e-harbours electric

Flexible demand for energy in a competitive logistic environment

Verbeeck J., Hommelberg M. and Delnooz A.

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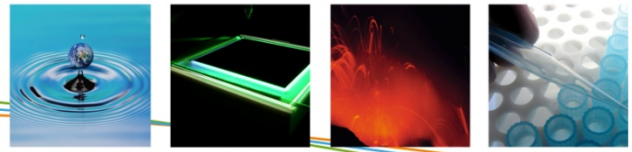

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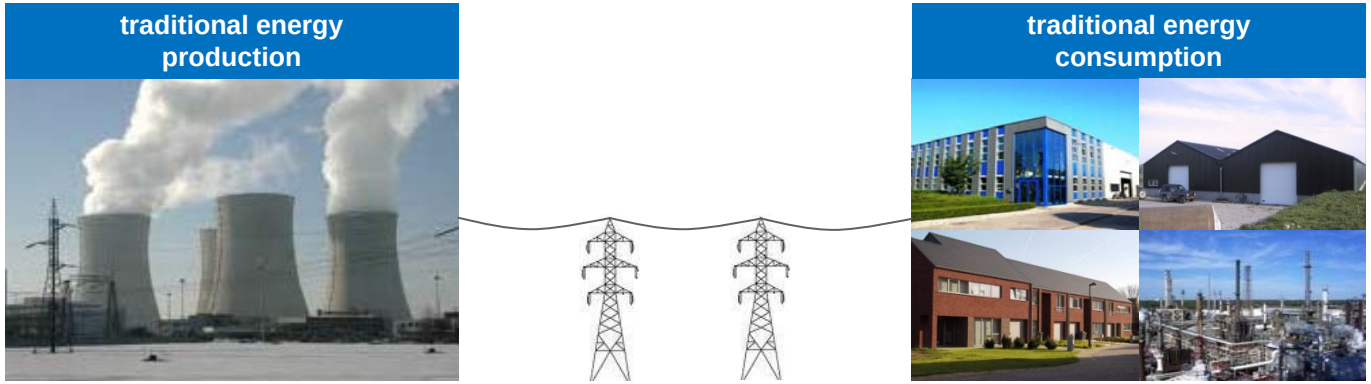
Traditional energy system



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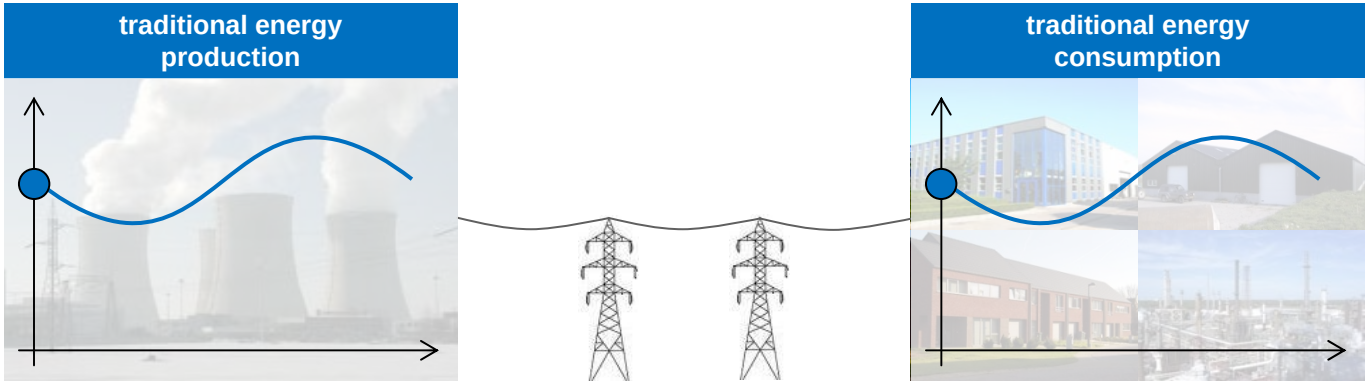
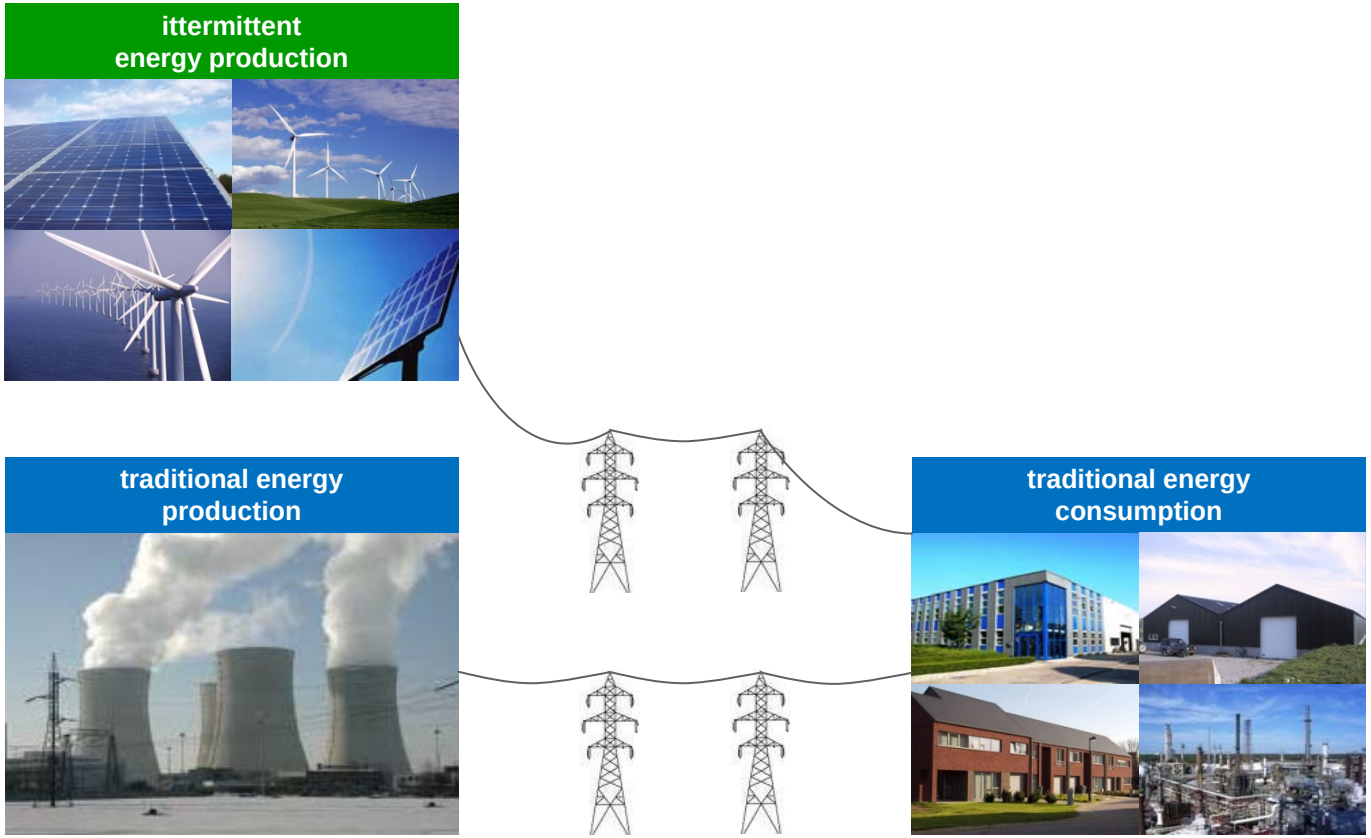


Introduction of renewable energy



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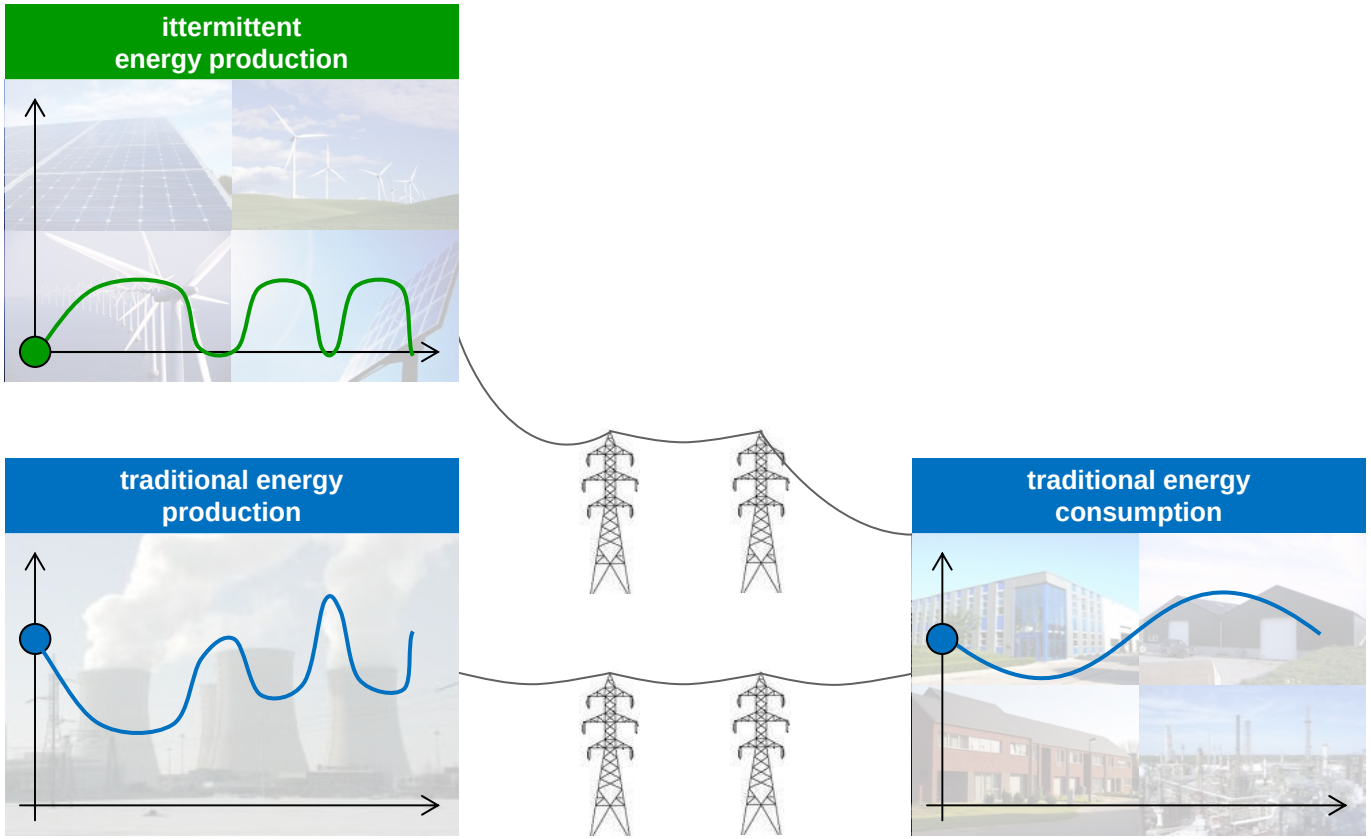
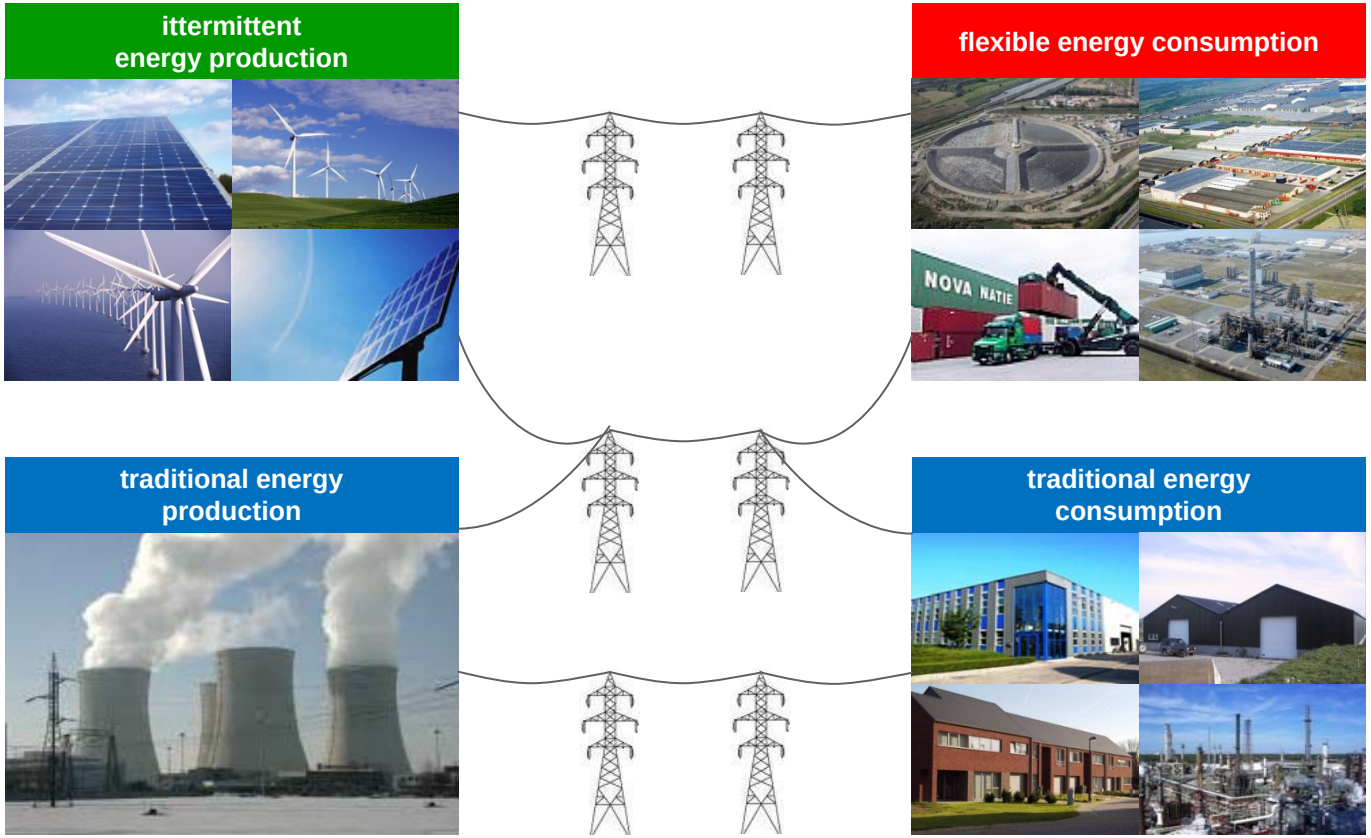
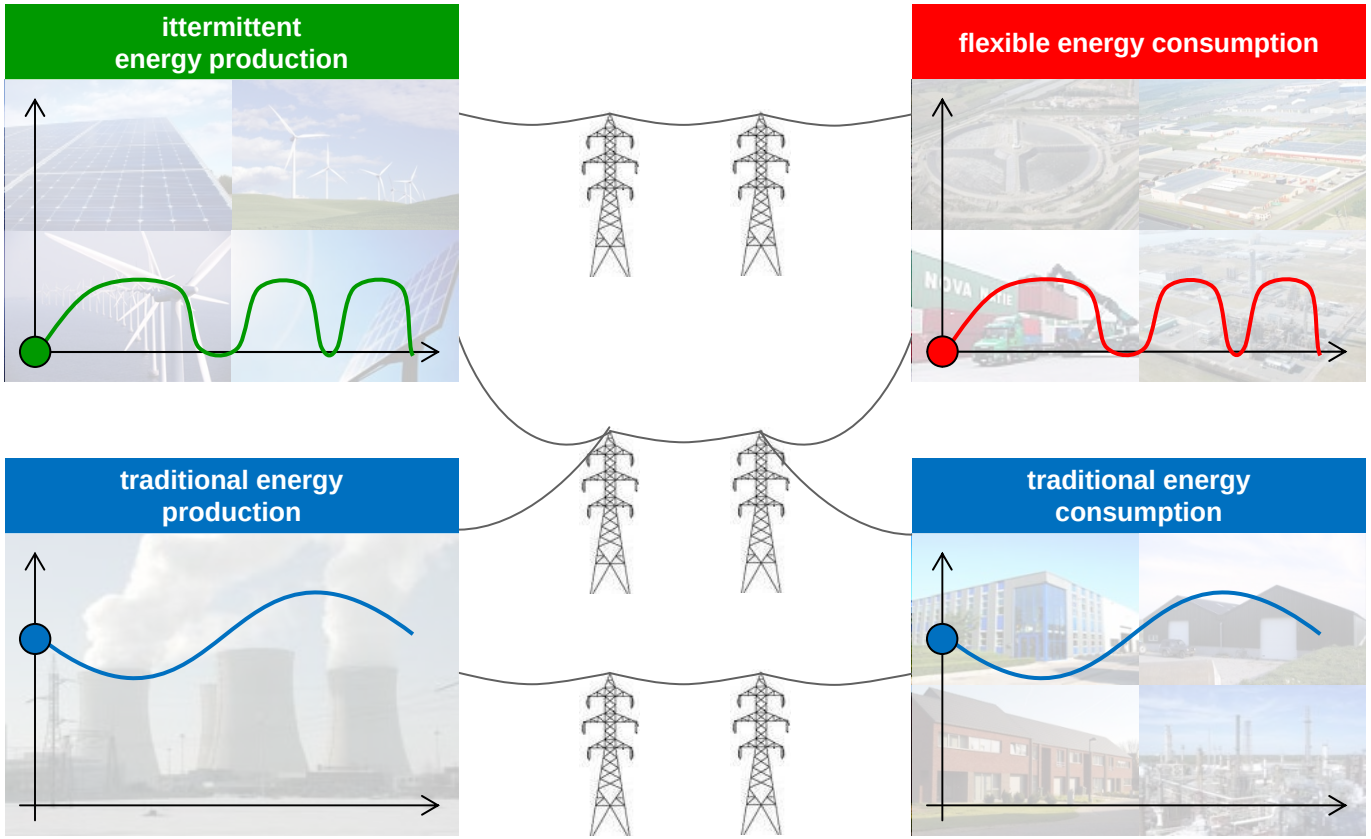


Demand side flexibility



Demand side flexibility



e-Harbours: The Antwerp showcase

The Antwerp harbour showcase

original scope

- detailed screening of individual companies on the presence flexibility
- economical value estimation of the flexibility within the current energy contract and future options
- order of magnitude flexibility estimate harbour wide based on the individual company results

e-Harbours: The Antwerp showcase

The Antwerp harbour showcase

extended scope

- optimal use of flexibility in combination with installed wind power for each individual company
- Wind power investments are planned by the “Port of Antwerp” with option for companies to directly use the available power

e-Harbours: The Antwerp showcase

Contributing companies

	activities	flexibility
 SEA-Invest	■ extensive know-how in stevedoring and other port related activities ■ storage of fruit and vegetables	■ cooling capacity with limited temperature margins
 LUIKNATIE	■ general port logistics, operations and transportation company with warehouse facilities	■ large cooling and freezing warehouse capacity ■ product portfolio which accepts large temperature variation
 NOVA NATIE	■ general port logistics, operations and transportation company with warehouse facilities	■ cooling and freezing warehouse capacity
 BOREALIS	■ chemical production plant for propylene and polypropylene	■ huge energy consumption ■ shifting activities with high energy demand in time
 Amoras	■ sustainable solution for the storage and processing of dredging material from the Port of Antwerp	■ shifting activities with high energy demand in time

Example of a detailed screening: Amoras

Amoras detailed screening results

without optimization

- Add windturbine to the Amoras site
- use the current Amoras energy usage patterns

with optimization

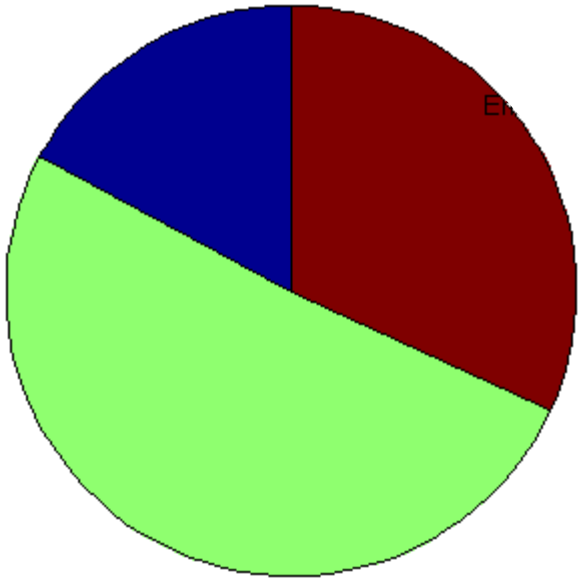
- Add windturbine to the Amoras site
- optimally use wind energy
- optimally use night energy

