DEMONSTRATION OF 4GDH SOLUTIONS IN A LARGE CITY DEVELOPMENT AREA

INTERNATIONAL CONFERENCE ON SMART ENERGY SYSTEMS AND 4TH GENERATION DISTRICT HEATING
TRACK 7: SMART ENERGY SYSTEMS
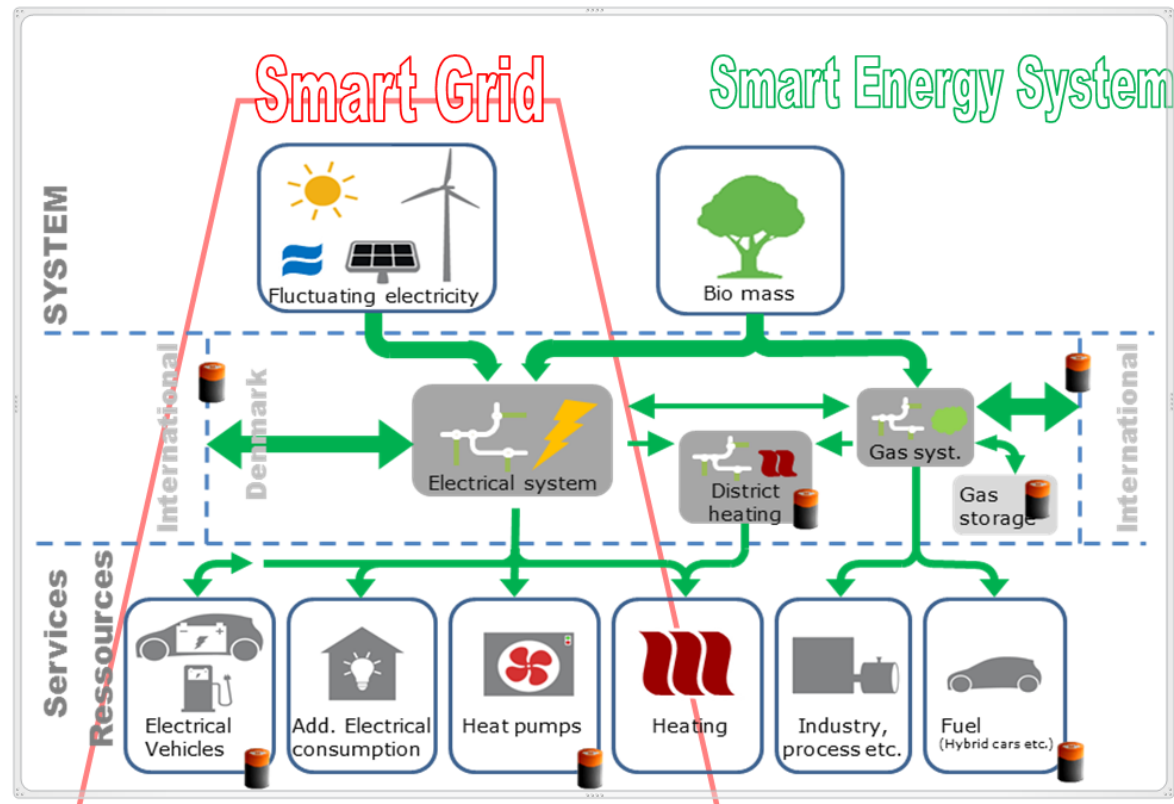
Copenhagen

25 August 2015

BEING SMART?
- PERSPECTIVE OF A DISTRICT HEATING COMPANY

- **Smart energy**   **… or just being clever**
- **Smart electricity**
- **Smart district heating**
- **Smart city**

DELIVER FLEXIBILITY TO THE ELECTRICITY SYSTEM

LARGE ENERGY STORES	Storage capacity (GWh)	Cost (kr/kWh)
Gas store, methane	11000	1
Gas store, hydrogen	3500	
District heating system	300 - 500	3 - 7
Heat pumps outside gas and district heating networks	10 - 30	
1.5 million electric cars	30 - 50	300 - 500

How may a district heating company provide flexibility to the electricity system

- Utilize the heat capacity in heat stores, pipelines, and buildings to receive 'surplus' electricity; e.g. by means of electric boilers and heat pumps.
- Utilize the heat capacity to accept lower heat production, allowing lower electricity production.
- If it owns cogeneration facilities, heat and/or electricity production may be increased beyond scheduled production.
- If it owns cogeneration facilities, heat production may be by-passed to produce extra electric power.
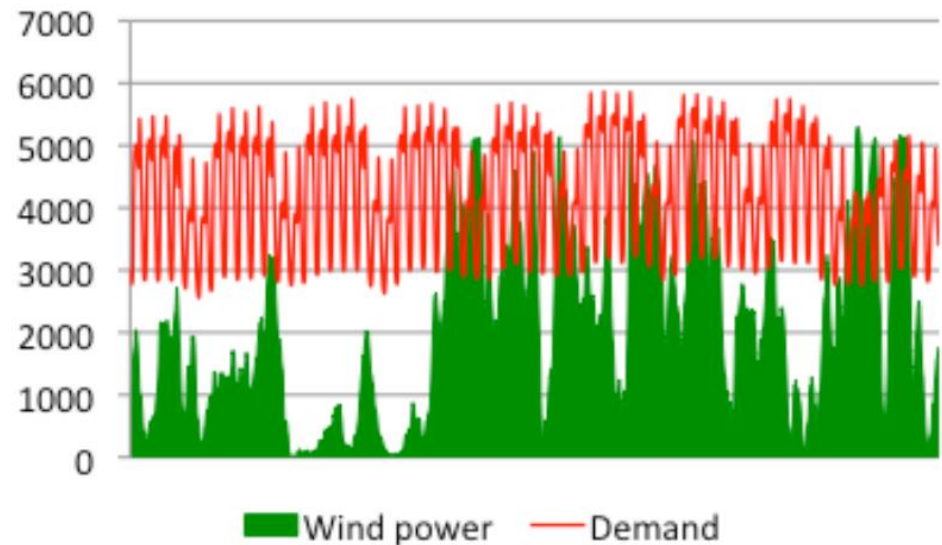
SMART OPERATION OF HEAT PUMPS

- A SIMPLE EXAMPLE
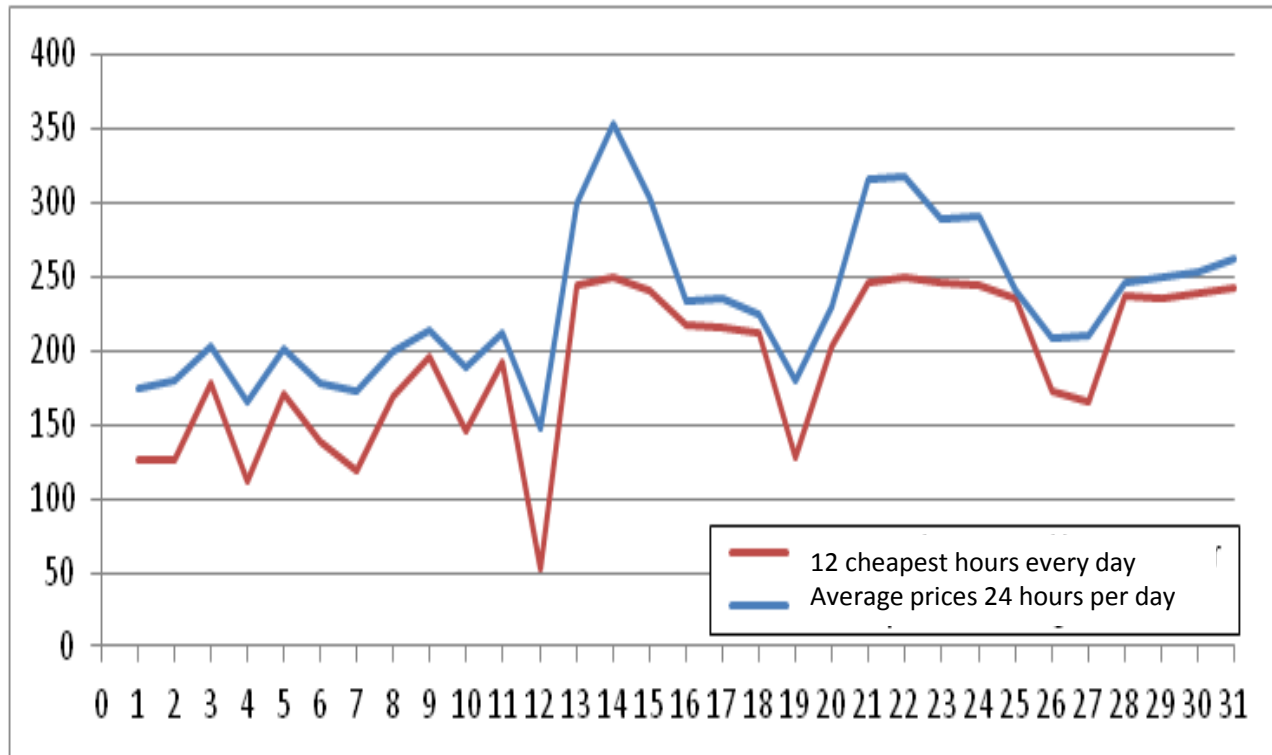
1 MJ/s heat pump operated full load (24 hours per day)

