Opportunities and barriers for asset managers integrating energy flexibility

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1. Introduction

Energy flexibility in a building = the ability to manage energy demand and generation according to local climate conditions, user needs and grid requirements (Jensen et al., 2017)

⇒ Need for demand side management/ load control based on the requirements of the surrounding grids

⇒ Affects various stakeholders: end-users, building owners, facility managers, ESCO's, project developers, architects, contractors, suppliers, aggregators, DSO's, TSO's,…

⇒ *Better understand the viewpoint of facility and asset managers (can act on a strategic building management level)*

2. Research approach

INTERVIEWS (23) and ACTION RESEARCH
related to a CASE STUDY:

Local climate conditions ⇒ The Netherlands (Delft)

User needs ⇒ Campus stakeholders: Focus on Facility Managers and campus frontrunners (Delft Energy Initiative, Green Village, research experts, spin-offs)

Grid requirements ⇒ heat grid towards lower operating temperature and smartness

⇒*Consequences for stakeholders:* End-users (staff and students), building owners (facility managers and spin-offs), researchers, HR officers, project developers, installers, architects, engineers, consultants, energy suppliers,…

⇒*Consequences for individual buildings*

3.1. Case study: campus TU Delft

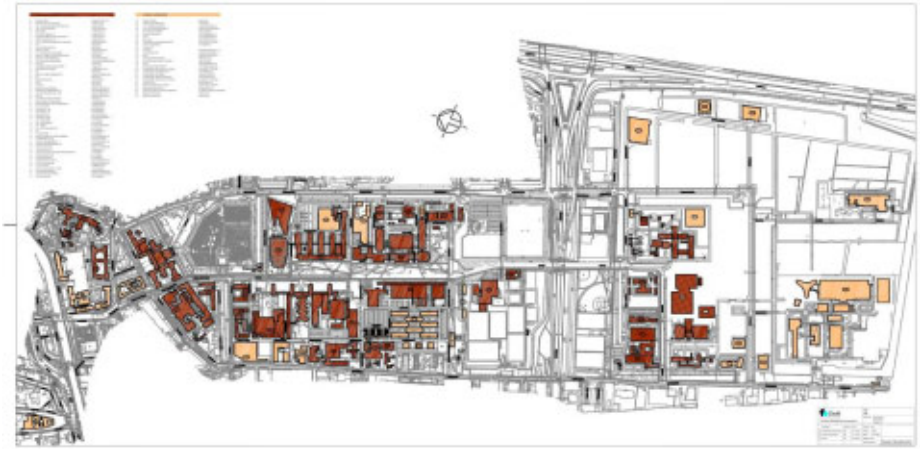
Campus = small village with a diversity of buildings

Surface = 3.072 – 46.860 m2

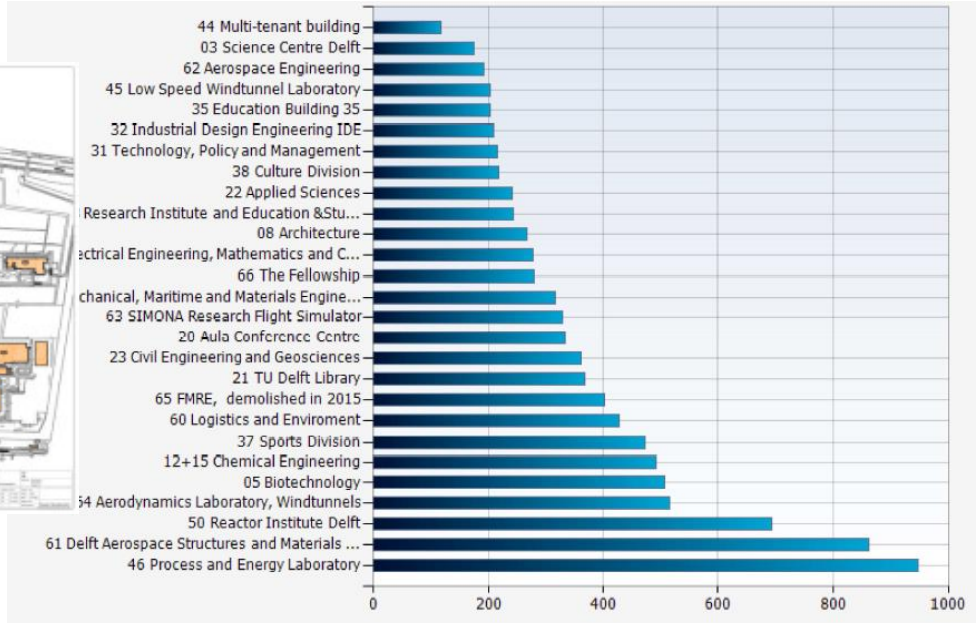
Installed power (TSA) = 407 – 13.410 kW

* Only larger buildings have a programmable building management system

* Energy information related to building (parts) instead of specific systems



Site plan of the TU Delft campus



Primary energy use in 2016 of TU Delft campus buildings connected to the energy monitoring system

3.2. Asset managers' initial view

Is energy flexibility a 'customer value'?

⇒*Asset managers' energy strategies go far beyond control, comfort and health concerns of individual buildings*

Not directly concerned about energy flexibility; real goals are:

1. Achieving ambitious overall energy saving goals
2. Maintenance actions to support energy saving
3. Deep renovation and rejection of campus buildings
4. Integrating innovation in construction
5. Transition of the energy grids and sources

⇒*Direct relation of energy flexibility with 5.: transition of the campus heat grid to medium supply temperature*

3.3 R&D project intelligent heat grid

Expected transition of the district heat network

gas-fired heat network ⇒ hybrid, integration of RES

Heat grid supply temperature 130 °C ⇒ 80 °C (same thermal comfort)

No price signal !

Movie gives an overview of the heat grid development: https://youtu.be/WeVe8-BVkaA

Source:
TU Delft:
FMVG:
C. Hellinga

3.4. Simulation and testing (2016-2017)

1. Coupled simulation studies (LEA/Wanda) to evaluate building behaviour
2. Practical testing of the dynamic control system (model predictive control of one test building)
3. Testing the prototype on a branch of the district heat network (3 buildings, 11 heat delivery stations)

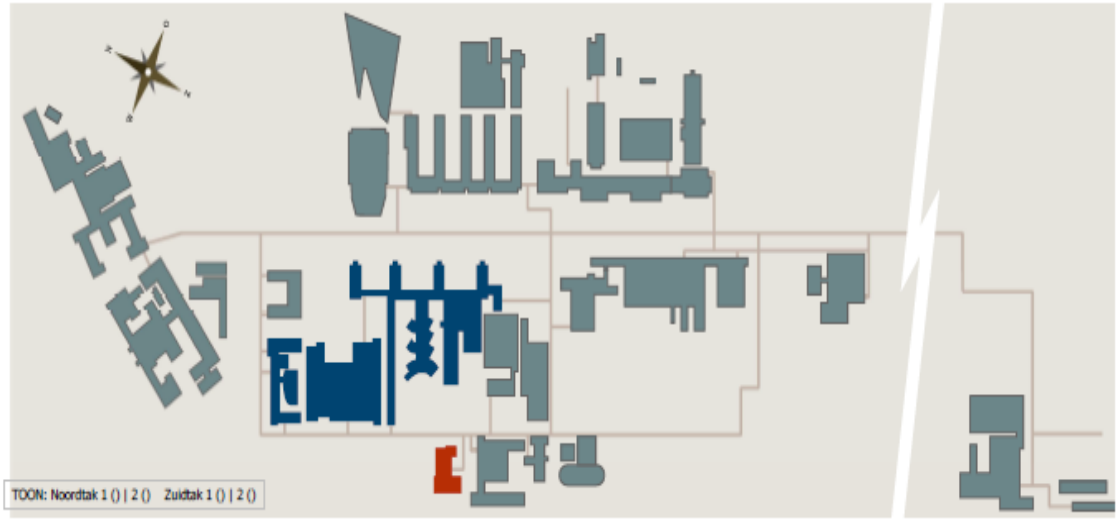


Figure 10. Tested branch and buildings of the TU Delft campus. Source: https://ipin-tudelft.erbis.nl/.