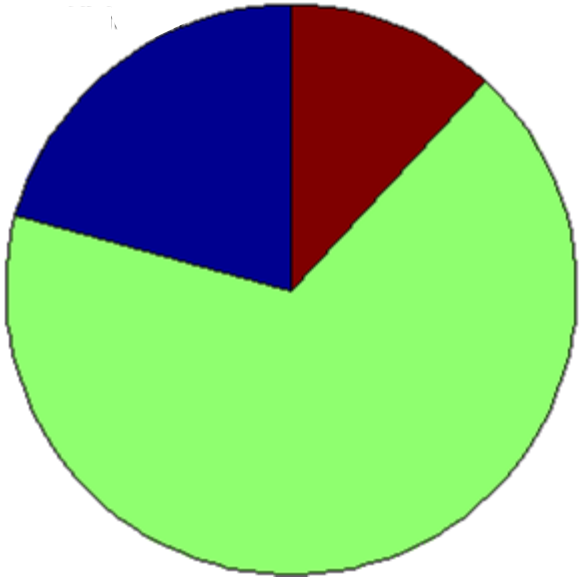
Example of a detailed screening: Amoras

Amoras energy sources

- energy from **wind**
- energy in **day** tariff
- energy in **night** tariff

without optimization	**with** optimization





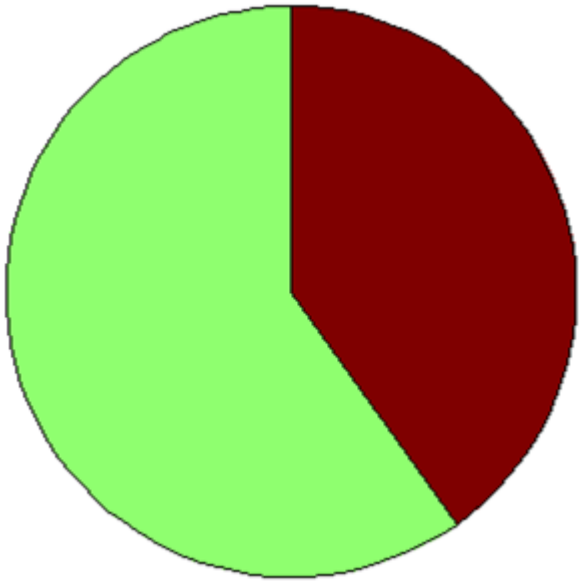
Energy cost reduction: **41%**

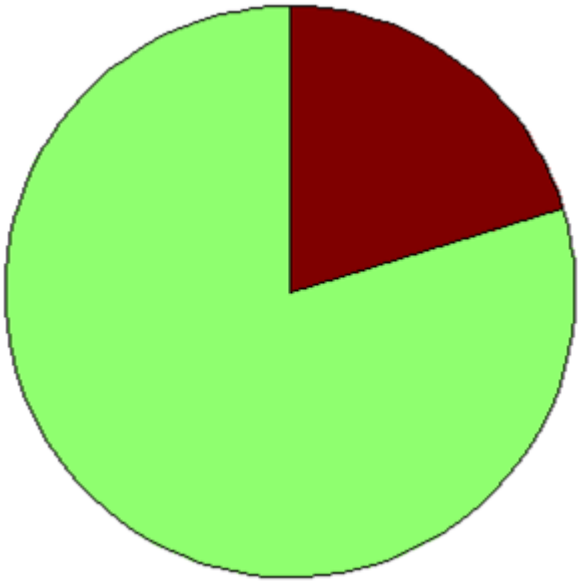
Example of a detailed screening: Amoras

Wind energy usage

- wind energy locally **used** at the Amoras site
- excess wind energy **sold** on the energy market

without optimization	**with** optimization





New sources of flexibility?

Refrigerated containers or “reefers”

reefer key figures

- peak power: 10-15kW
- specified for operation at temperatures up to 60 degrees
- average power consumption 3-4kW
- ISO 6346 standardized insulation categories (0.4.. 0.7 W/m^2.K)

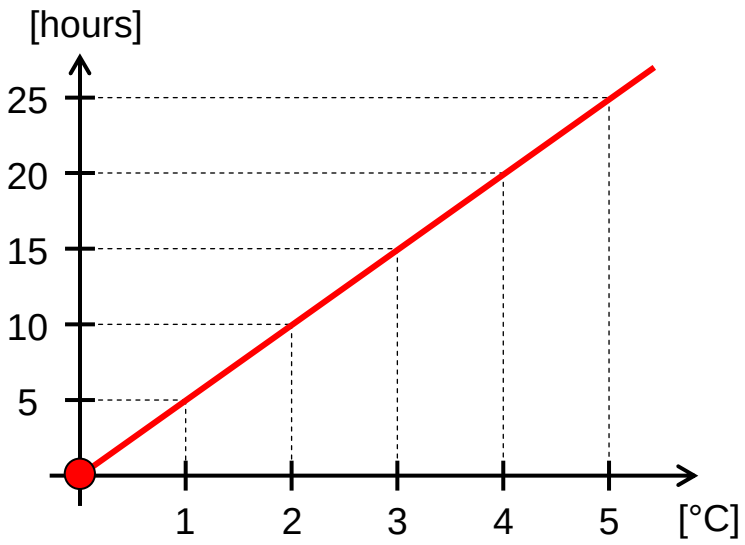
reefers in the Antwerp harbour

- 2008: 200.000 – 250.000 TEU
- average connection time: 3-4 days

New sources of flexibility?

Flexibility in reefers

How long can you "switch off" a reefer container as function of the allowed temperature variation?



flexibility expressed in duration

- insulation level container: **0.4** W/m2.k
- outside temperature: **20** °C
- acceptable temperature variation: **5** °C

➔ **25 hours without power**

flexibility expressed in power

- Volume per year: **250.000** TEU
- average connection time: **4** days

➔2750 reefers connected

➔ **27.5 – 40 MW of flexibility**

New sources of flexibility?

Harbour cranes

key figures

- peak power: **200-600** kW
- not always connected to the electricity grid using individual power generator

estimated flexibility

- rough estimation of harbour cranes with individual power generator in the Antwerp harbour: **100**
- estimated availability: **4000 h/year**

➔ **20 MW** of flexible generation available

Lessons learned during the assessments

You find flexibility where you don't expect it

Amoras

- Amoras was added to the e-Harbours Antwerp showcase with limited expectations
- A first assessment showed that Amoras:
  - has the highest flexibility
  - has flexibility which is relatively easy to exploit

Lessons learned during the assessments

Benefit and burden: often different parties

"Interesting story, but why should I change something? We'll need more staff during the night … and we don't even pay the electricity bill"

"The fruit trader has to invest in a more expensive "smart" reefer … and the logistics organization has the benefits"

Lessons learned during the assessments

Don’t touch their core business

“Storage and ripening of bananas is our core competence which requires accurate temperature control …”

“Getting our forklifts charged for the next job is more important than saving a few euro’s in night tariff …”

Are there any questions ?