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

Task 7 – Context and strategic decisions

Project team at stakeholder workshop 14 September 2017:
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Philippe Rivière - Armines/MINES Paris-Tech

*Under multiple framework contract N°ENER/C3/2012-418-Lot N°1

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Enabling uptake of smart appliances

interests of the customers of smart appliances

interests of the manufacturers of smart appliances

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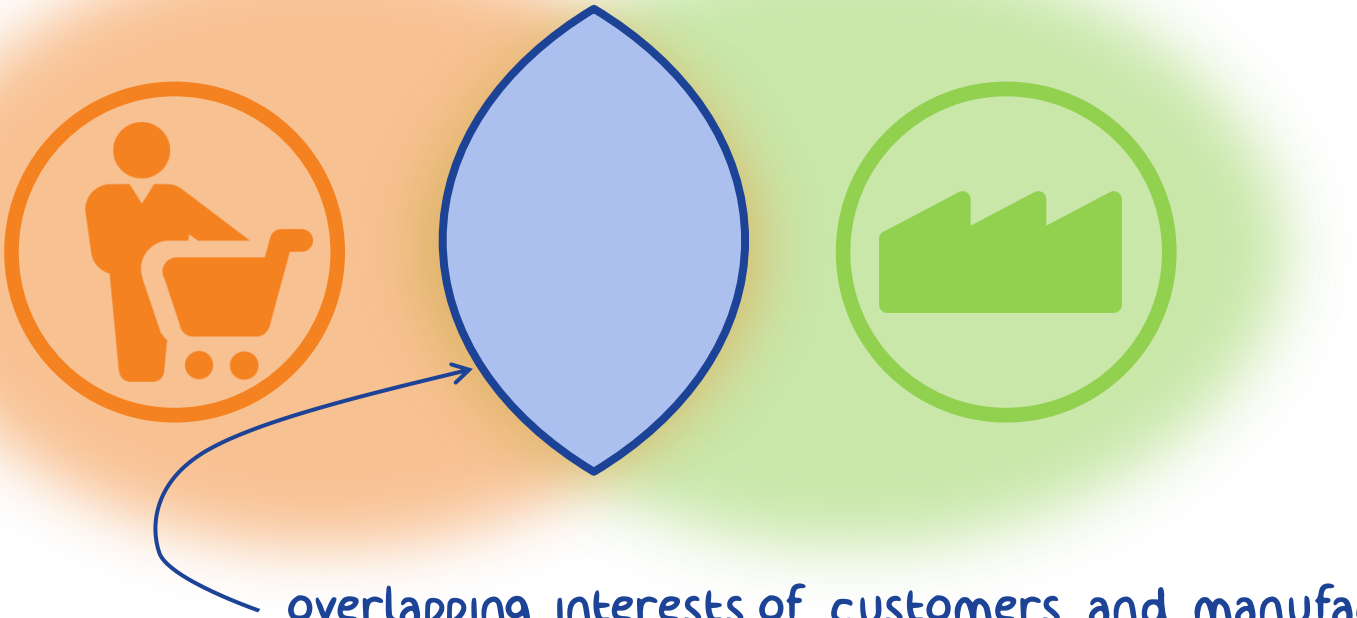
Enabling uptake of smart appliances



Enabling residential demand response

interests of users of flexibility: aggregators, suppliers, grid operators

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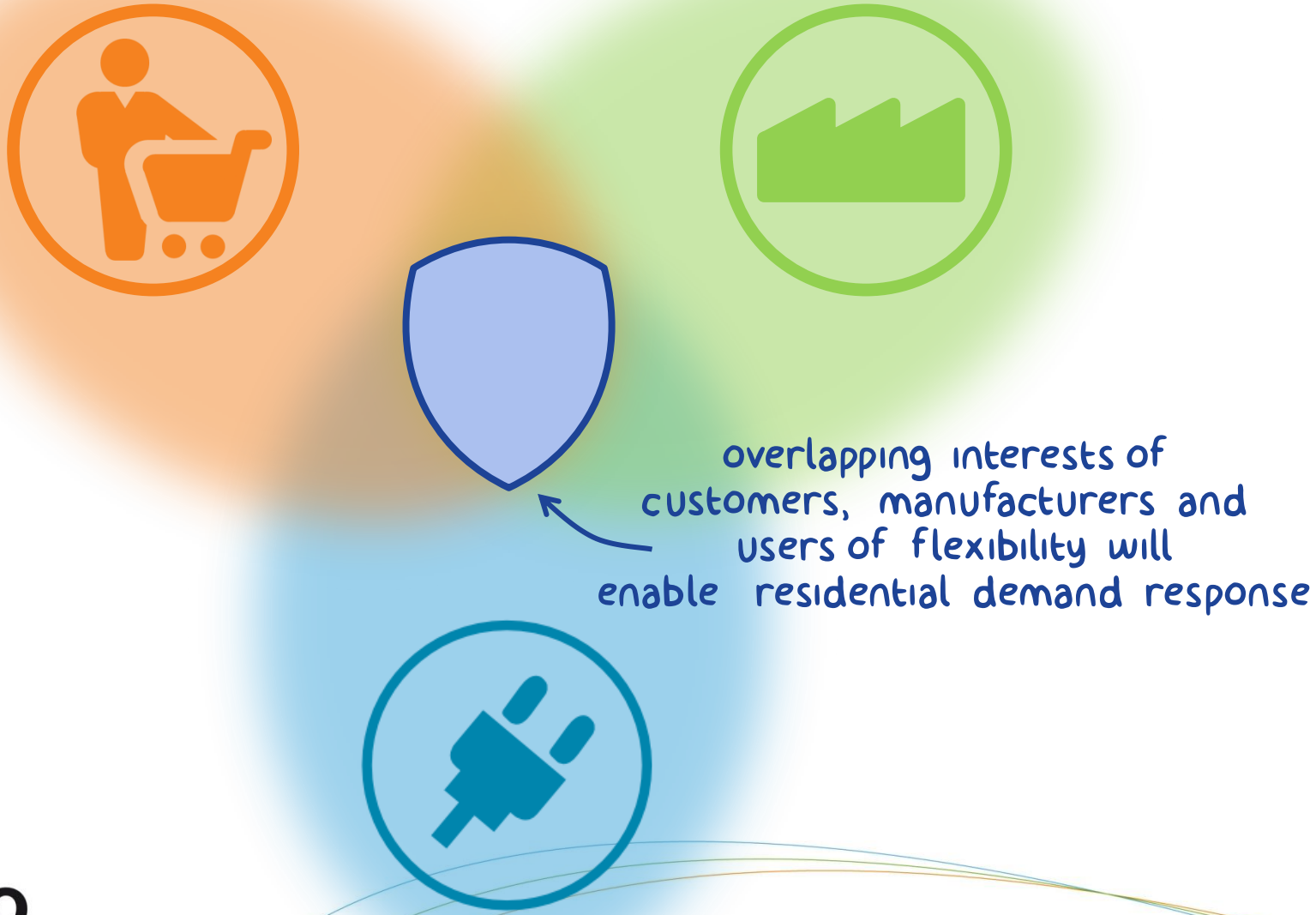
Enabling residential demand response



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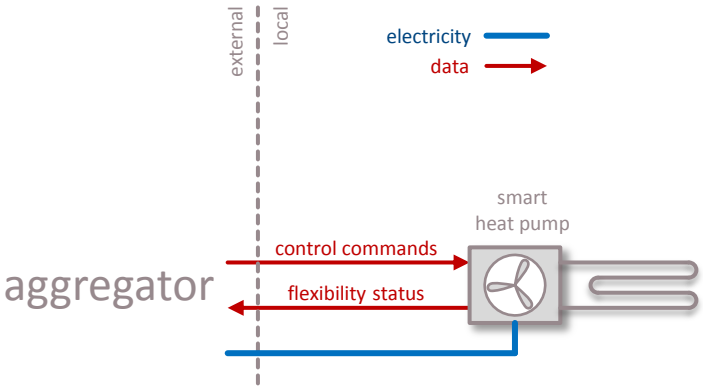
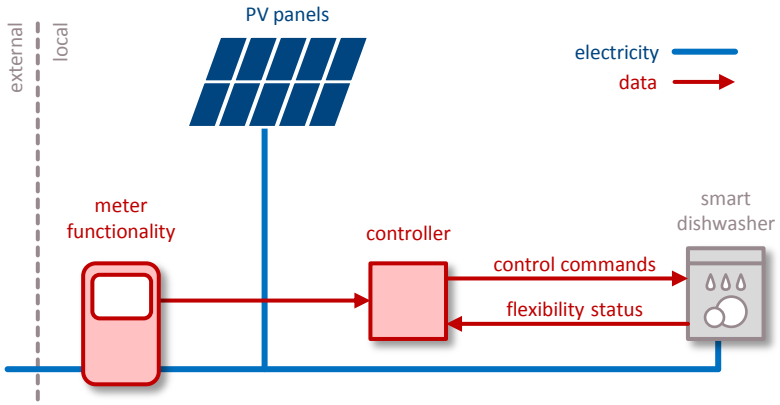
Use case 1:

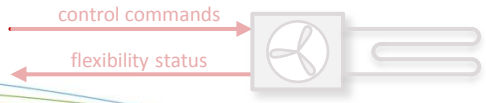
Load shifting of heat pump supplied houses



Use case 2:

Self consumption of on-site produced renewable energy





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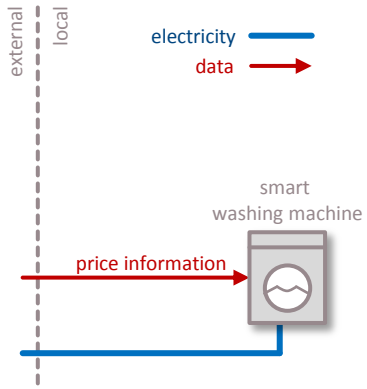
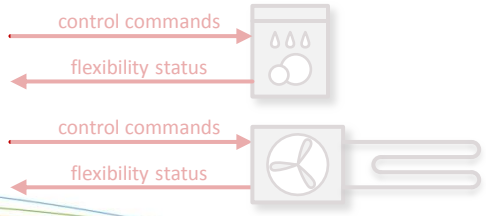
Use case 3:

Variable pricing support by a washing machine





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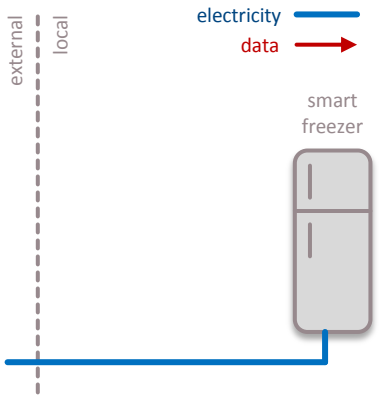
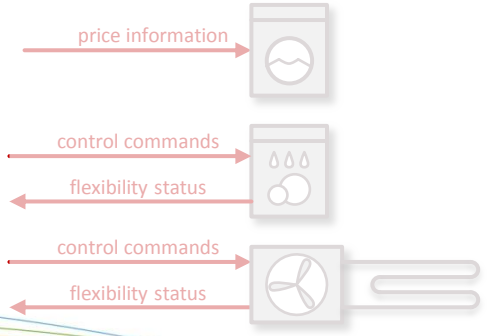
Use case 4:

Appliance based system frequency control of freezers



freezer with internal
frequency measurement



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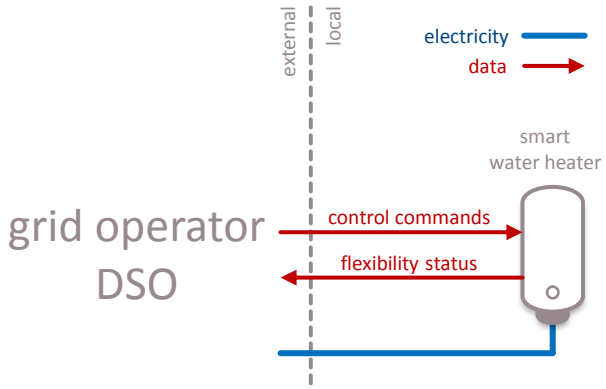
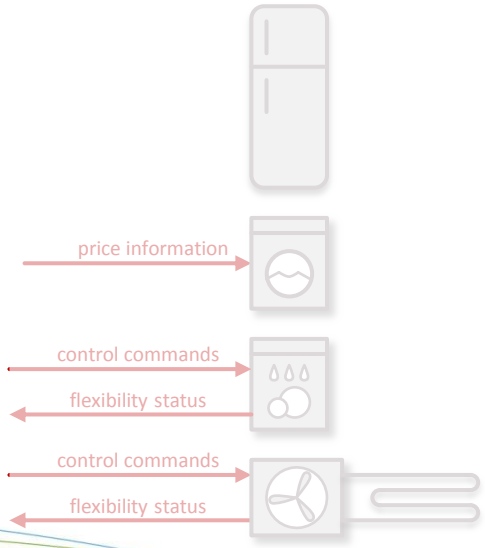
Use case 5:

Distribution grid congestion management by buffered water heaters





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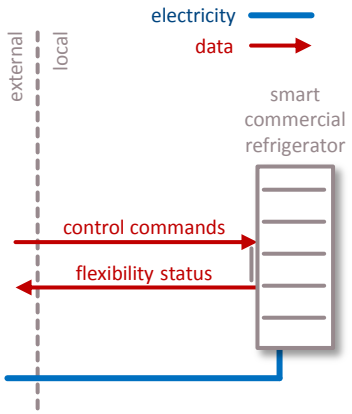
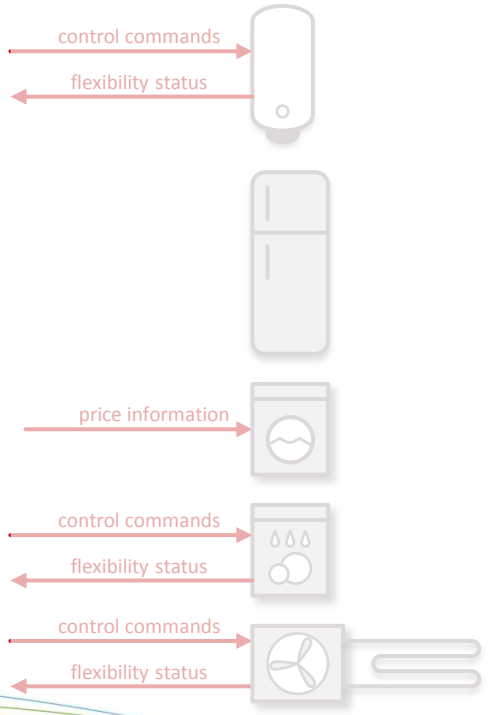
Use case 6:

Frequency restoration reserves based on commercial refrigeration

ancillary services TSO





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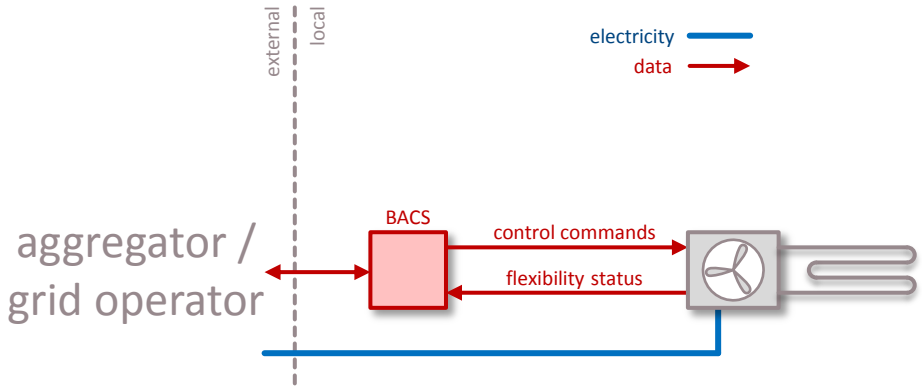
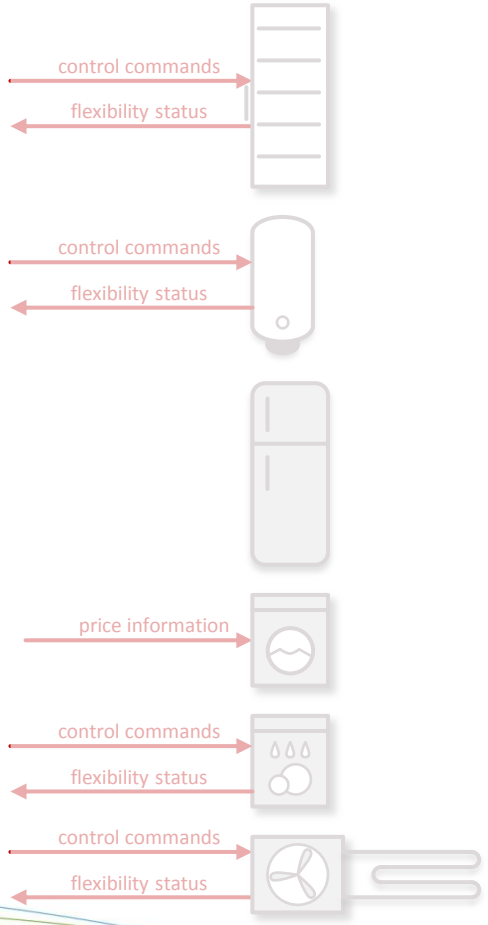
Use case 7:

Peak shaving combined with energy efficiency controlled by a building automation control system





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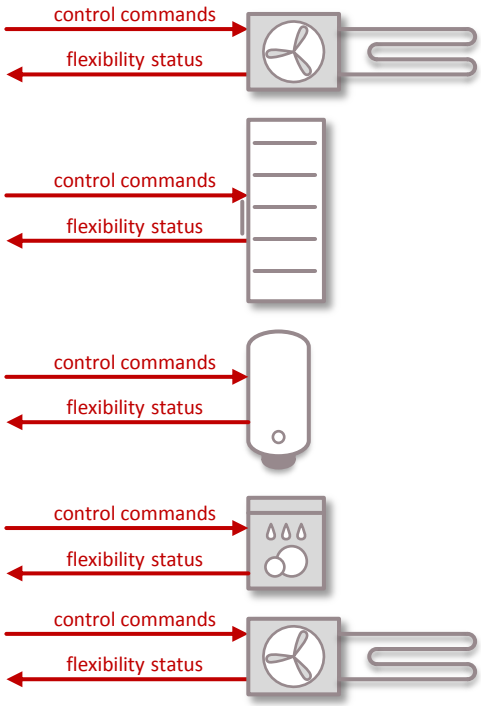
Interface architectures

direct flexibility interface

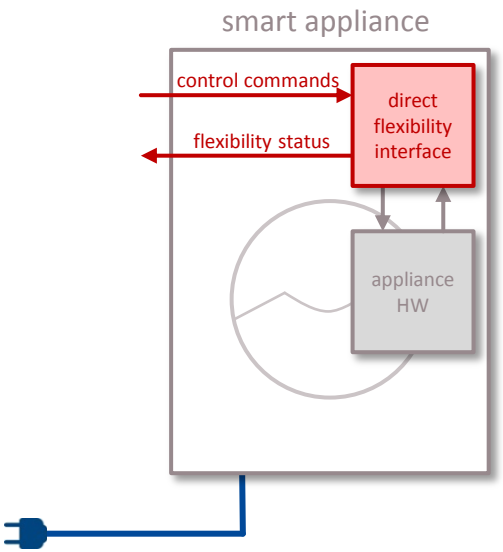


indirect flexibility interface

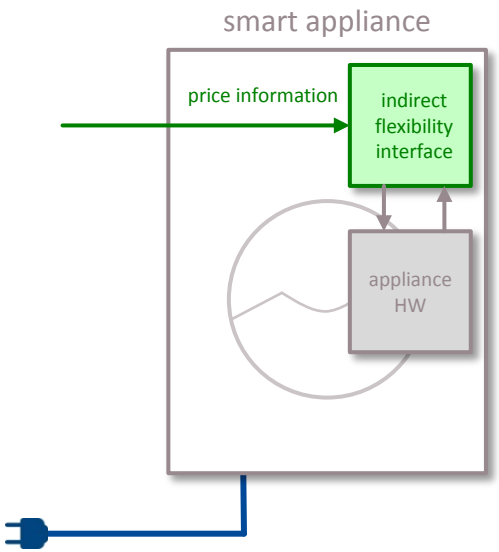
internal measurement interface

Interface architectures

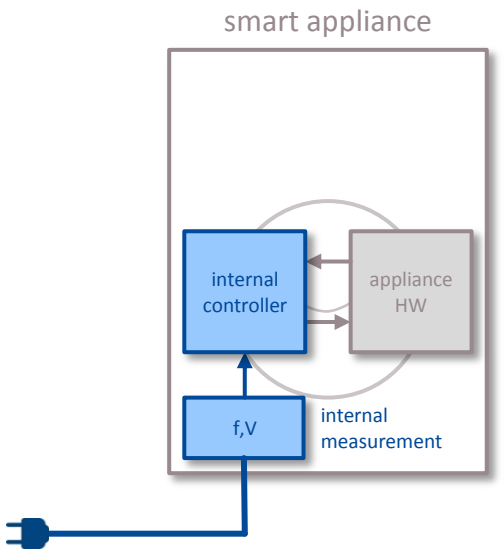
direct flexibility interface



indirect flexibility interface



internal measurement interface



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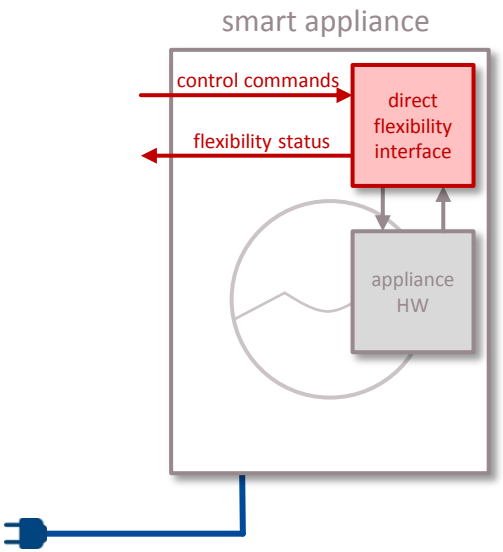
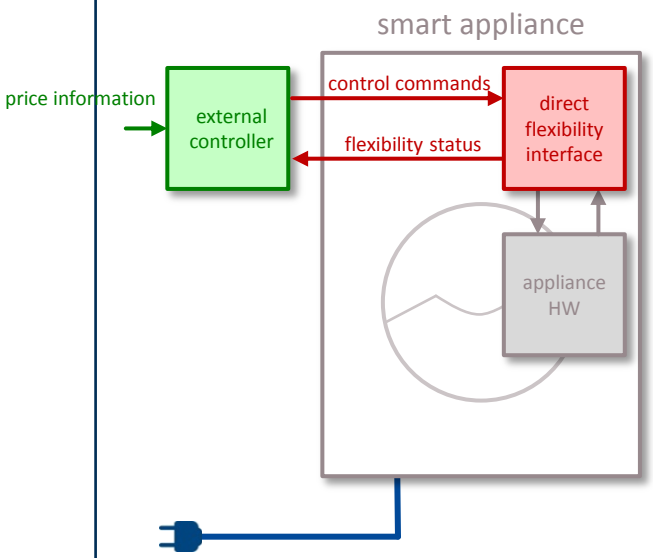
Interface architecture relationships

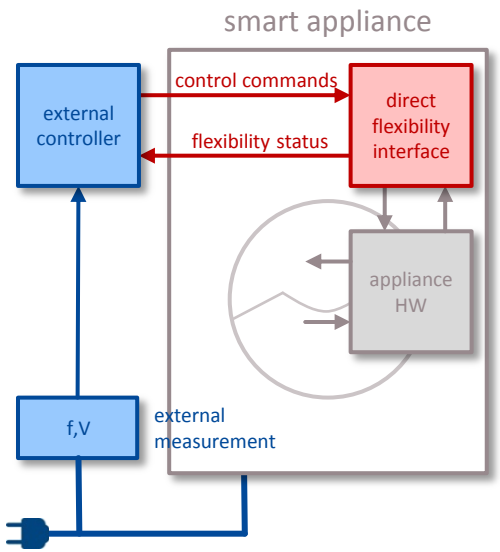
direct flexibility interface



indirect flexibility interface



internal measurement interface



Interface architecture recommendation

direct flexibility interface

- used in quite a lot of use cases
- generic building block for other interfaces

recommendation:

MANDATORY

indirect flexibility interface

- only used in variable price based demand response
- difficult to reuse for other use cases

recommendation:

OPTIONAL

internal measurement interface

- only used grid support oriented demand response
- impossible to reuse for other use case
- solve grid issues in (local) specific cases

recommendation:

OUT of SCOPE

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Interface strategic decision

Keeping in mind:

- the generic character of the direct flexibility interface
- the importance of variable pricing
- the very specific character of the internal measurement interface

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*Direct flexibility interface : **MANDATORY***
*Indirect flexibility interface: **OPTIONAL***
*Internal measurement interface: **OUT of SCOPE***

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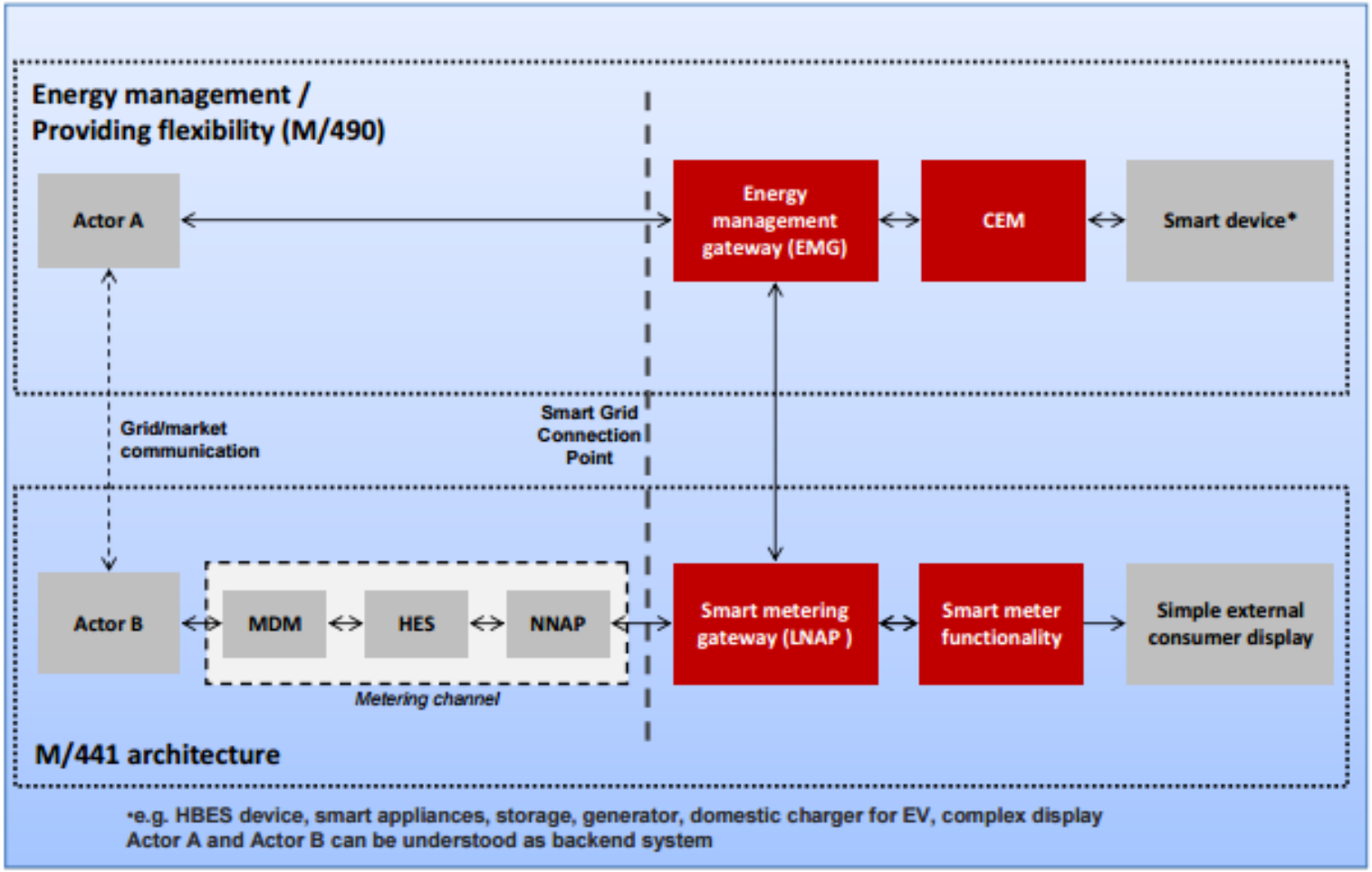
Interoperability: Starting point top-down



CEN-CENELEC-ETSI Smart Grid Coordination Group – Flexibility functional architecture

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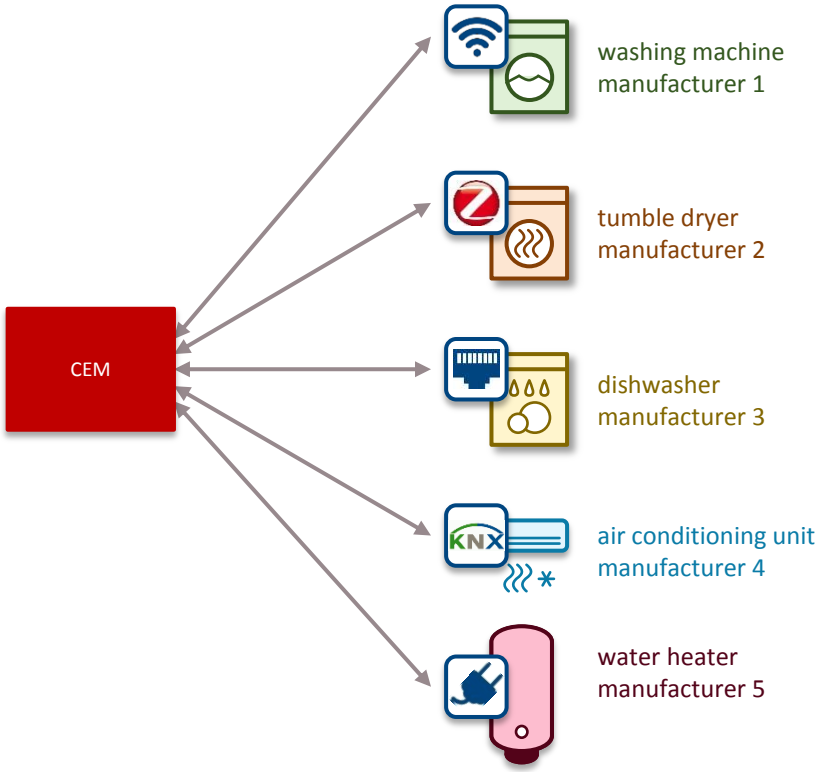
Interoperability: Points of attention

- This study aims at defining requirements for energy smart appliances keeping the SG-CG functional architecture in mind
- This study is **not defining** a complete **smart grid architecture**
- Avoid creating barriers by introducing unnecessary dependencies

Interoperability: Pragmatic bottom-up investigation



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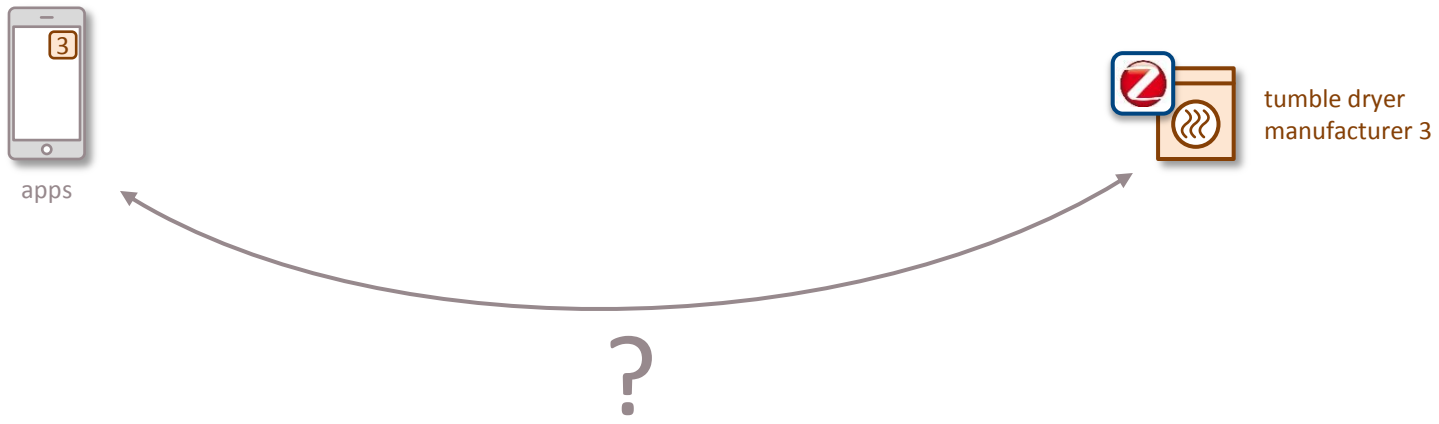
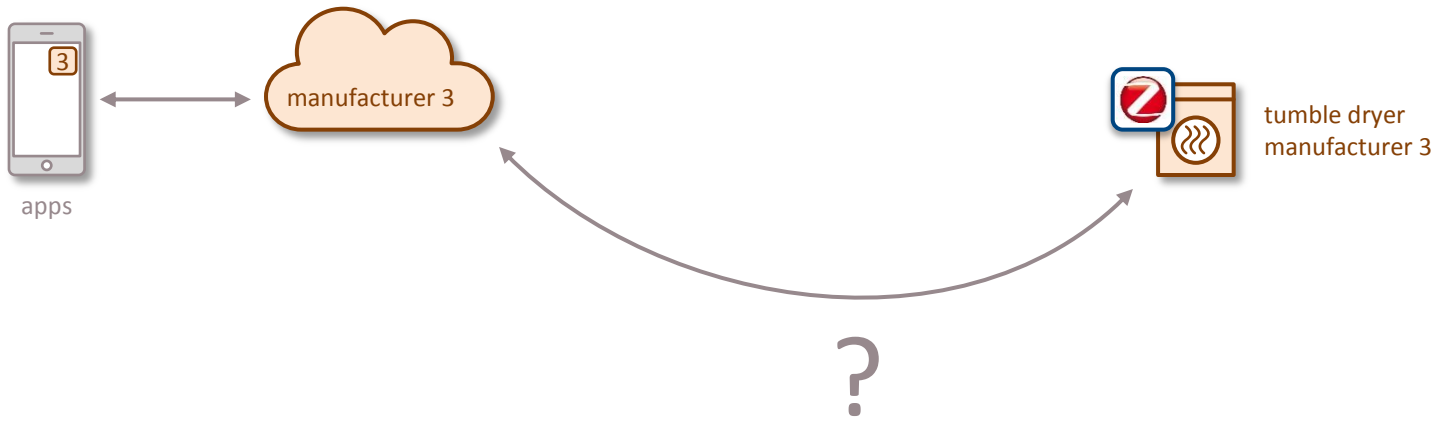
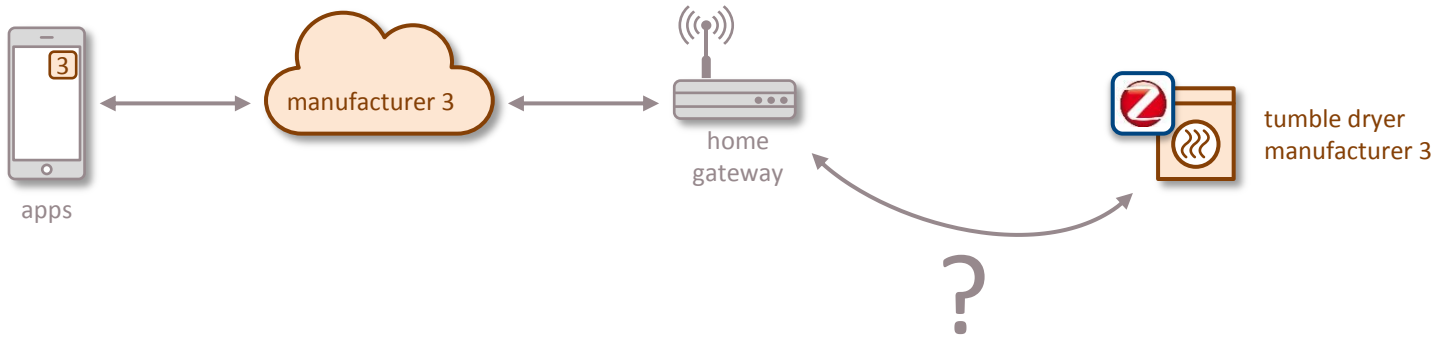
Apps as de-facto common market practice today



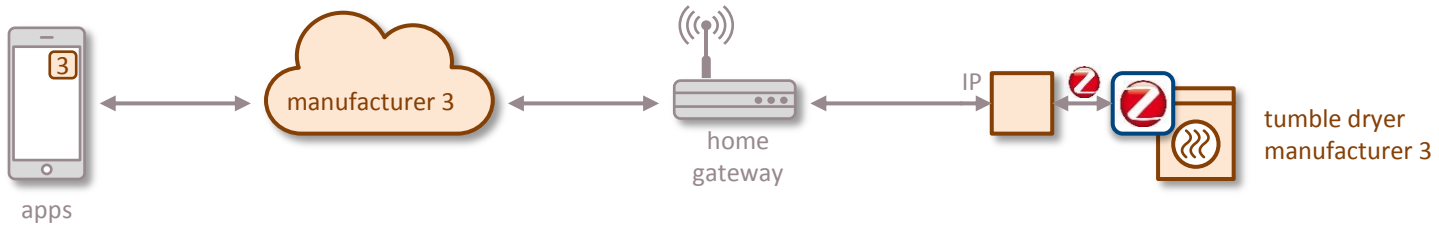
Apps as de-facto common market practice today



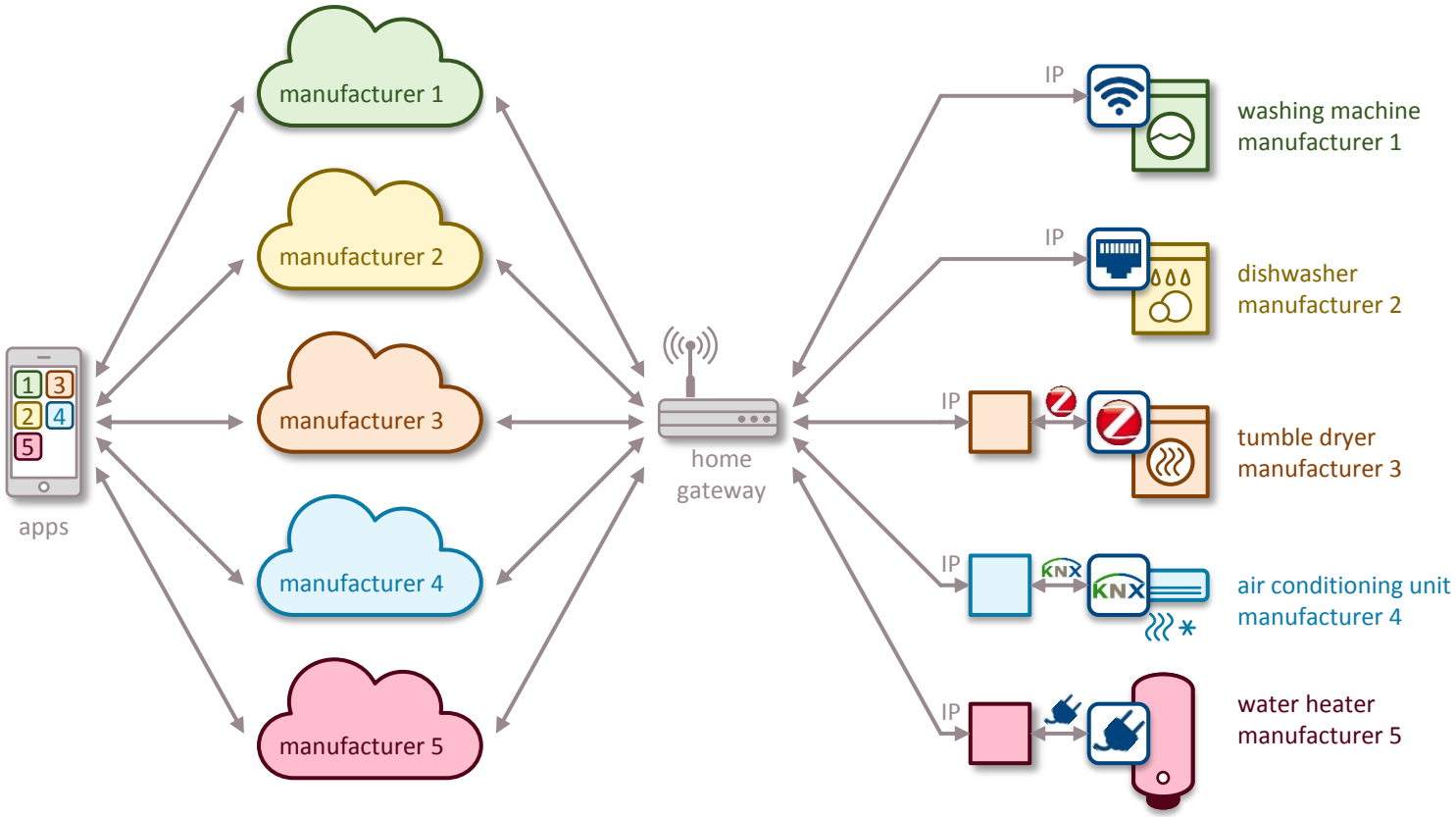
Apps as de-facto common market practice today



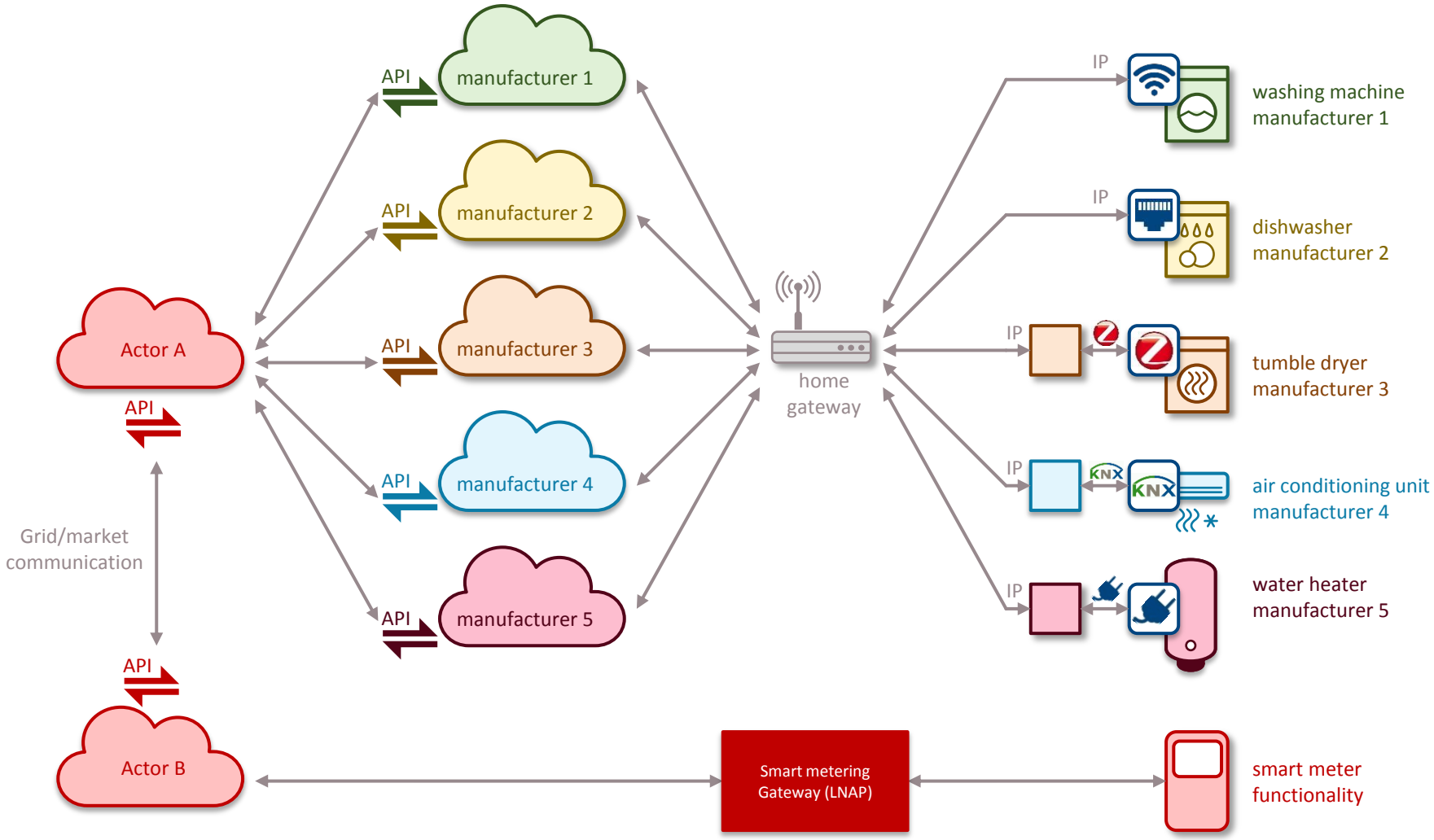
Apps as de-facto common market practice today



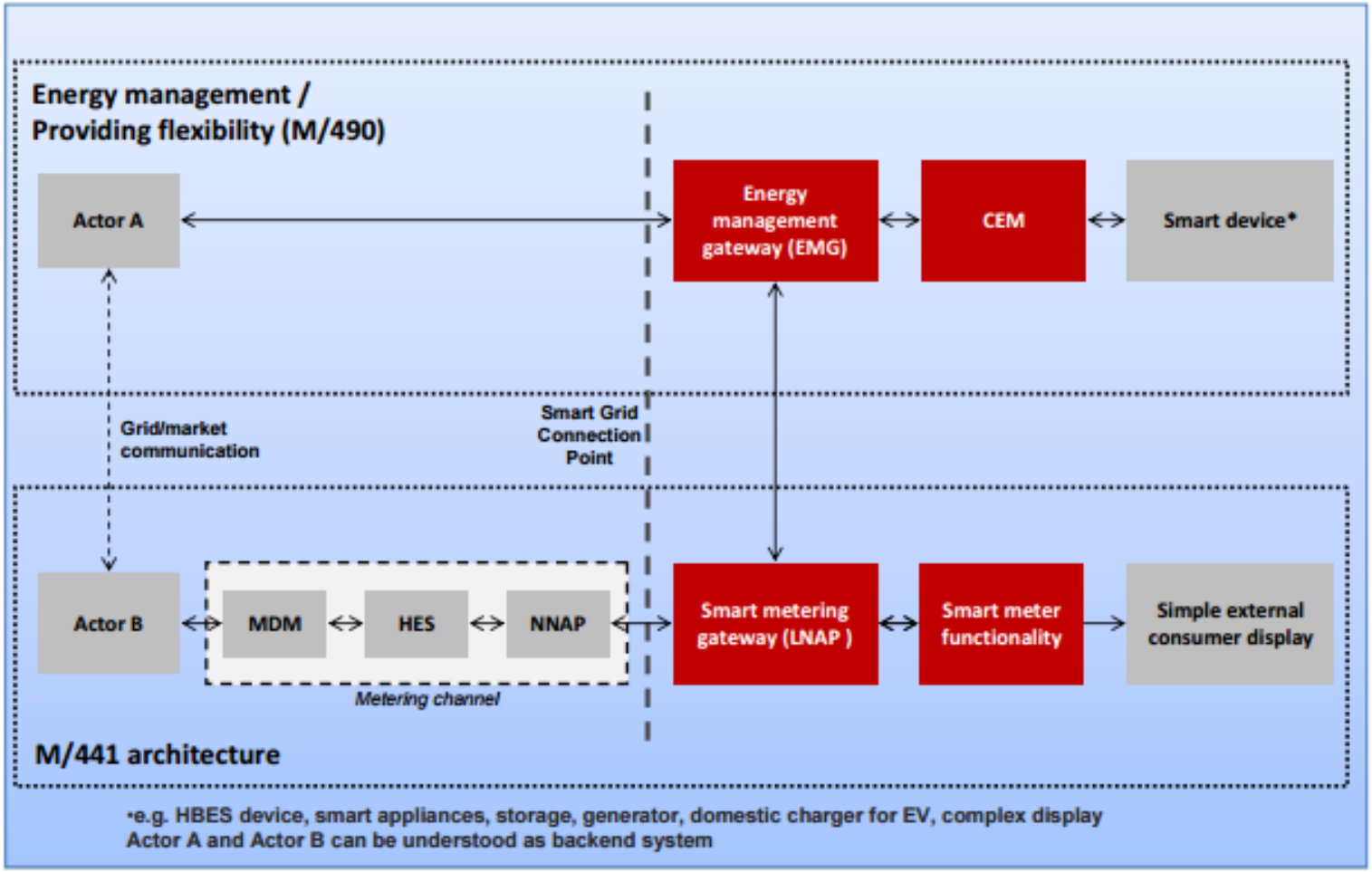
Apps as de-facto common market practice today



From apps to smart grid interoperability



And back to the flexibility functional architecture



CEN-CENELEC-ETSI Smart Grid Coordination Group – Flexibility functional architecture

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Interoperability strategic decisions

Although:

- CEM can play a role in aggregating local flexibility
- CEM can play a role as a local controller (e.g. local renewable eneryg)
- CEM can implement translation of price signals into direct control signals

But keeping in mind that:

- Role of a CEM in cloud based solutions is limited
- (Lack of) CEM interoperability/standardization should not create an additional barrier

2

*Energy smart appliances should be able to function **without** the presence of a **Home/Customer Energy Manager***

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Interoperability strategic decisions

Although:

- smart meter can act as a variable price information interface
- smart meter can act as an interface for real time electricity consumption

But keeping in mind that:

- smart meter can not distinguish consumption of smart appliances and other consumers in the house
- measurement requirements typically not sufficient for settlement
- there are large differences in smart meter specifications and planned roll-out over Europe

3

*Energy smart appliances should be able to function **without** the presence of a **Smart Meter***

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Interoperability strategic decisions

Keeping in mind that:

- energy smart appliances should be able to connect to a local customer/home energy manager
- energy smart appliances should be able to connect to interfaces of external parties

4

*Energy smart appliances should be able to receive instructions from a controller **inside and outside** the customer **home network***

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Part IV: Technical appliance categories

4 technical appliance categories

Category I:
Periodical appliances

- dishwasher
- washing machine
- tumble dryer

Category II:
Thermal appliances

Category IIa:
internal controller
internal flexibility

- refrigerators
- freezers
- commercial refrigeraton
- storage water heater
- electric radiator with inertia
- heatpump with internal thermal storage
- air conditioning with internal storage

Category IIb:
internal controller,
external flexibility

- electric radiator without inertia
- electric boiler
- heatpump without thermal storage
- air conditioning without thermal storage