    replaced by a

2 MJ/s heat pump operated the cheapest 12 hours every day

Legend: Wind power (green), Demand (red)

FEASIBILITY OF SMART HEAT PUMP

Average spot market electricity prices (DKK/MWh), January 2014:

Average spot price
Full-day: 32 €/MWh
12-hours: 28 €/MWh
Saving: 13 %

Average buying price
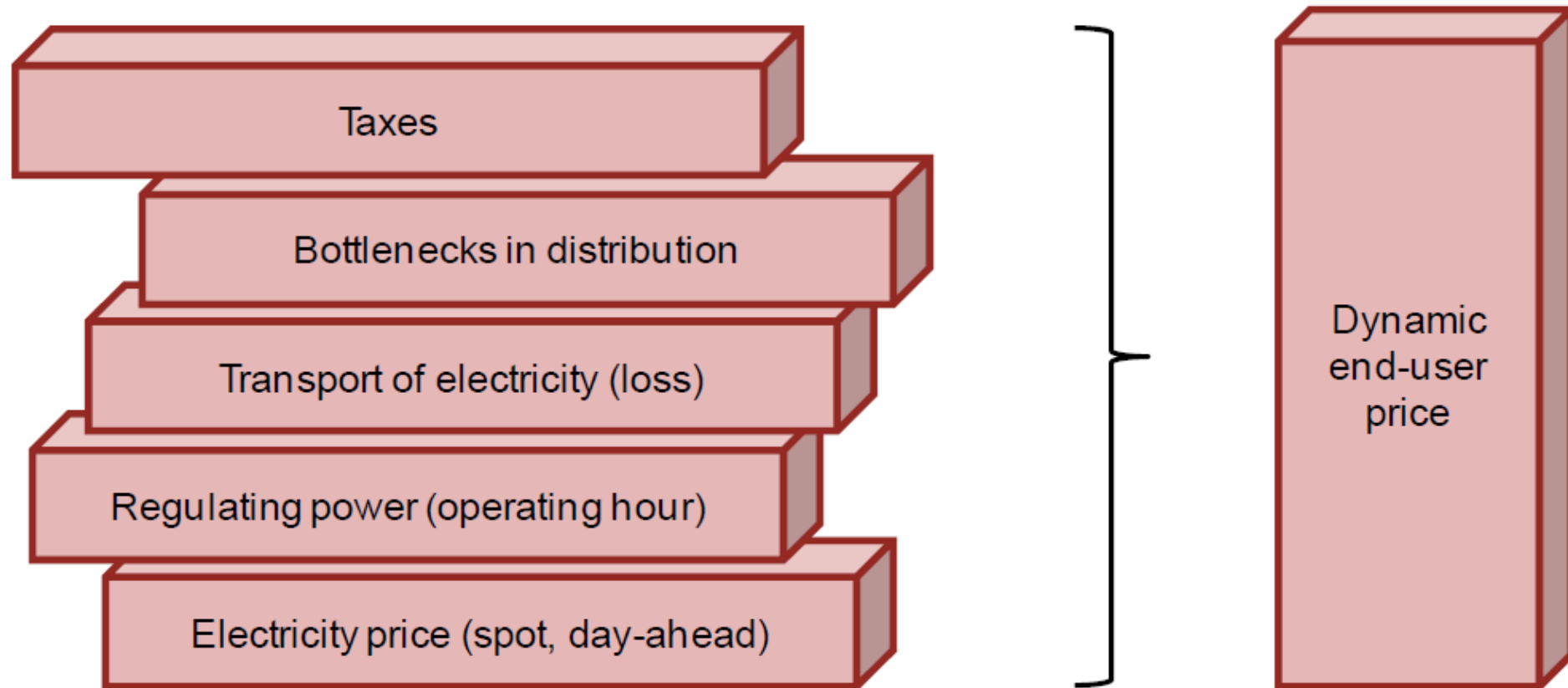Full-day: 144 €/MWh
12-hours: 140 €/MWh
Saving: 3 %

