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E2District: Behaviour Demand Response

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E2DISTRICT

People Behaviour & Technology Integration

Introduction

• **Behaviour Demand Response (BDR)** is considered as one building block for achieving DHC energy efficiency in the E2District project. By including the building occupants in the energy optimisation process and considering their ability to interact with the environment as a flexibility asset, we are aiming to go beyond what purely technical solutions can achieve.

• We propose to use a rigorous behavioural model to translate dynamic supply side constraints into adequate prosumer interactions, taking all relevant behavioural, motivational, environment and context parameters into account.

• This model-based optimisation approach enables **the right person to be targeted with the right message at the right time**, dynamically involving the building occupants in the process as active participants.

What are the objectives of E2District?

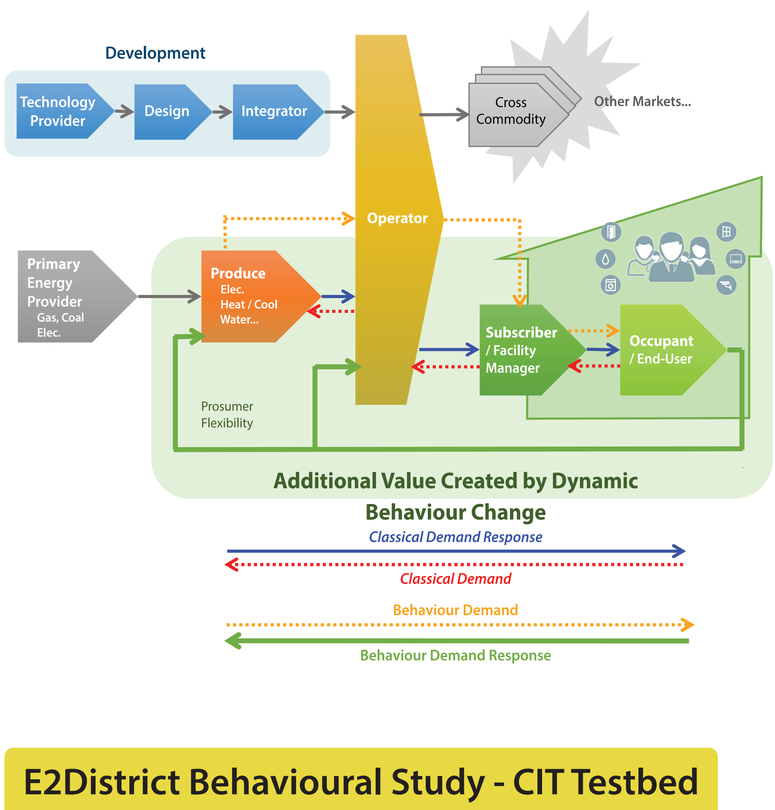
E2District brings together key stakeholders within the European District Heating & Cooling (DHC) value chain working together with the aim of developing an innovative set of tools for the optimisation of energy efficiency in the DHC industry.

• To develop a **District Simulation Platform** for use as an **Asset Portfolio Decision Support tool** to optimise DHC asset configuration and utilisation. **>5% energy reduction**

• To develop **Adaptive Control and Optimisation Methods** for flexible production, storage and demand assets and to develop algorithms for system fault diagnostics to enable cost effective maintenance. **>10 and 20% energy reduction**

• To apply **People Behaviour Demand Response** by introducing additional behaviour flexibility to the system, keeping the human user in the loop. **>5% energy reduction**

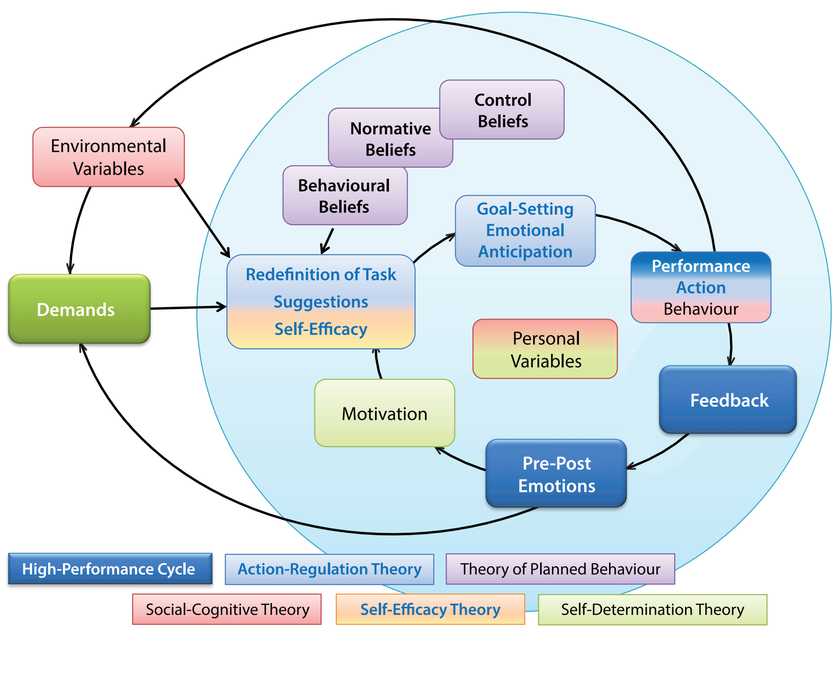
Value Chain Innovation



• Allow for demand going in both directions, i.e. not only let energy suppliers react to consumer demand but also let prosumers react to supply side constraints.

