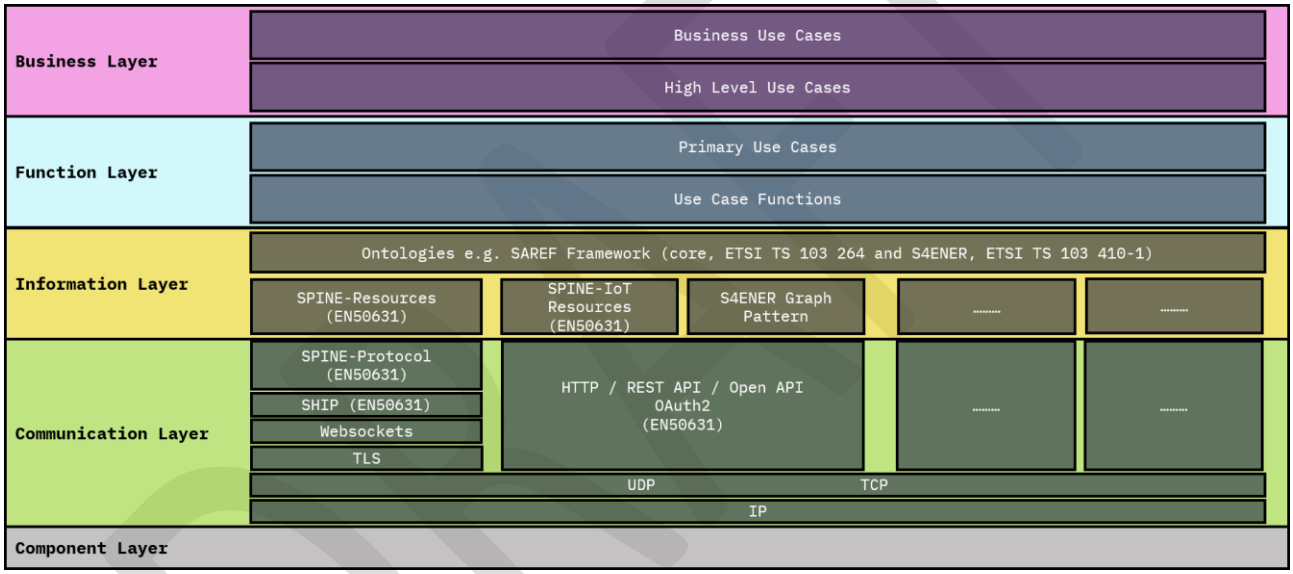

Figure A4.1. Code of Conduct reference layer model,
(based on SGAM layer model and CENELEC standard EN50631, 2023)

The SAREF (Smart Applications REFerence) ontology framework, driven by ETSI (European Telecommunication Standardization Institute) and the European Commission, is used at the Information Layer. It is chosen because it is a mature, living standard, open and actively managed solution to ensure interoperability on the long term. SAREF can be extended to cover other new use cases.

The Code of Conduct does not address the “Communication Layer”, although it is essential for the exchange of information. There are already a large number of communication standards and interfaces, and the future will show further developments. These can be mapped at the “Information Layer” using the SAREF ontology framework.

This allows manufacturer to implement standards like EN50631 to be fully compliant with this Code of Conduct.

Annex 5 - Signing form

Code of Conduct on energy management related interoperability of Energy Smart Appliances

SIGNING FORM

The organisation …….
signs the Code of Conduct on Energy Smart Appliances and commits itself to abide to the principles described in Chapter 3 “Commitment” for the products described in Chapter 1 “Appliances” it places on the market as of one year after the date of signing.

The organisation, through regular upgrade reports, will keep the European Commission informed on the implementation of the Code of Conduct on Energy Smart Appliances.

For the organisation,
person authorised to sign:

Name: ……
Function: ……
Address: ……
Tel: ……
Email: ……
Date: ……

Signature ……

Please send the signed form to:

XX
European Commission - DG XX

E-mail: