DHC and ICT: potentialities and opportunities of a synergy

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DHC+

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- R&D in the field of information technologies and communications
- Promote highly innovative projects and integrated programmes with public and private partners

- The Department of ENERGY (DENERG) is the point of reference in Politecnico di Torino for the areas of knowledge concerned with energy and sustainable development
- DENERG promotes, coordinates and manages basic and applied research, training, technology transfer and services to the local community and industries.

Presentation Outline

- **Introduction: ICT and Energy opportunities of a sinergy**
  - ICT: Definition and technologies
  - Future (and present) Energy challenges
- **A concrete example: Heat demand management and shaping**
  - Heat load profile shapes
  - Storage to fill the gaps between pick demand requests
- **Effects and Countermeasures**
  - Managed at the production side
  - Clipped from the users
- **User engagements for a coperative and better use of DH systems**
  - ICT for user engagement and energy awareness
  - Decision Support Systems for Utilities, Users and local authorities
- **Conclusions and future Perspectives**

Introduction

Definition

It stands for "**I**nformation and **C**ommunication **T**echnologies

ICT

It is a generic name used to describe a range of technologies for gathering, storing, retrieving, processing, analyzing, and transmitting information

Key Words

Introduction

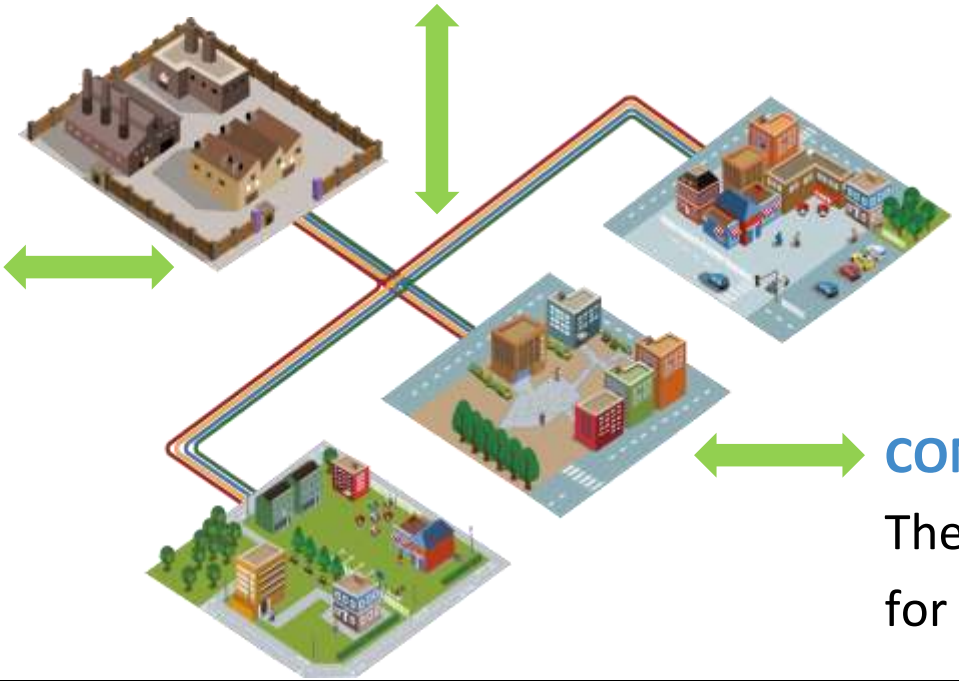
RES Integration	Toward a total decarbonisation of current district heating systems a rising problem will be related to the coexistence of fossil and renewable energy production.
Supply Side Management	An increase penetration of RES will definitely increase the need of storage solutions to cope with the fluctuations of the production curves so increasing the level of smartness required in the management and control policies of the network.
Demand Response	Future smart thermal grids will also have to strengthen the link between energy production and energy demand by raising the level of interaction between users and network and thus to improve the consistency between the user demand profile and the RES-integrated production curves.

