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Demand flexibility is a crucial concept in the energy sector, referring to the ability to adjust the quantity of electricity or energy consumed based on changing supply and demand conditions in the electricity grid. It plays a fundamental role in achieving a more sustainable and efficient energy system. Demand flexibility can be explicitly manifested when grid actors negotiate flexibility execution through a contract requiring compliance or it can also be implicitly manifested, where the grid utilizes dynamic electricity pricing to encourage users to reduce consumption during expensive periods and shift demand to cheaper periods.

Innovation is brought to life through the PHOENIX platform, which offers demand flexibility management service. This smart platform offers the unique ability to collect and analyse all relevant information about a building, including energy consumption, energy production and analytics outcomes. Thanks to PHOENIX, it is possible to accurately assess the flexibility potential that the building can bring to the grid during the required periods. In addition, the device operation control functionality allows for efficient control of the devices, eliminating the need for the user to participate directly in flexibility events. PHOENIX represents a tangible and effective solution that contributes to the optimisation of the energy system, providing an optimal response to the flexibility needs of the electrical grid.

The PHOENIX platform's demand flexibility management service includes several key functions aimed at meeting grid flexibility needs, improving energy efficiency, and reducing energy costs:

- **Implicit Flexibility:** Energy demand is modified according to the variation of the energy price, reducing consumption in expensive periods, and shifting part of it to cheap periods.
- **Explicit Flexibility:** This type of flexibility is achieved through a USEF interpreter, designed to receive flexibility signals from grid agents, such as the aggregator, via the UFTP protocol. This process includes negotiation, evaluation, and execution of flexibility. The UFTP protocol is a USEF approach to negotiate flexibility.
- **Direct Load Control:** Thanks to the actuating devices that have been integrated into the platform, the demand flexibility management service can control its operation to reduce demand at specific periods. This may involve shutting down the device or reducing the setpoint.
- **Device Flexibility Characterization:** Users can set up a flexibility configuration for their actuator devices, indicating a control limit through a factor or a time window during which the device control can be altered.
- **Flexibility Notifications and Recommendations:** The service offers flexibility recommendations to users, notifying them about periods of high prices or the start of a demand response event.

The PHOENIX service optimizes energy consumption patterns, enabling users to respond to price signals and incentives for taking advantage of off-peak energy periods with lower prices. The Direct Load Control feature ensures devices operate efficiently during peak demand, avoiding costly energy spikes. This empowers users to make cost-effective energy decisions, leading to tangible savings on their energy bills. The demand flexibility management service on the PHOENIX platform has been successfully deployed and adapted in various scenarios, including buildings and countries with diverse characteristics. This adaptability has facilitated the control of devices serving different purposes, such as batteries, heating, ventilation, and air conditioning (HVAC) systems, combined heat and power (CHP) plants, heat pumps, hot water tanks, among others.

