European Workshop on Underground Energy Storage
November 7th 2019, Paris

UNIVERSITÉ DE GENÈVE

Value of integrating HT UTES with DH to enhance performance

Fleury de Oliveira

Groupe Systèmes Energétiques
ISE / DEFSE
www.unige.ch/sysener

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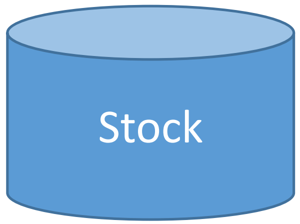

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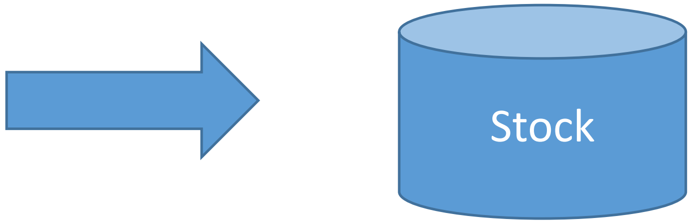
Energy surplus
or
Low prices



charge

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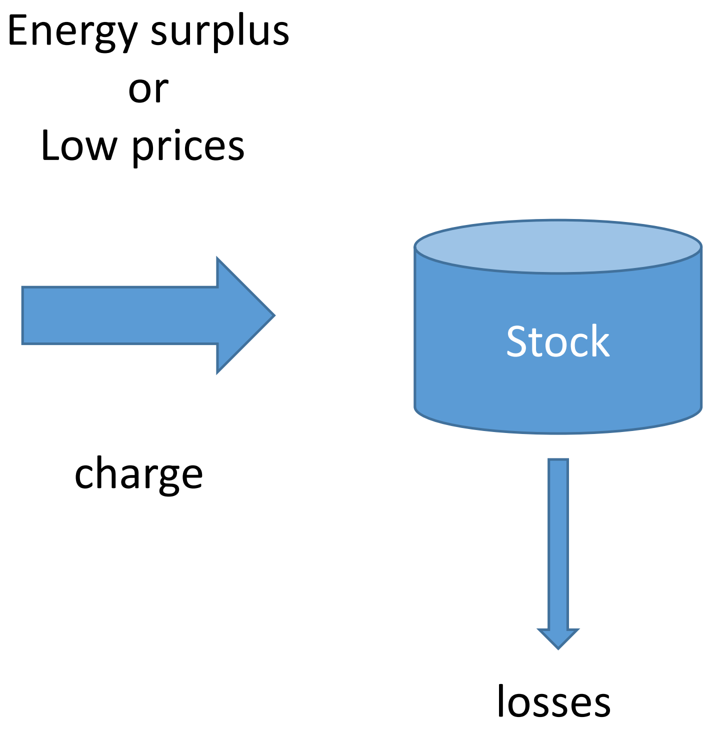

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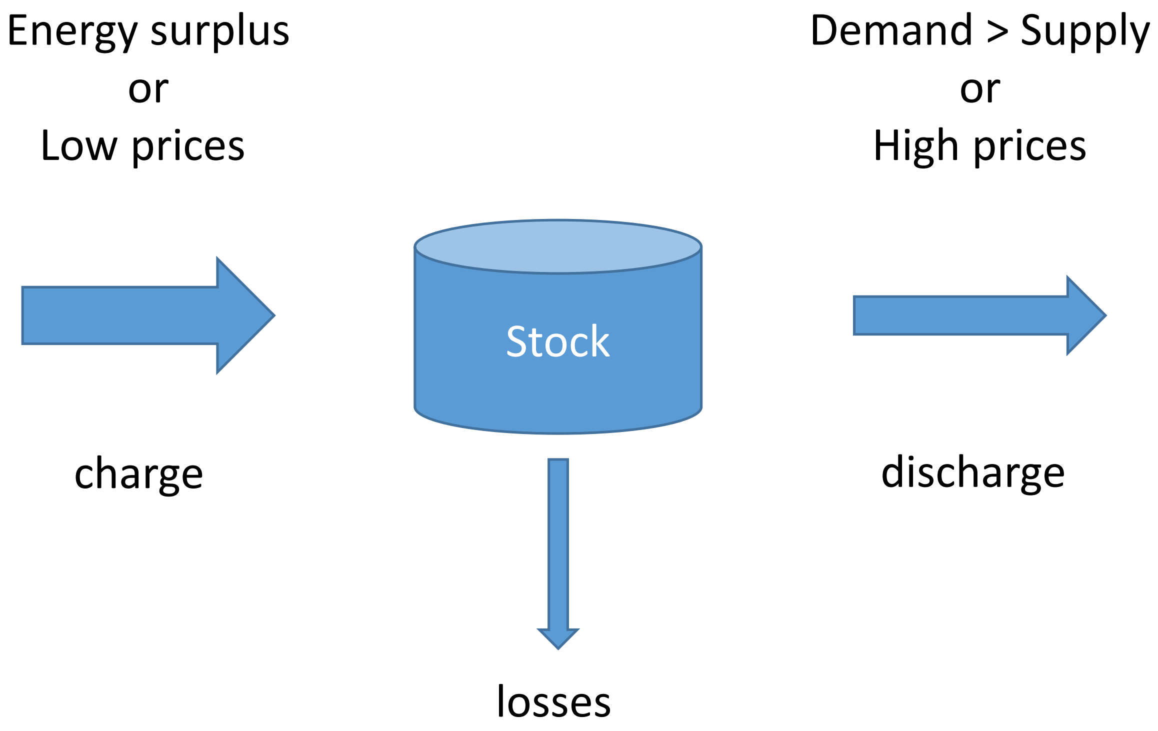