DHC Conceptual Diagram

HEAT SOURCES: energy sources as gas, oil, waste, sun, biomass, geotermal, etc.

PIPELINES

The transportation layer for heat (cool) of the network



ENERGY PLANTS

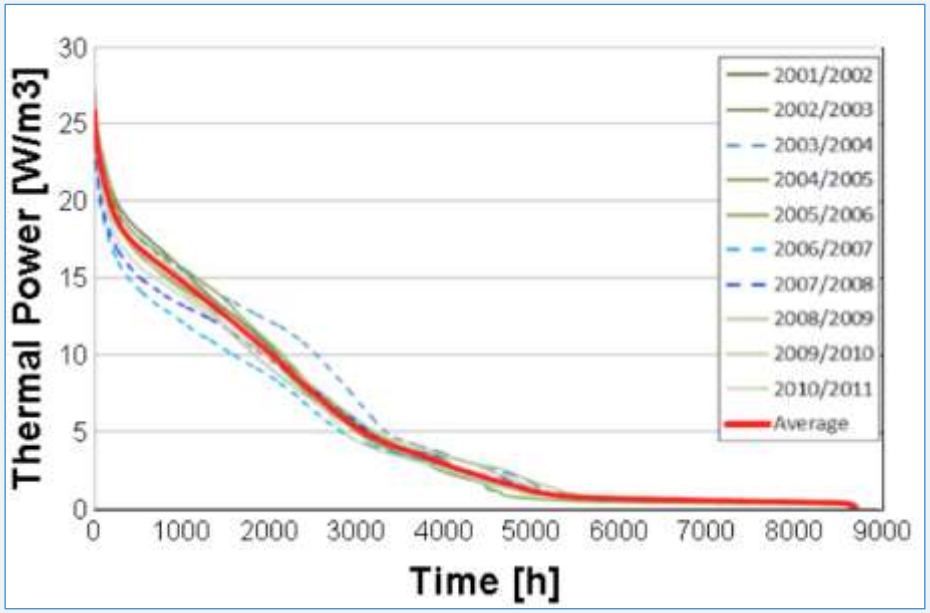
A centralized facility which uses boilers and chillers, heat pumps to heat the entire district

CONSUMERS

The society needs for energy

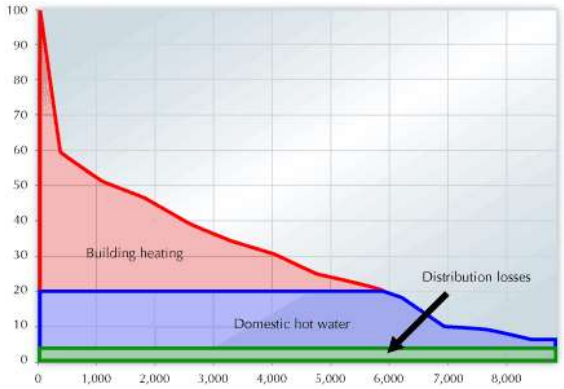
DH annual load duration curves

Turin, Italy



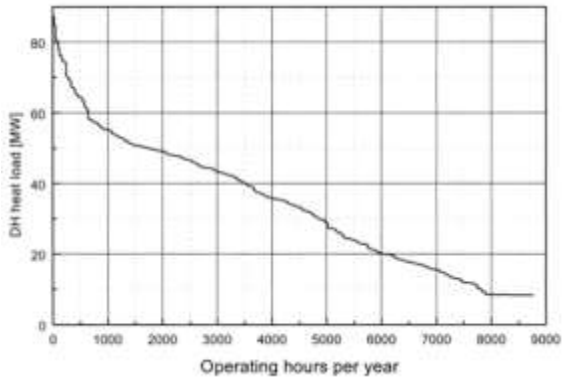
Each DH system has different characteristics, but with similar behaviour during most hours of the heating season.

Stockholm, Sweden



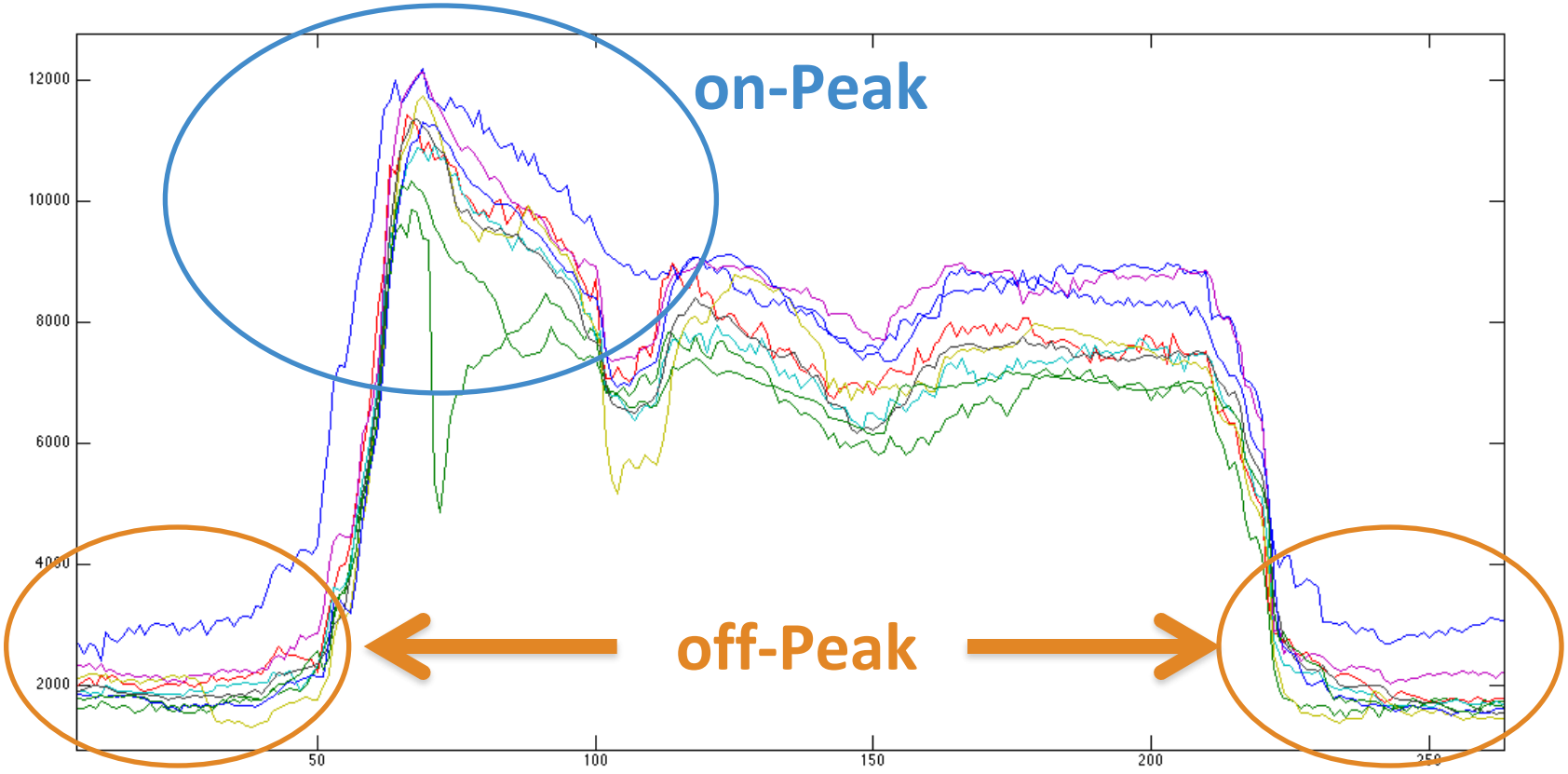
NRCAN (2011)