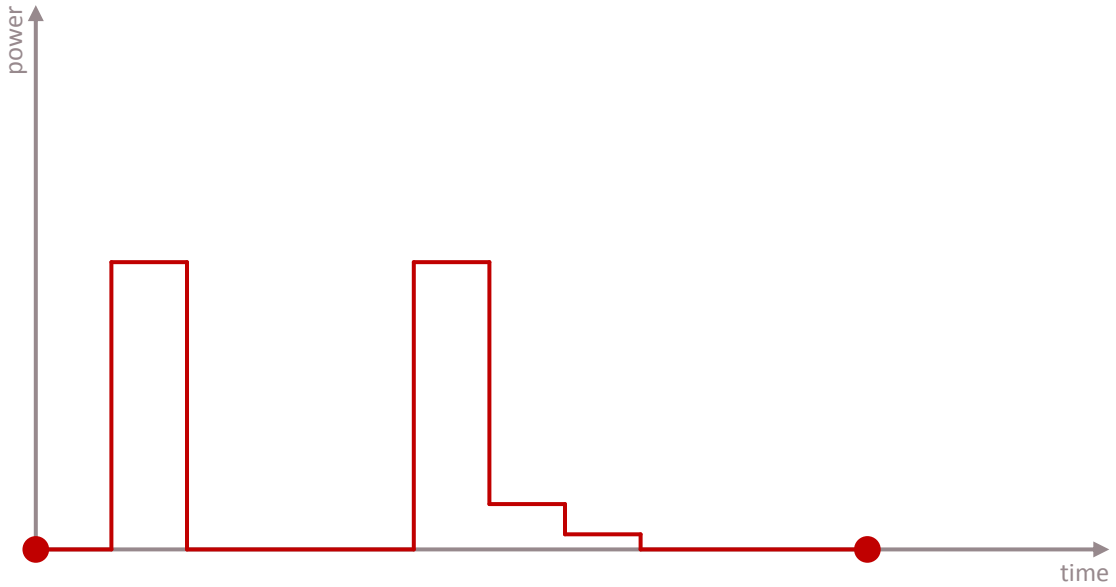
Category III:
Energy storage systems

Category IV:
EV charging poles

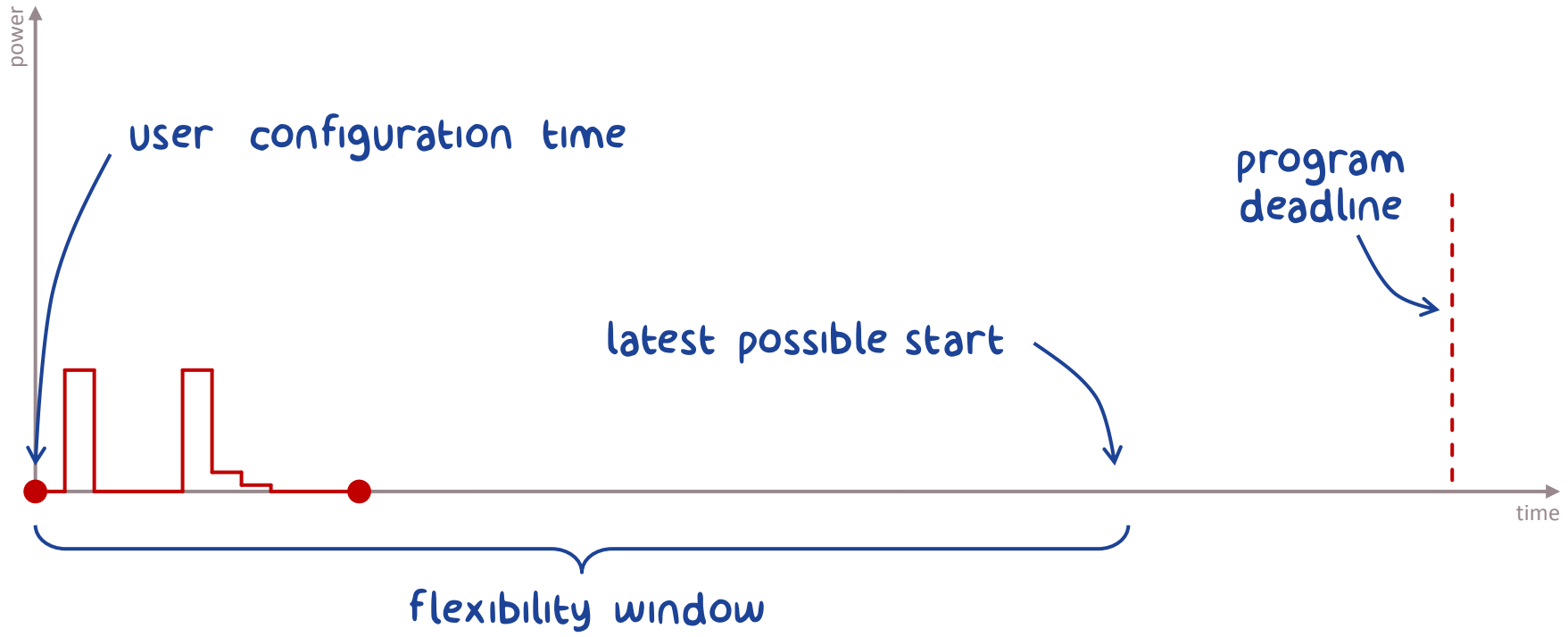
5

Split-up** in appliances groups with **vertical requirements where needed

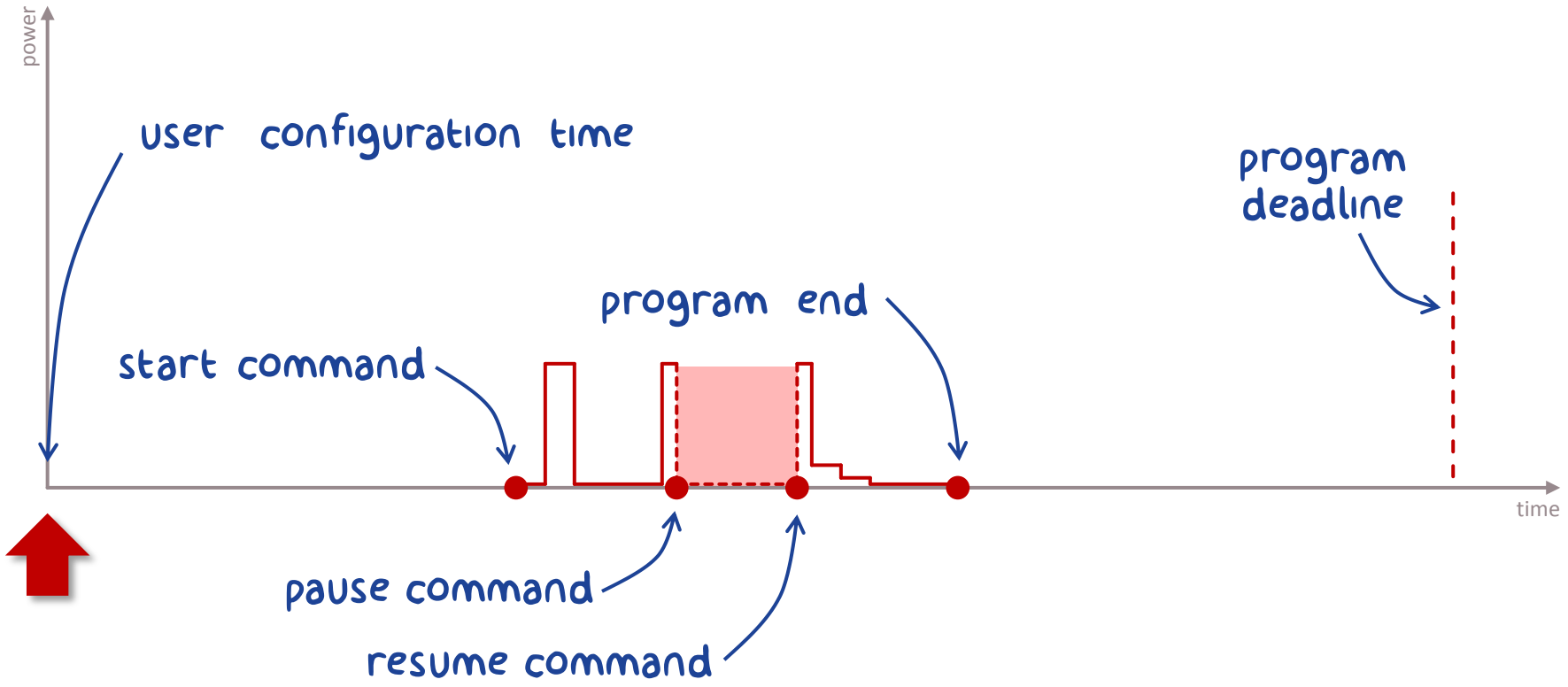
Periodical appliance basics: the program



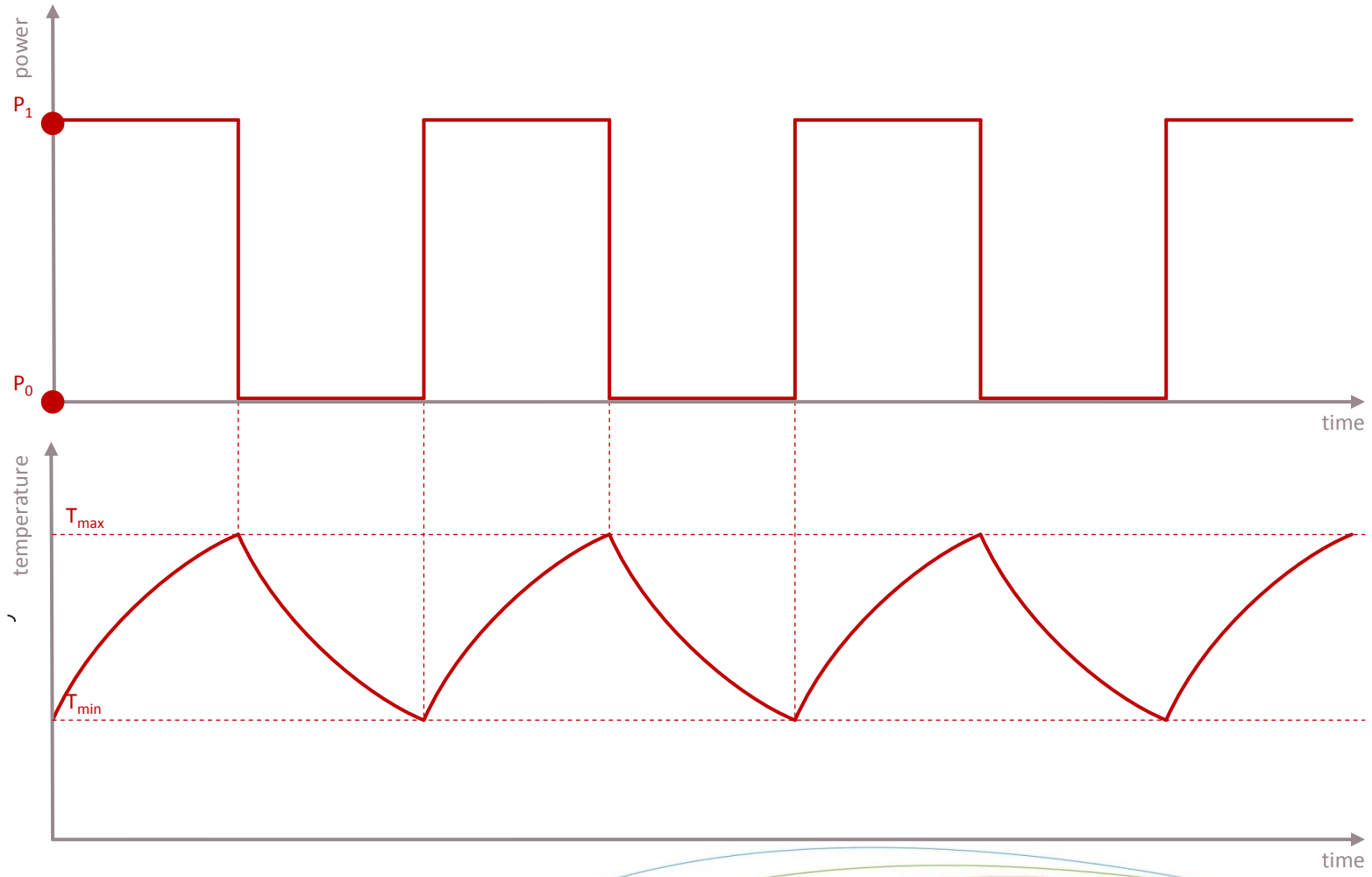
Periodical appliance basics: the flexibility window



Periodical appliance basics: interruptibility



Thermal appliance basics: hysteresis control <u>without</u> flexibility activation