3.3 Asset managers' progressive view

CONSEQUENCES for facility management:

- Redefine branching and apply cascade circuits in heat connectors
- Reduce supply T and control supply T per building cluster based on five-day weather forecast; Reduce excessive flow based on wanted ΔT

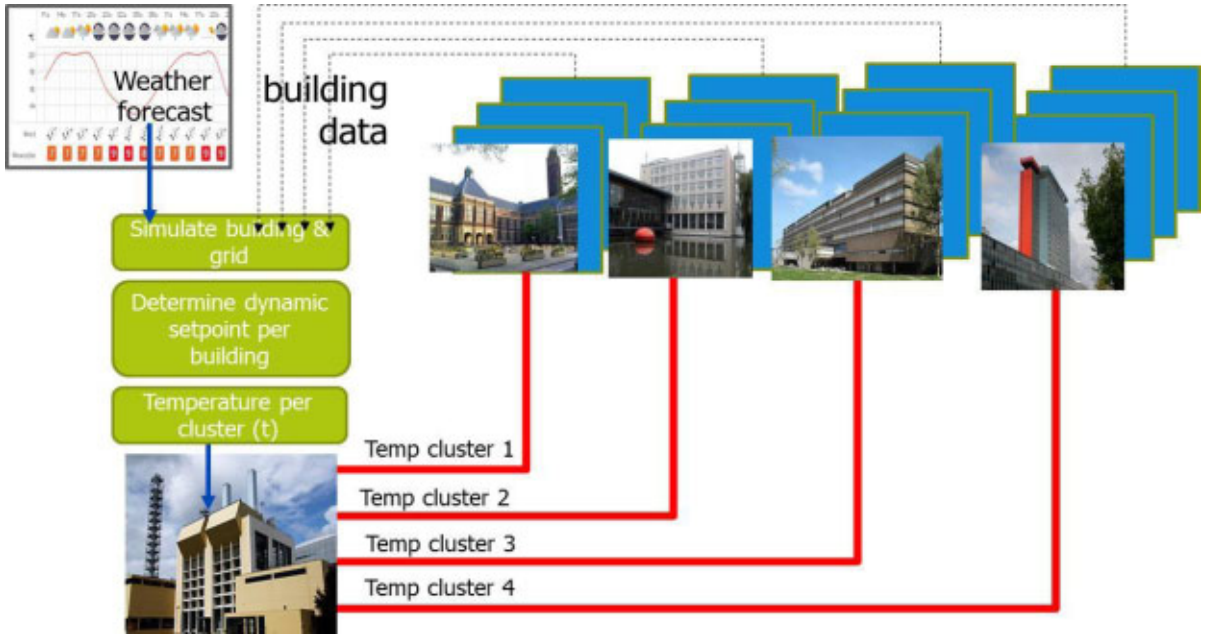


Figure 6. Expected changes in the TU Delft campus district heat network: branching and control strategies (future situation). Source: TU Delft/ Deerns, 2015.

3.5. Asset managers' progressive view

Assessment by asset manager	**Simulation**	**MPC test**	**Branch test**
Positive	Grid supply T can be reduced in some branches/ buildings (provided there are heating operation time shifts)	MPC was robust during test period	Supply temperature heat grid successfully lowered to conditions where RES can be used
Negative	Needed investment: Expected modifications in networks, buildings, building systems/ components	Lack of available energy management systems & data coupling	Limited match simulation results/ real energy use & concern influence of computer crashes on operability

4. Discussion

Asset managers' perspectives	Before case study	After case study
Economical	Older buildings can be made suitable for low supply T with fast and – compared to renovations - relatively small investments.	Investments per building higher then expected and limitations development RES due to current size of network
Technical	Expected as 'control' problem	Also need for technical modifications on all levels, servers and emergency switches
Social	Innovation process involving multiple stakeholders	One asset manager should be in charge but development of grid towards added areas
Environmental	Expected reduction of gas consumption 10-15%	Discussion about getting rid of gas as energy carrier

5. Conclusion (case study)

Main opportunities for asset managers integrating energy flexibility:

- Reduction energy consumption and CO_2 emissions can be achieved
- Integration of (more stable) renewable energy sources is feasible (geothermal energy, cogeneration)

Main barriers for asset managers integrating energy flexibility:

- Needed changes - compared to expected lifetime - of buildings and systems
- Need to expand grid beyond the campus, involve multiple stakeholders

Full report: http://www.annex67.org/publications/reports/

Thank you

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QUESTIONS?