Goteborg, Sweden



Harvey et. al. (2000), Applied Thermal Engineering

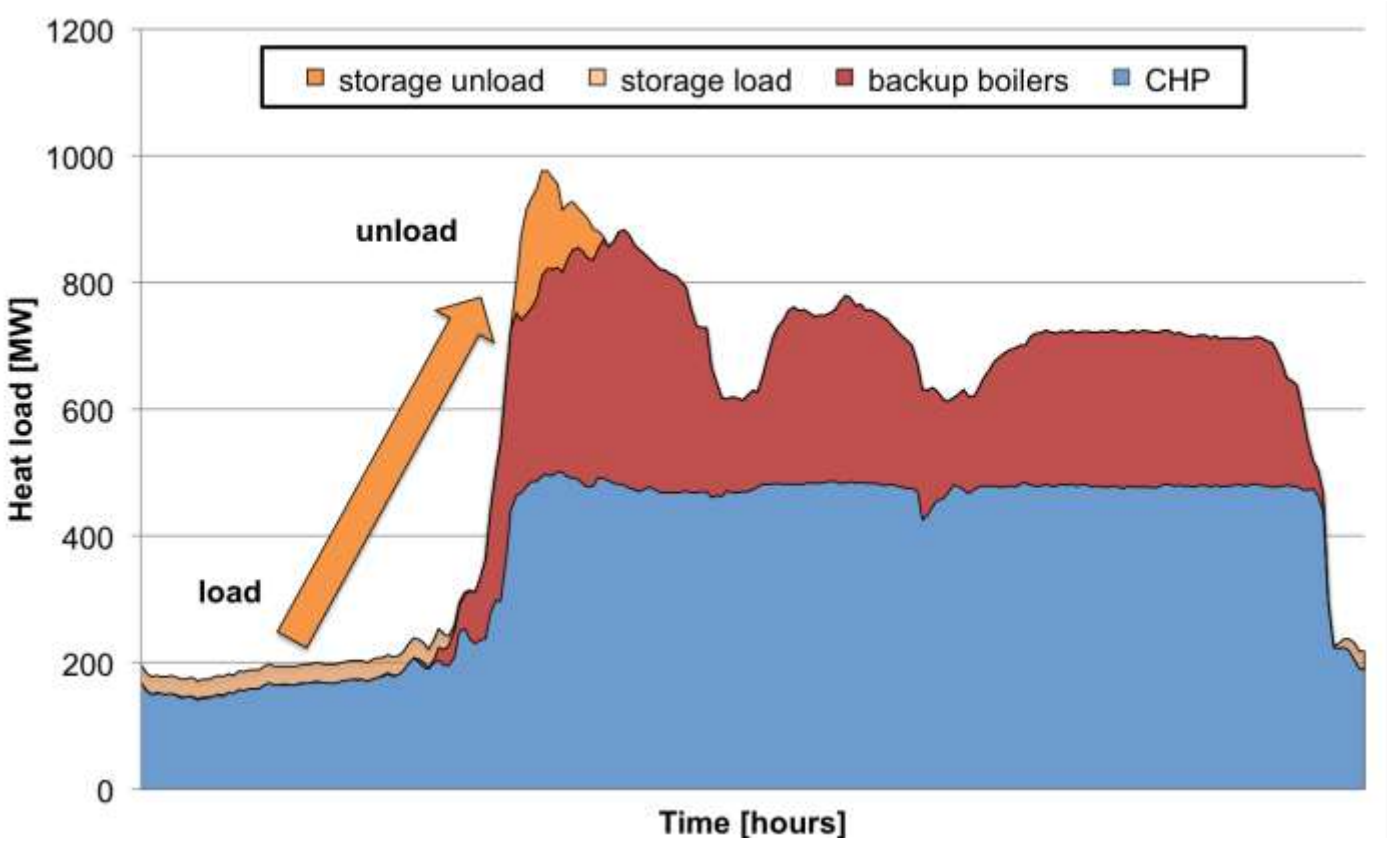
Examples of typical daily DH load curves



M. Noussan, G. Cerino Abdin, A. Poggio, R. Roberto. Installation of Small-Size Biomass-Fired CHP Units in Existing District Heating Systems. In: 21st European Biomass Conference and Exhibition, Copenhagen, 2013.