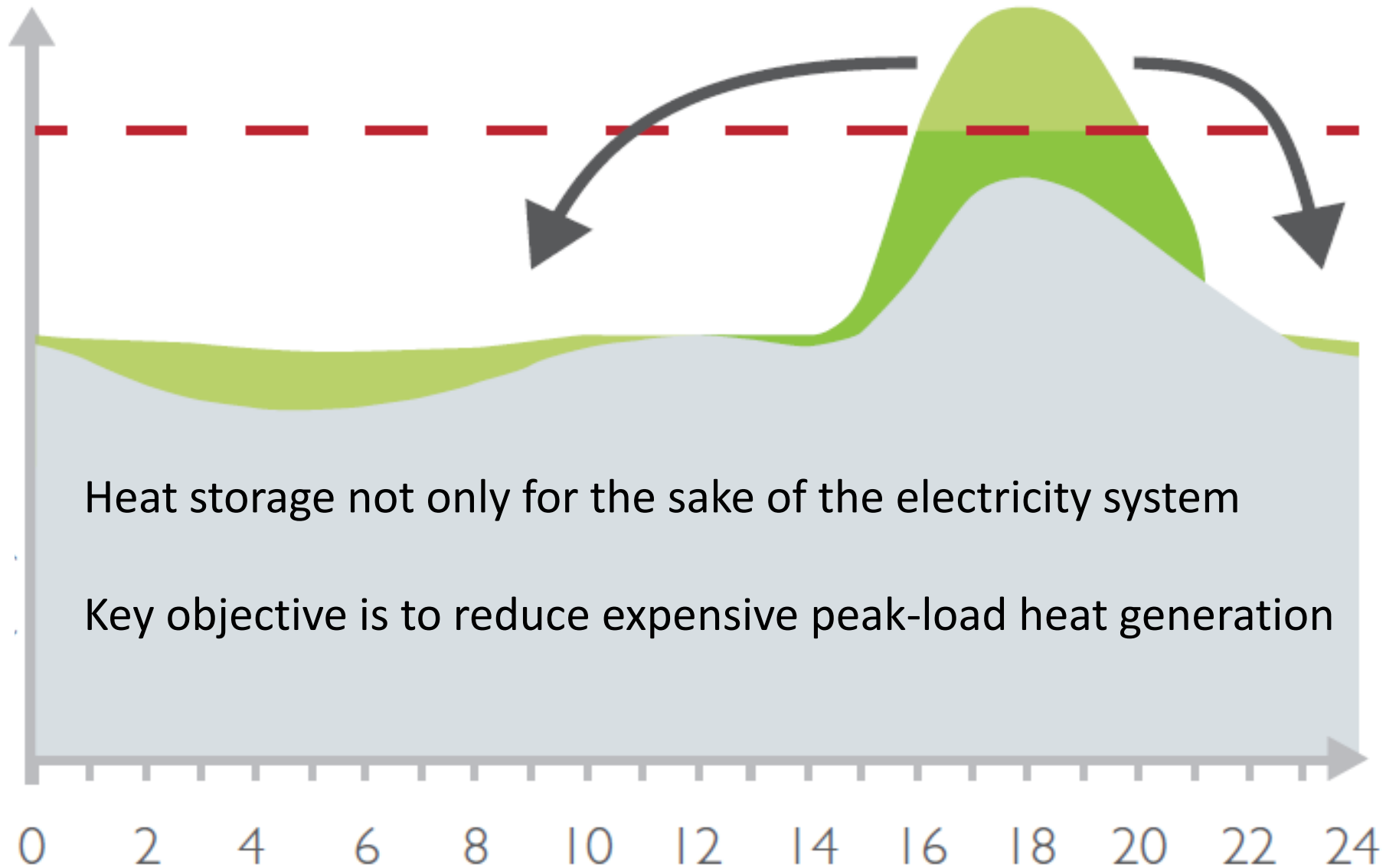| Electricity tariff	
Spot market	32 EUR/MWh
Duties and taxes	112 EUR/MWh
Total price	144 EUR/MWh

2 MJ/s heat pump
Extra investment 530,000 €. Extra O&M 2,700 €/year.
Electricity saving 12,500 €/year -> Simple pay-back 54 years