• Change the classical demand-response paradigm towards a more efficient solution that integrates the prosumer as an active stakeholder into the value chain.

Integrated Behavioural Model



• Apply a model-driven approach to translate supply side constraints into prosumer interactions.

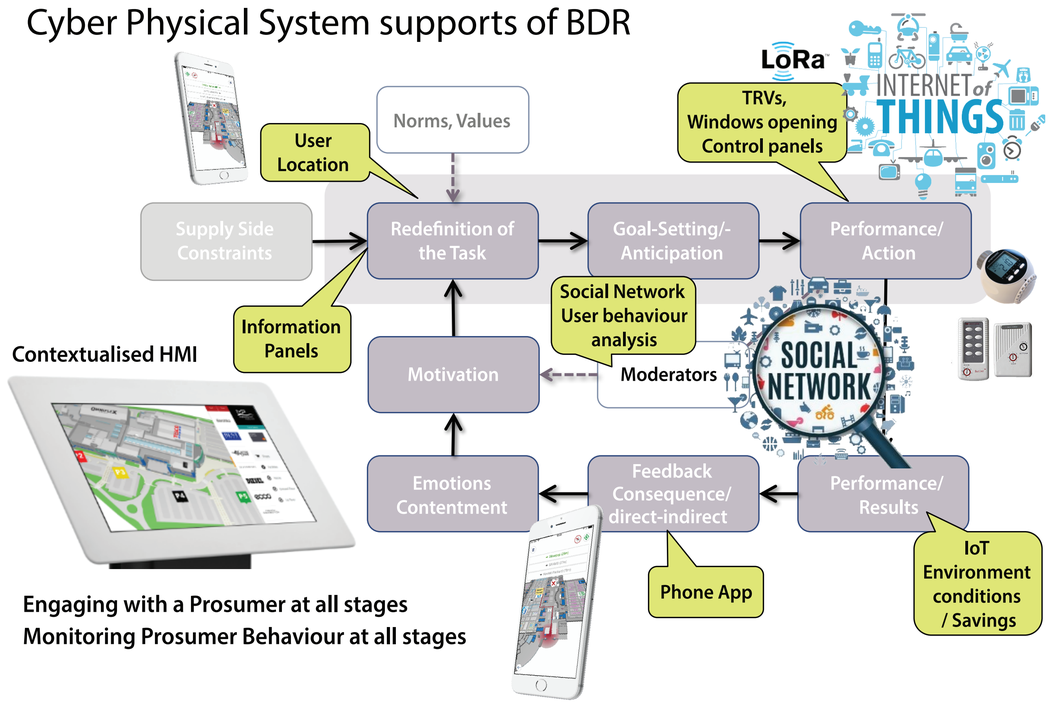
• Use a model-driven approach to calibrate behavioural parameters based on real time measurements.

E2District Behavioural Study - CIT Testbed

• The first stage of the study involves the establishing of a research baseline by using technical sensors located throughout the campus testbed to monitor room temperatures, light intensity and air quality. Staff and student behaviour, in relation to temperature regulation, is also monitored i.e. opening and closing of doors and windows and adjustment of radiator valves.

• The second stage sees the introduction of the CIT Testbed mobile application, supported by interactive kiosks. The Integrated Behavioural Model is used to configure the application to evaluate traits that influence human behaviour such as environmental and personal factors. The aim of the application is to promote energy effecting behaviour through contextualised personalised suggestions that enable users to influence their environment. The application also includes useful features that benefit people in their daily tasks at CIT as user retention incentives.

Cyber Physical System supports of BDR

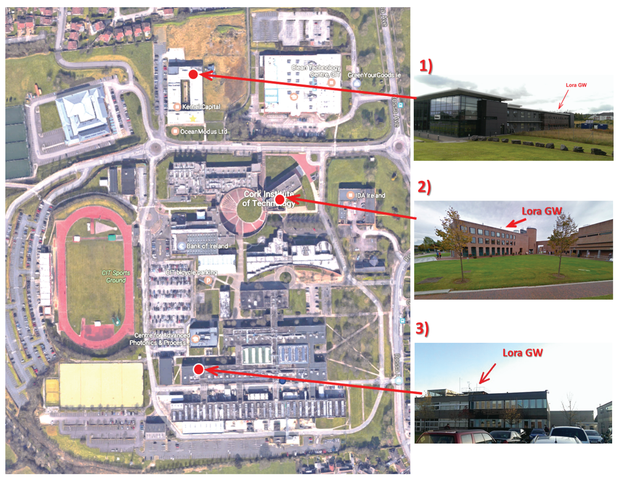


CIT Behaviour Demand Response Testbed

Science Foundation Ireland sfi For what's next

CONNECT Networks of the Future

LoRa IoT Network



450 x BMS OPC Data Points
250 x LoRa Wireless Sensors & Actuators
400 x iBeacons for People Indoor Localisation

• Environment state and condition
• People behaviour & occupancy
• People's attitude and sentiment towards the environment and the system

Conclusion

• Behaviour Demand Response (BDR) enables the integration of energy prosumers as active stakeholders into the energy supply value chain.

• Energy prosumers can be considered a flexibility asset to make the energy system more efficient.

• Behavioural modelling enables optimisation of the overall process based on rigorous principles that allow the right people to be targeted with the right message at the right time, always adapting to changing dynamic context conditions.

• This approach is usable beyond the energy domain, in use cases such as building and smart city management, healthcare and personal health intervention and strategic tourism management.

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