Daily heat storage behaviour (load/unload)

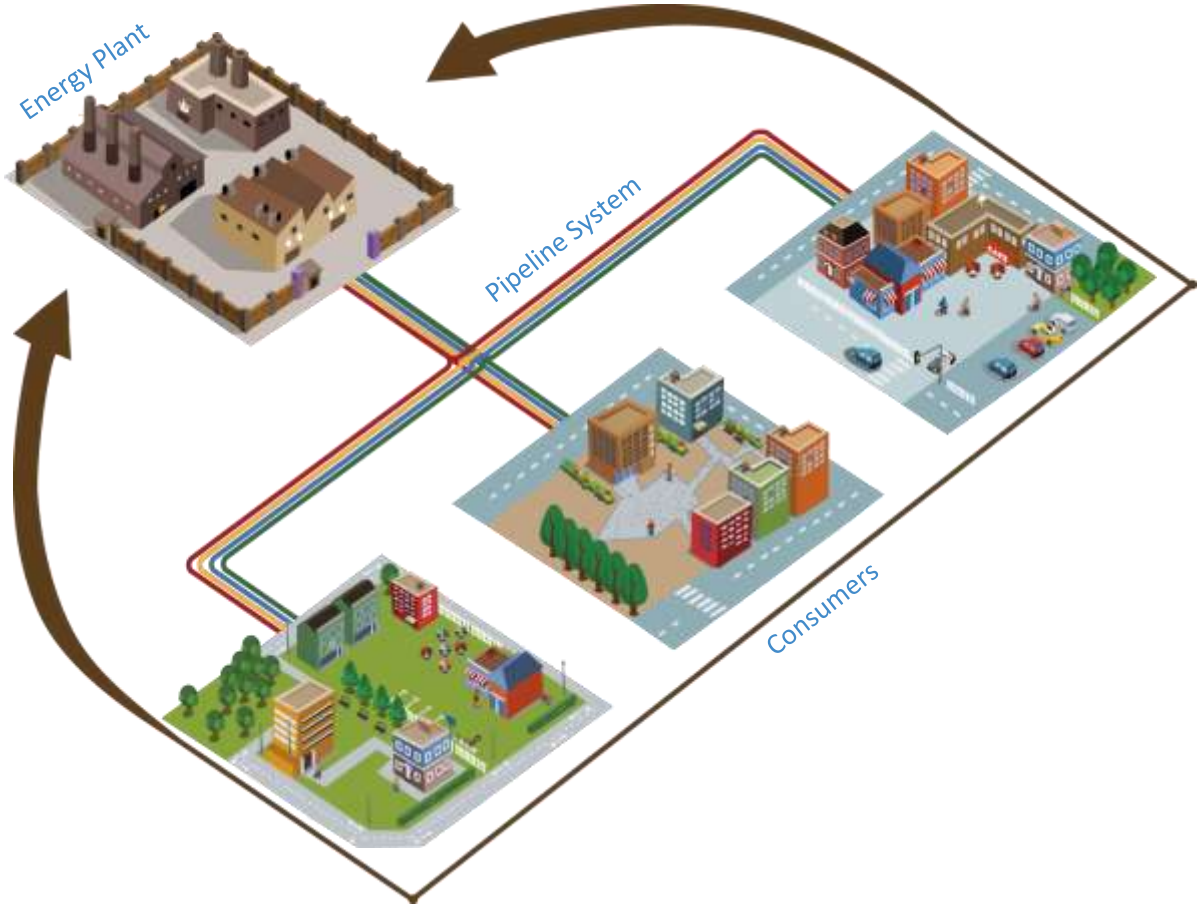
DH system of Turin (current network operation)