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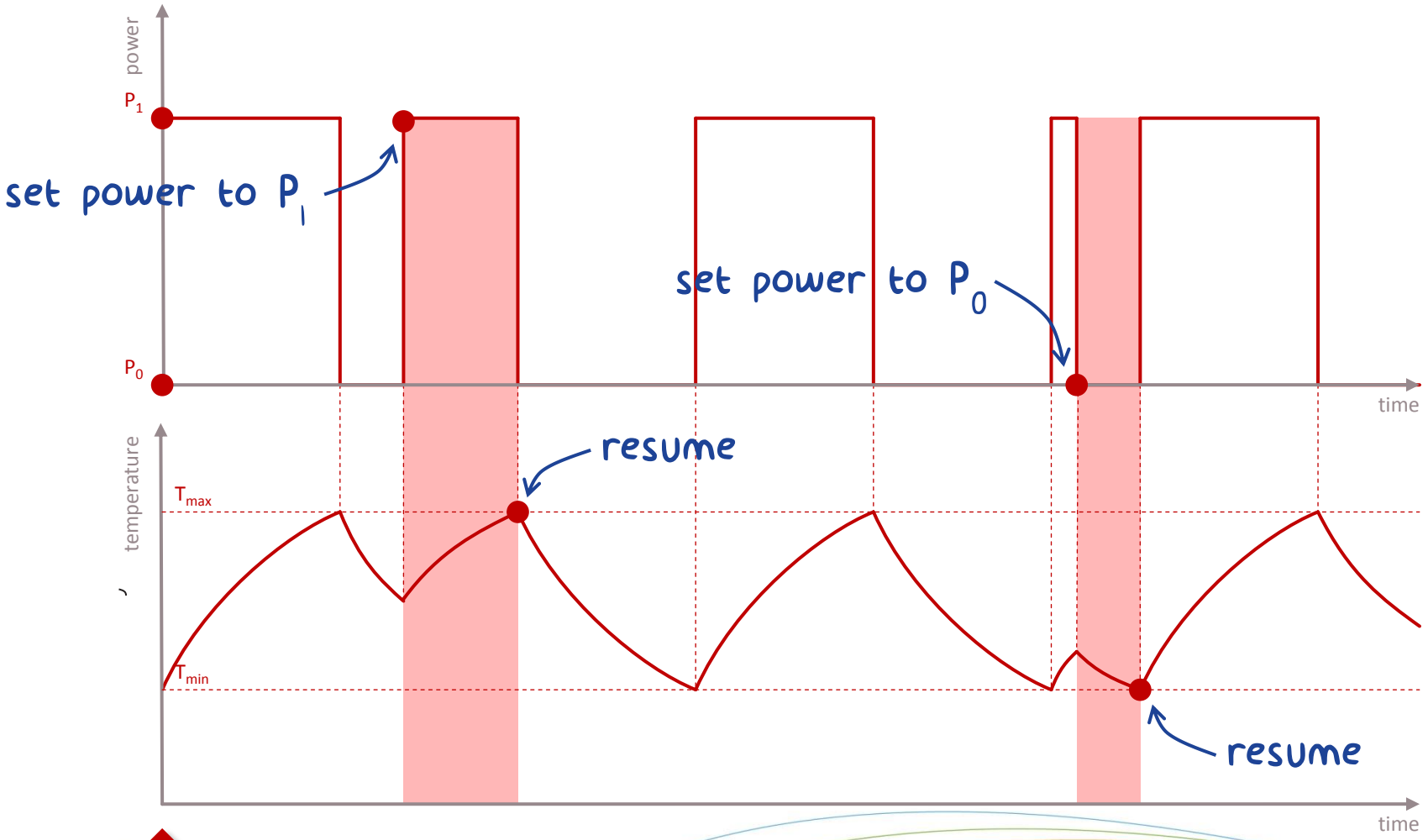
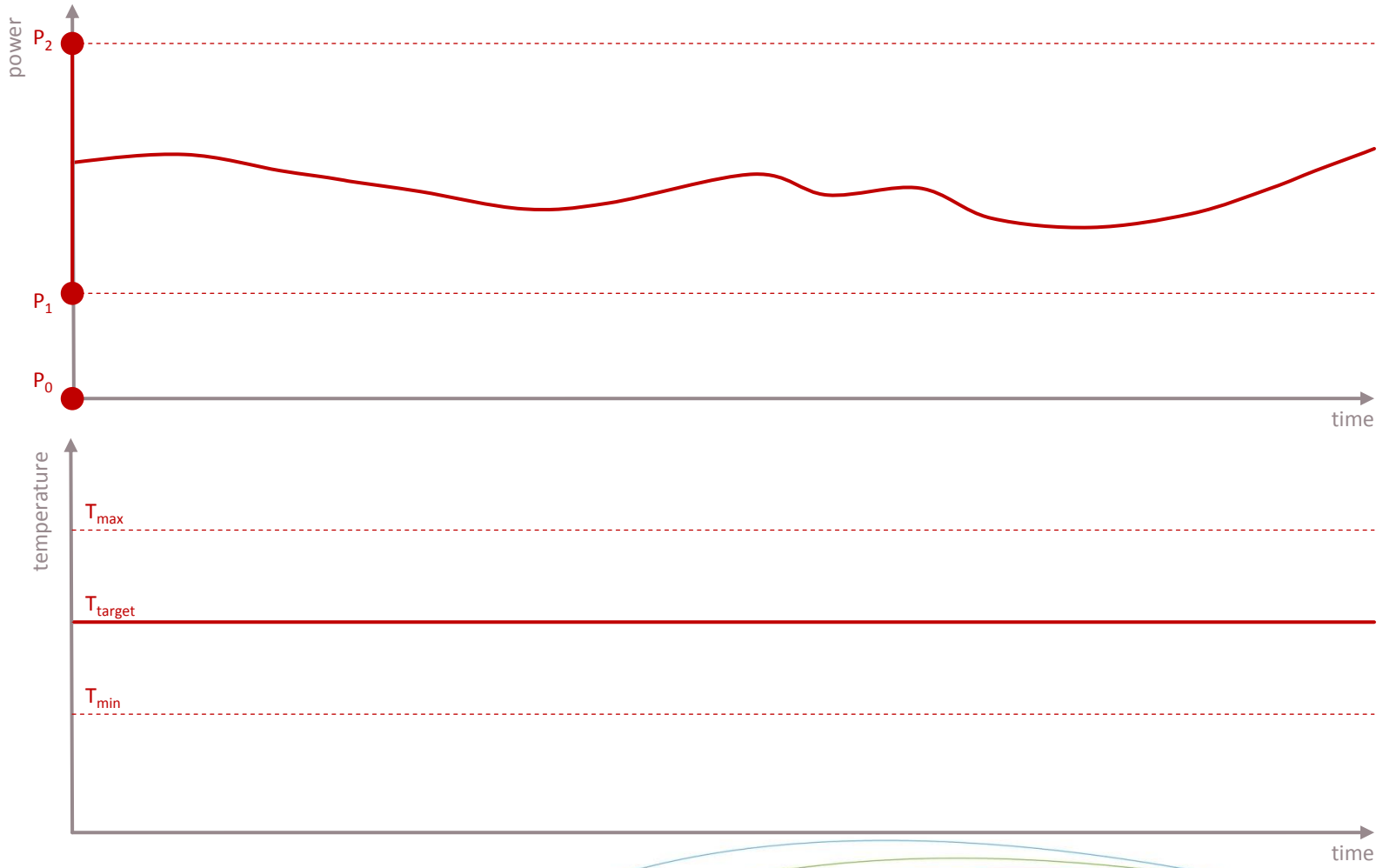
Thermal appliance basics: hysteresis control with flexibility activation



Thermal appliance basics: continuous control without flexibility activation



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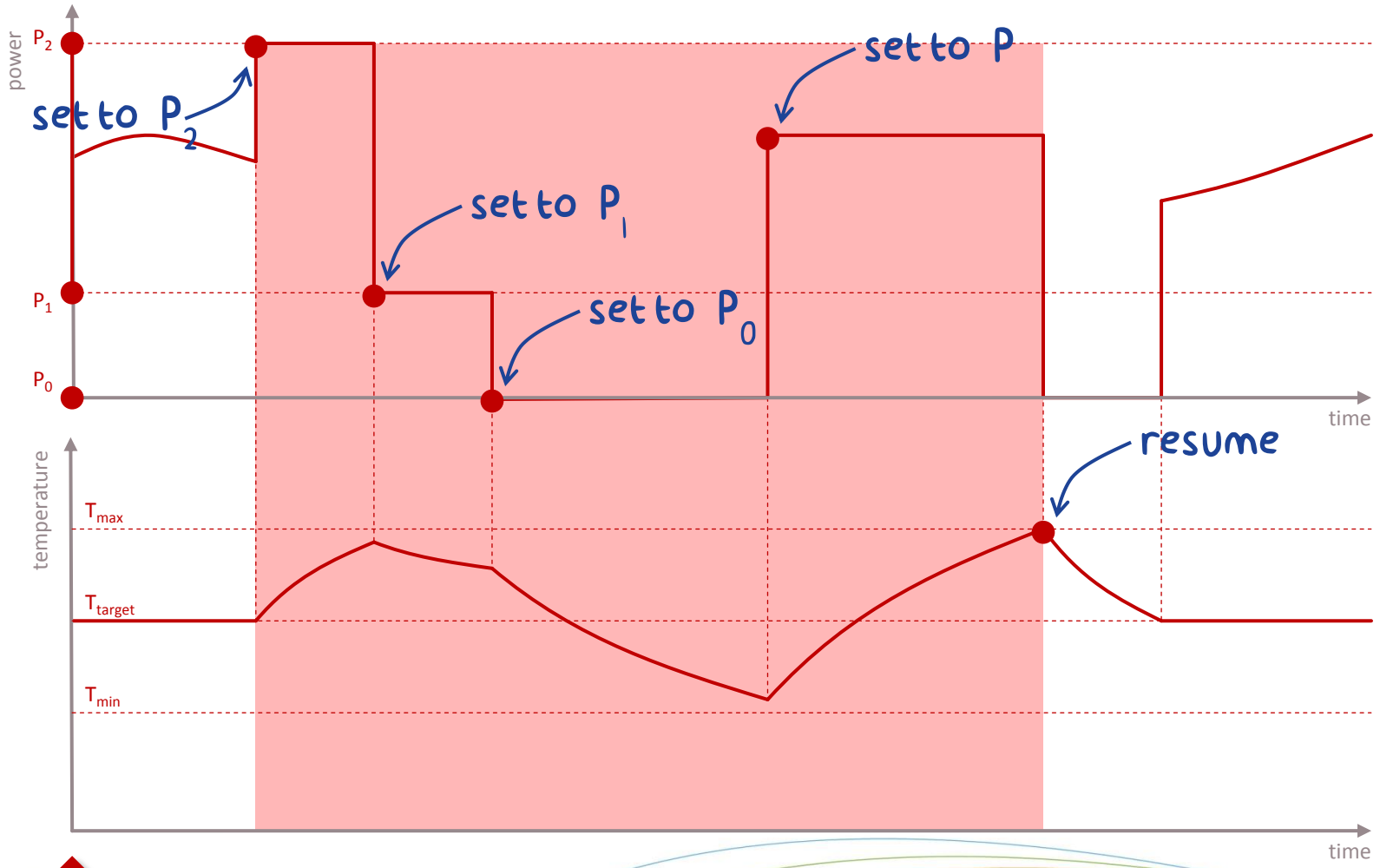
Thermal appliance basics: continuous control with flexibility activation



