Smart Grids Interface for the connection of larger residential and small industrial prosumers

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Smart-grid Interface
Challenges

- migration of the previously passive consumers to active “prosumers”
- increasing the percentage of renewables in energy mix
- real-time communication for monitoring and controlling the energy system
Smart-grid Interface
Communication Infrastructure

Communication based on energy automation technology
Communication based on “last mile” communication technology
Communication based on in-building/in-home technology

BMS = building management system
HA = home automation
M = smart meter
C = communication gateway
EC = energy control
Smart-grid Interface
EU SmartGrid investments
Smart-grid Interface
Features

- Data collection from attached equipment
- Demand response algorithm
- Control of the connected equipment (heat pumps, boilers, ..)
- Communication with provider
- Optimization Algorithm:
  - Calculation of consumption
  - Preparation of consumer adaptation
  - Real Time Execution of adaptation
- Actions Recording

\[
E_{\text{prd}} (k) = E_{\text{old}} + P_{\text{max}} (k) \cdot (T_{\text{drt}} - T_{\text{tmp}} \cdot k)
\]

\[
T_{\text{end}} (k) = (T_{\text{drt}} - T_{\text{tmp}} \cdot k)
\]

\[
E_{\text{avl red}} (k) = \begin{cases} 
\Delta P \cdot T_{\text{end}} (k) & \text{if } T_{\text{end}} (k) \leq T_{\text{frs int}} \\
\Delta P \cdot \text{round}(a) \cdot T_{\text{int}} + e & \text{if } T_{\text{end}} (k) > T_{\text{frs int}}
\end{cases}
\]

\[
a = \frac{T_{\text{end}} (k) - T_{\text{frs int}}}{T_{\text{int}} + T_{\text{no int}}}
\]

\[
e = \begin{cases} 
0 & \text{if } a' \leq T_{\text{no int}} \\
\Delta P \cdot (a' - T_{\text{no int}}) & \text{if } a' > T_{\text{no int}}
\end{cases}
\]

\[
\Delta P = P_{\text{max}} - P_{\text{min}}
\]

\[
E_{\text{avl enl}} (k) = 0
\]
Smart-grid Interface

FlexOffer

[Diagram of class relationships]
Smart-grid Interface

Sftw architecture
Smart-grid Interface
Laboratory Prototype

- Single board
- Cost effective
- ARM environment
- Ethernet communication
- Zigbee communication
- Other communication (opt.)
Thank You

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