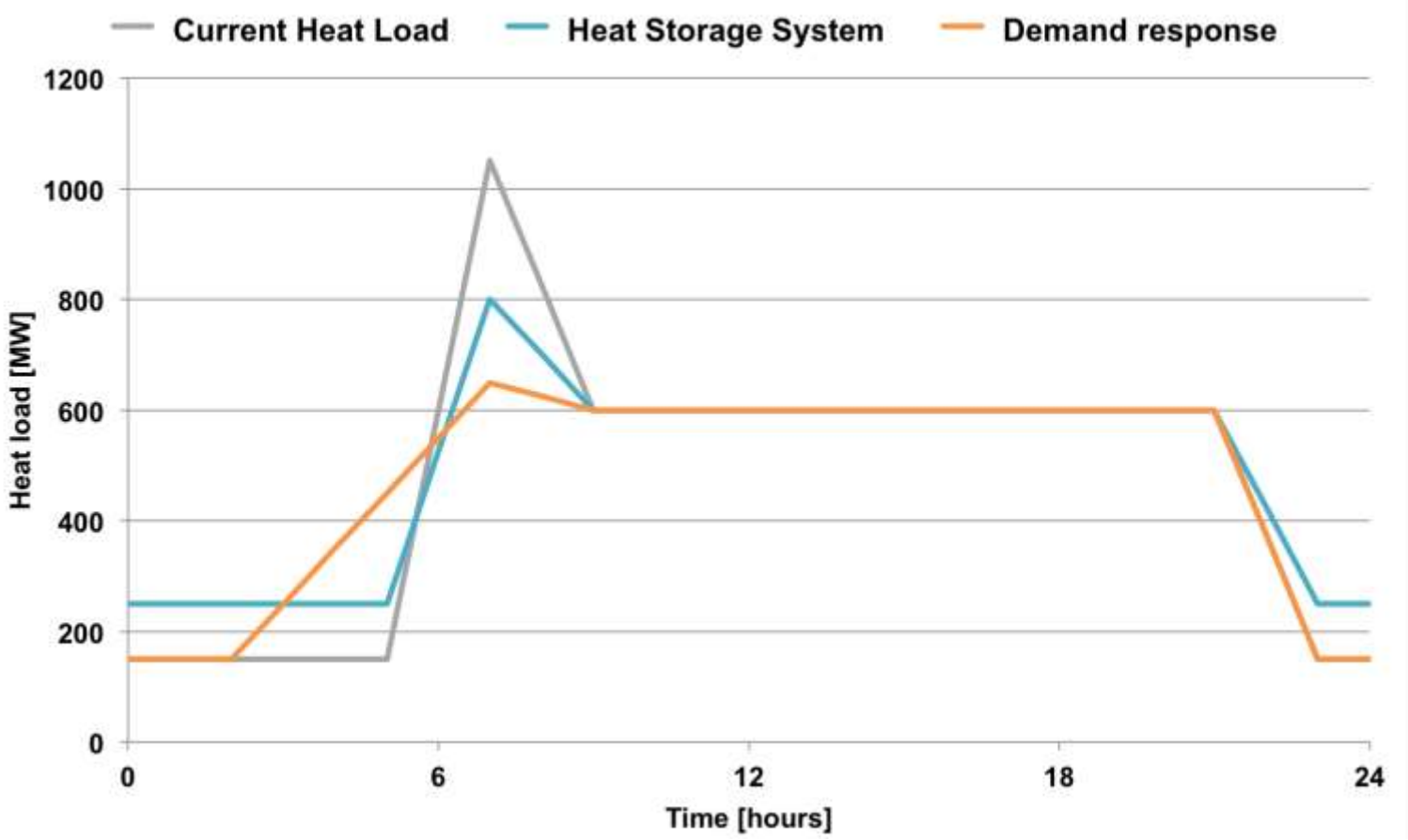
DHC+ Conceptual Diagram

USERS IN THE LOOP

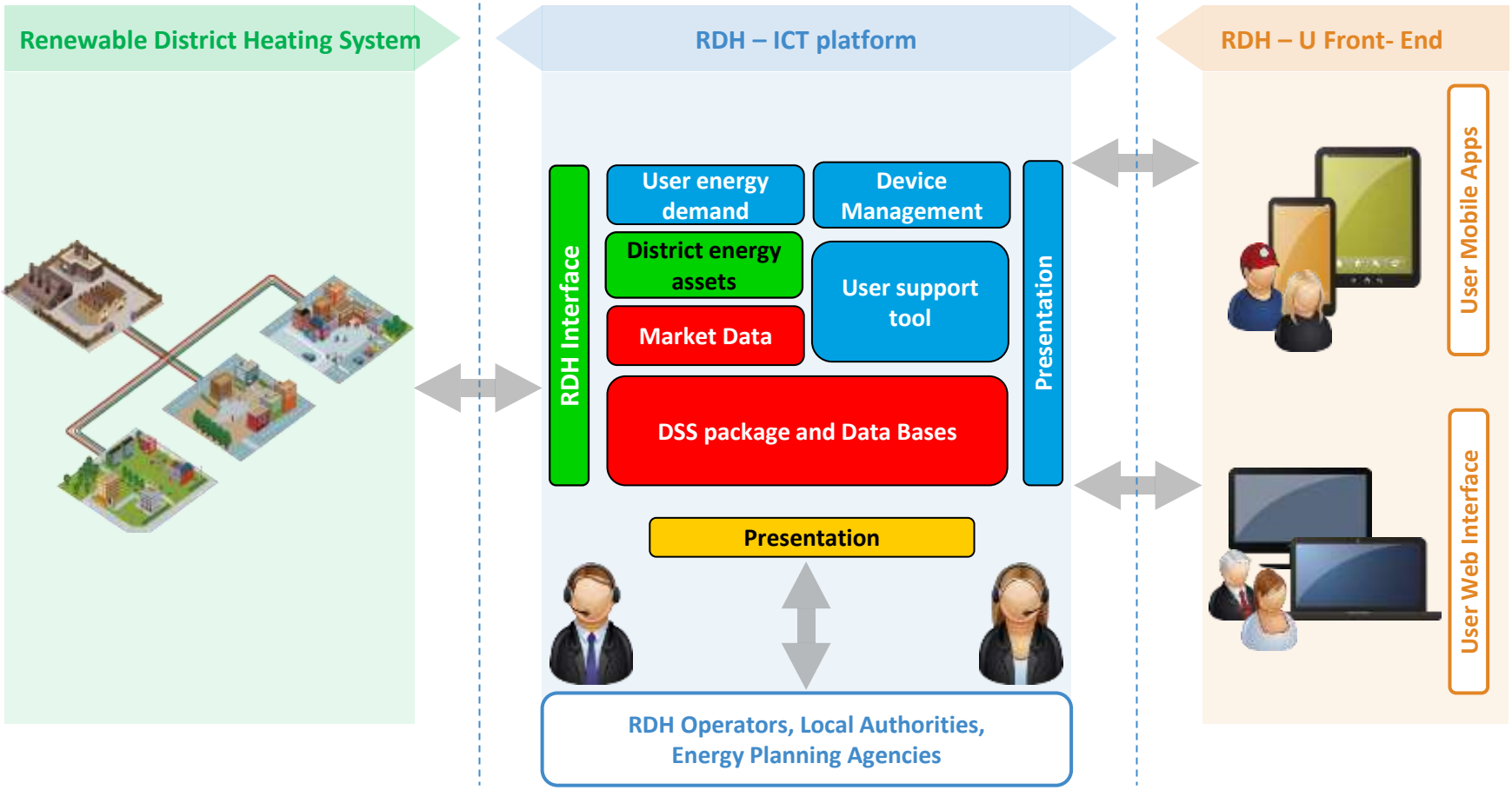
From monodirectional flow of energy and information to a bidirectional control with the user awareness, engagement and control