In a smart energy system, the major price elements should have a dynamic component
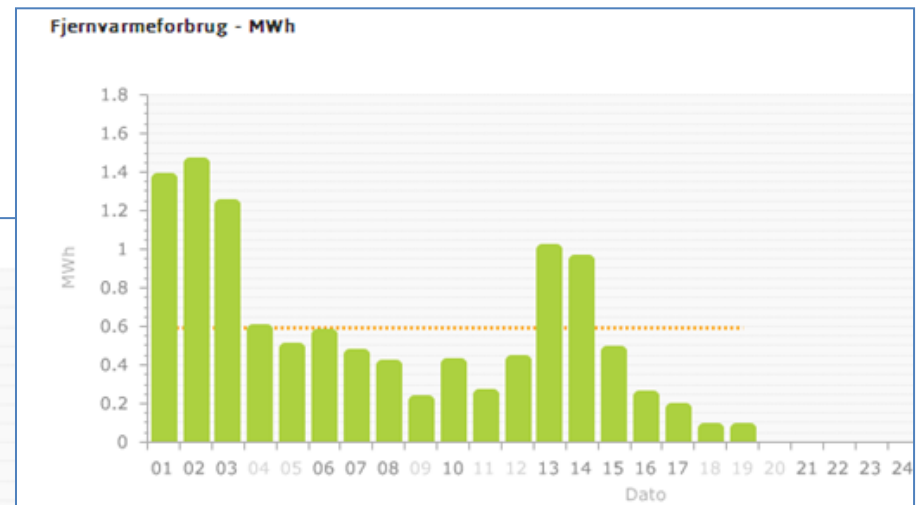
SMART DISTRICT HEATING