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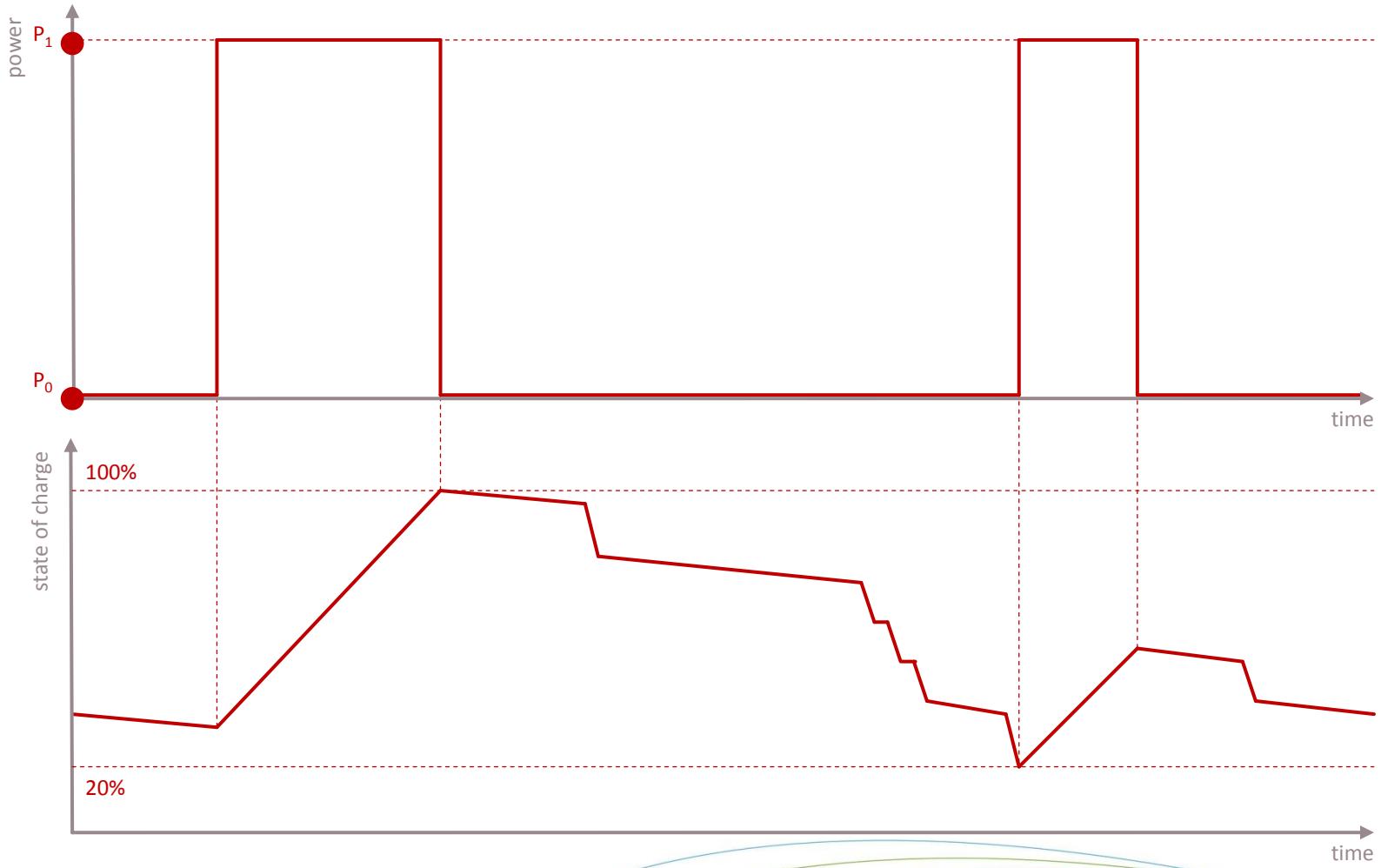
Thermal appliance basics: Domestic hot water boiler without flexibility activation



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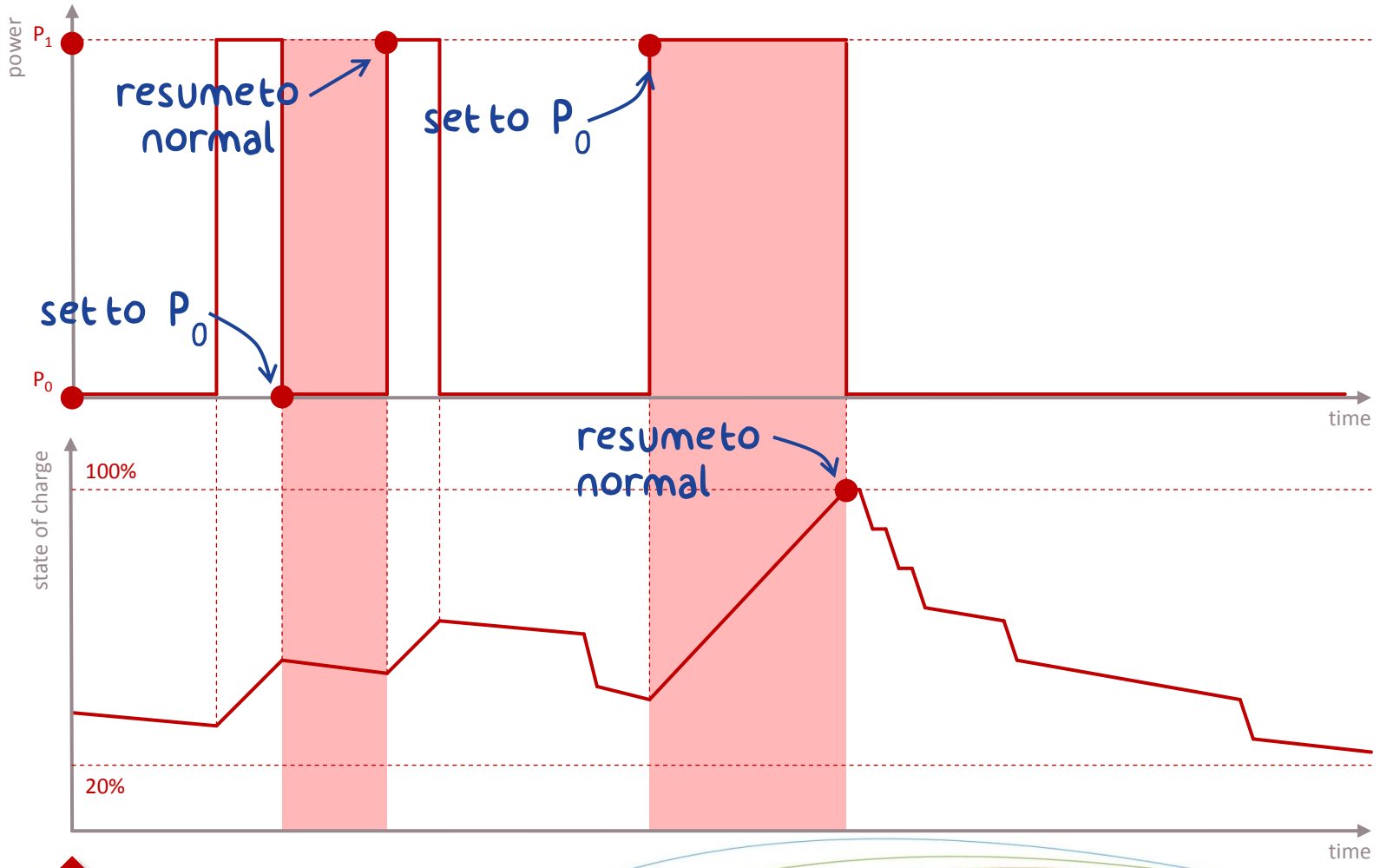
Thermal appliance basics: Domestic hot water boiler with flexibility activation

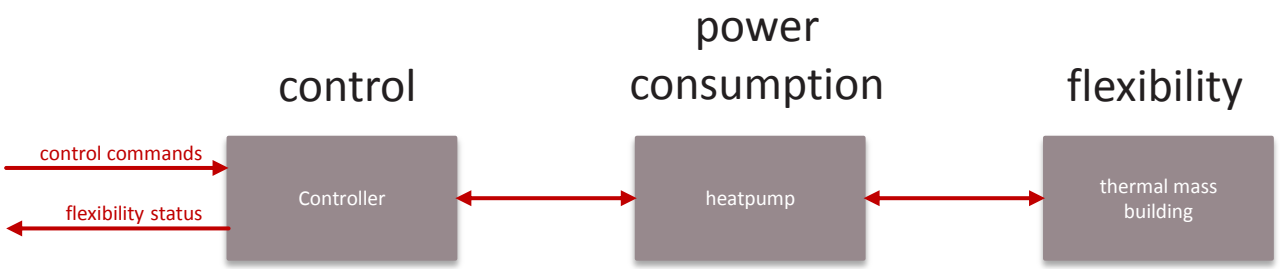


Why different thermal appliance categories?

Some properties of a smart appliance

- contains flexibility: it is possible to adapt the electricity consumption pattern is such a way that the comfort of the customer is not affected
- consumes electricity: otherwise it cannot adapt its electricity consumption
- has a controller: which is able to interpret the instructions into actions

A typical HVAC example



- power consumption is in the heat pump
- flexibility is in the thermal mass of the building
- heatpump can be controlled by an external controller

Thermal appliances strategic decisions

Keeping in mind that:

» it is very difficult to define criteria for energy smart appliances without having a controller

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*From the thermal appliances group, only thermal appliances **including a controller** can be considered as energy smart*

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Strategic decisions

1. *Direct flexibility interface : **MANDATORY***
   *Indirect flexibility interface: **OPTIONAL***
   *Internal measurement interface: **OUT of SCOPE***

2. *Energy smart appliances should be able to function **without** the presence of a **Home/Customer Energy Manager***

3. *Energy smart appliances should be able to function **without** the presence of a **Smart Meter***

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Strategic decisions

4 *Energy smart appliances should be able to receive instructions from a controller **inside and outside** the customer **home network***

5 ***Split-up** in appliances groups with **vertical requirements where needed***

6 *From the thermal appliances group, **only thermal appliances including a controller** can be considered as energy smart*

Strategic decisions

We would like to hear from you.
Thank you for your input!

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