The potential effect of demand side management

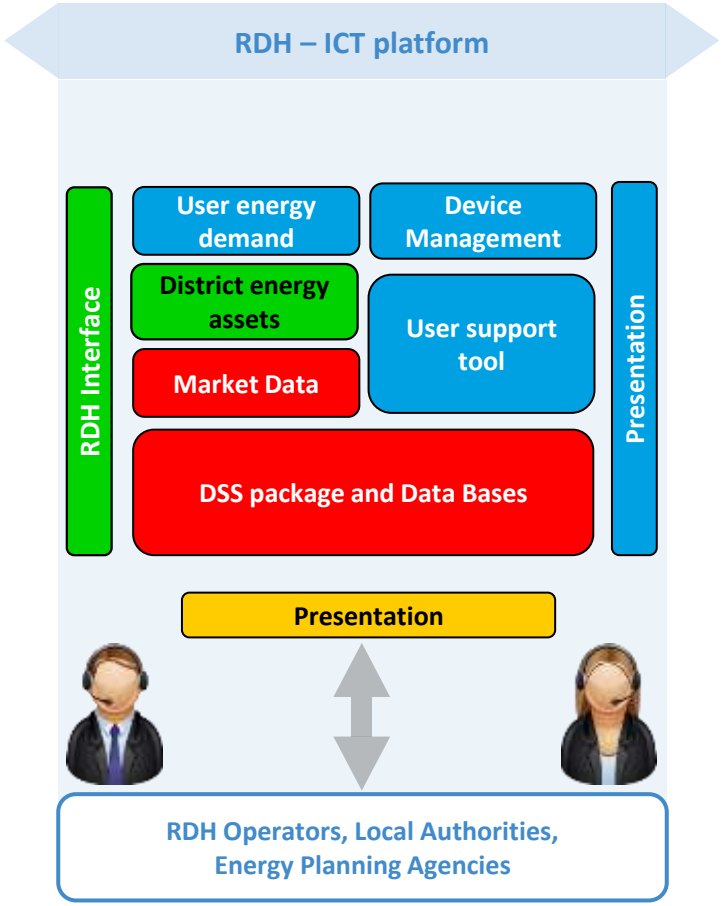


Users in the Loop



ICT Core of the Platform

- To develop a **decision support system** enabling Utilities and Local Authorities to plan new RES-integrated district heating systems
- To build the link among users and DHs
- To anticipating the consequences of the adopted users behaviour so to optimize the heat demand profile
- To support the integration and maximization of energy contribution from solar thermal systems and biomass power plants in existing DHs



Users Side of the ICT platform

RDH – U Front- End

User Mobile Apps

User Web Interface

- Setting-up smart users' engagement mechanisms able to raise user awareness and thus to improve the consistency between the user demand profile and production curves.
- Enhancement of final users behavior towards a proper use of energy, as much compatible as possible with the characteristics of energy production from RES systems.
- To enable the final Users of the district heating services to choose their preferred energy profile by having an anticipation of the cost and the environmental effects of their choice.

Conclusions

- Smart Thermal Grids shall be:
  - **Flexible** and be able to adapt both the energy supply and the energy demand
  - **Intelligent** and well operated enabling the users to interact with the network
  - **Integrated** in the whole energy urban system (i.e interacting with other network, ICT, waste)
  - **Efficient** acieving the highest results in terms of overal performance
  - **Competitive** being cost-effective for the society
  - **Scalable** and then suitable for neighbourhood level or city wide
  - **Secure** by for example supplying more energy from local resources

Increasing the approach of Users in the loop as enabling factor for the previous KPI of smartness of DHC systems.

FOR YOUR ATTENTION!

QUESTIONS?

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