Heat storage not only for the sake of the electricity system

Key objective is to reduce expensive peak-load heat generation

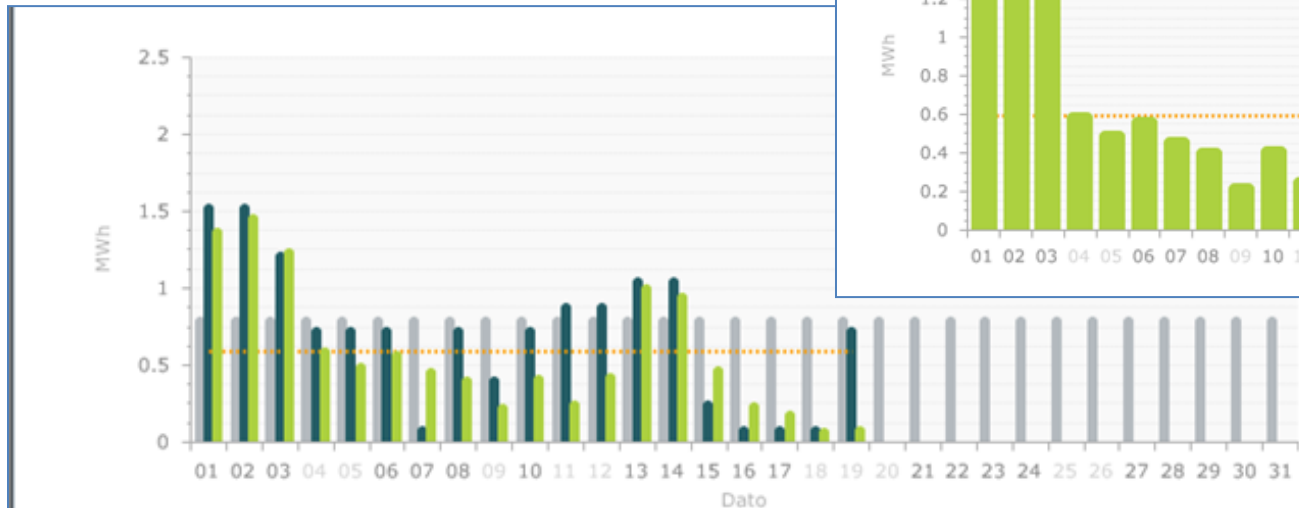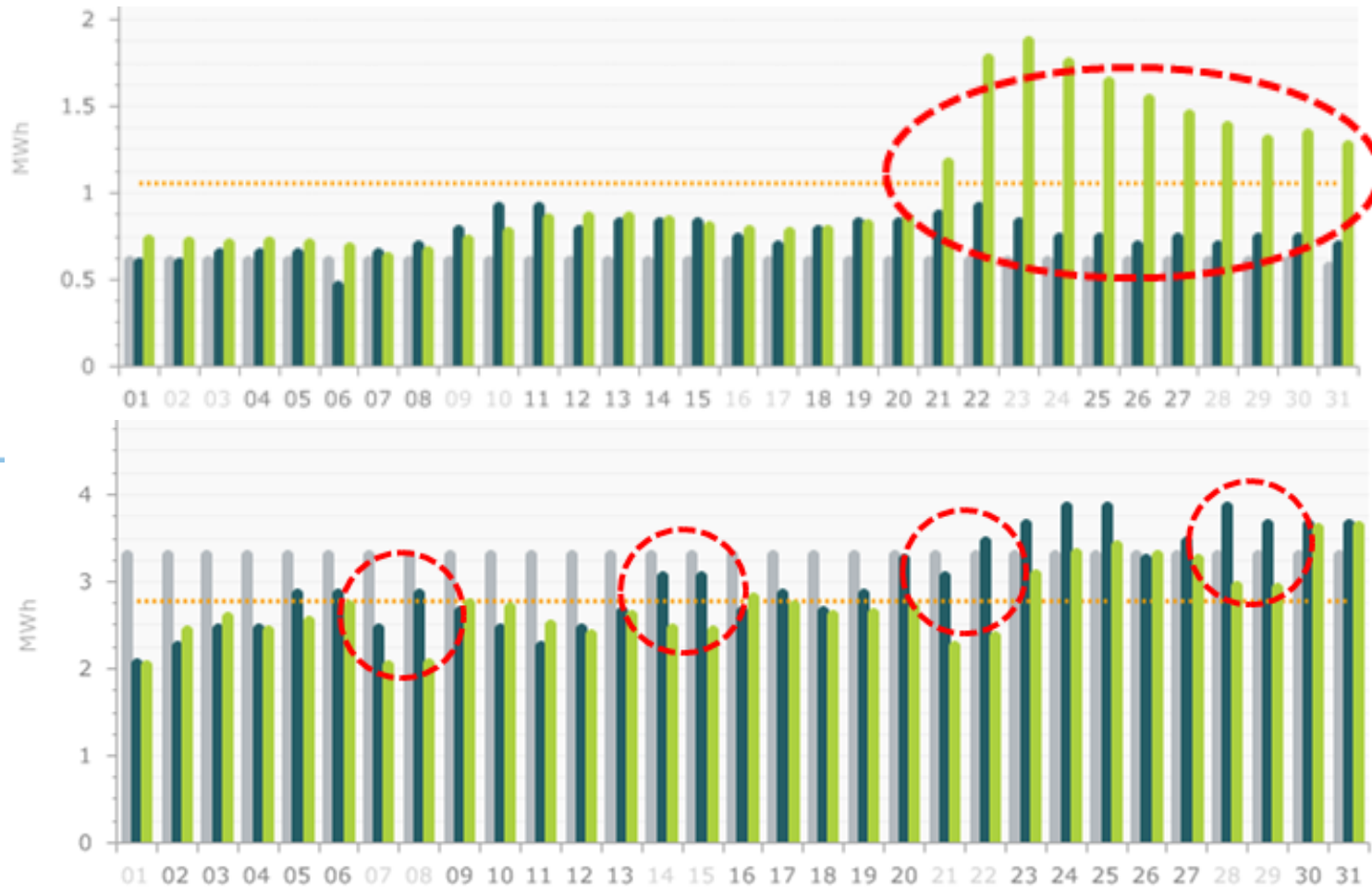|												
0	2	4	6	8	10	12	14	16	18	20	22	24

EFFICIENT ENERGY MANAGEMENT OF BUILDINGS

- **Data from smart meters, consumption budgets and degree days based reporting ensures the right knowledge and focus.**

- **Simple and correct follow-up & know-how**

- **Training of operational staff is essential**

DISTRICT HEATING IS ALREADY SMART

... or just clever?

Nordhavn
Former free-port
Future:
40,000 living
40,000 working
40 years

EnergyLab Nordhavn
RD&D Project
2015 – 2019

Budget 17 million €
Public funding:
10 million €

EnergyLab Nordhavn
New Urban Energy Infrastructures

www.energylabnordhavn.dk

Flexibility from heat and cooling grids

Integrated markets and control centers

Power grid operation

Storage flexibility

Fuel - shift components

Smart charging infrastructure

Measurements and data warehouse

Flexible buildings and users

Showroom and visualisation

Thank you for your attention

Nordhavn: A Smart City

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