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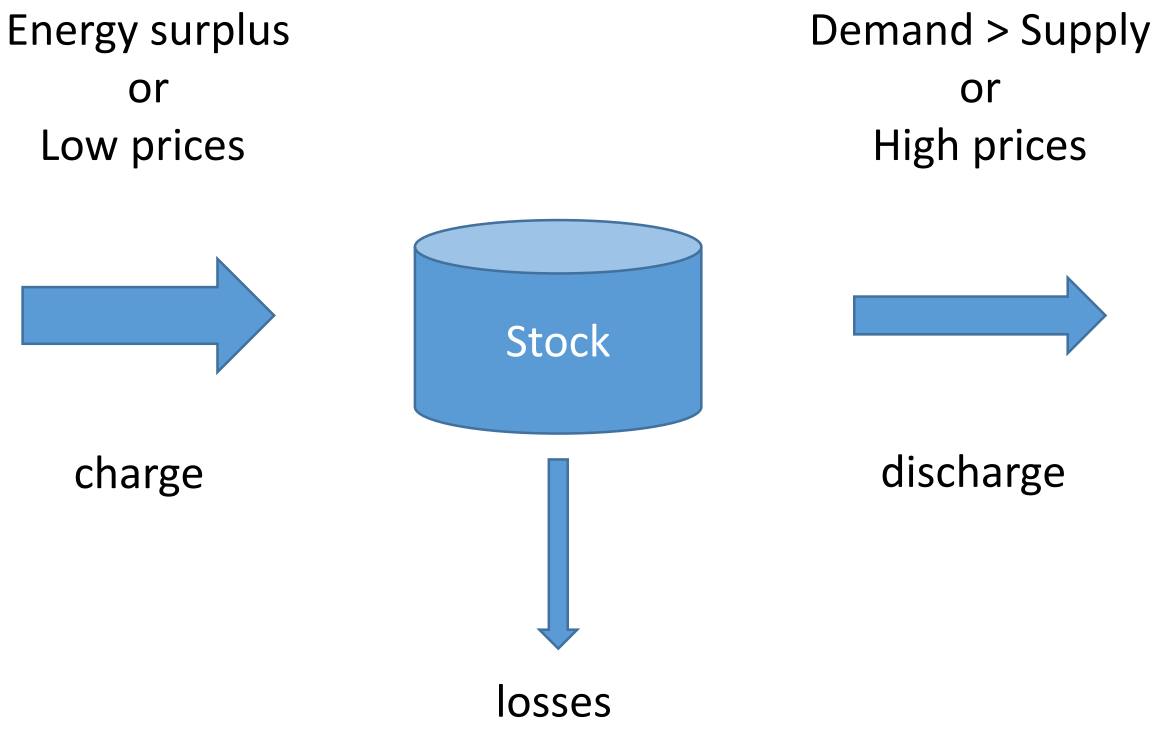

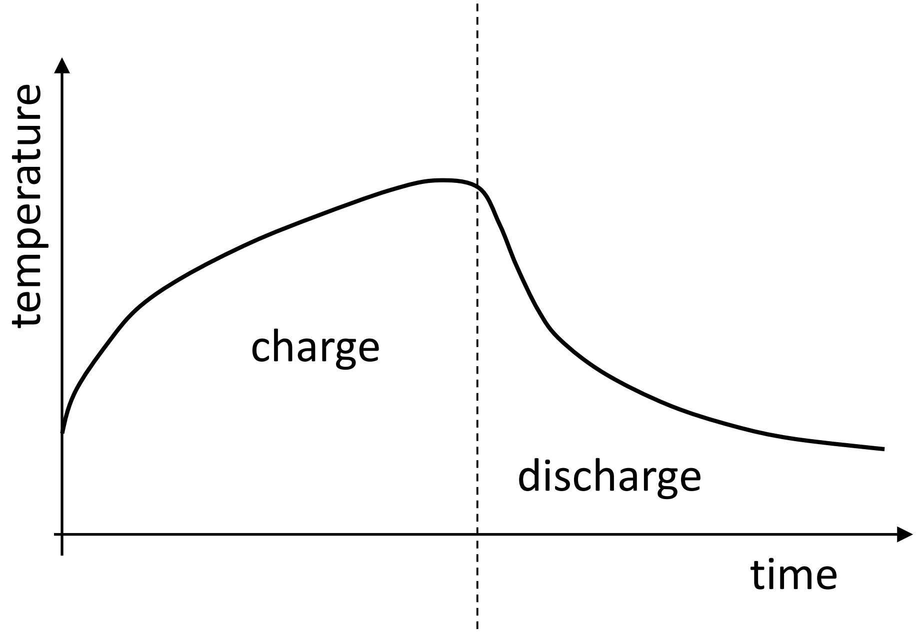

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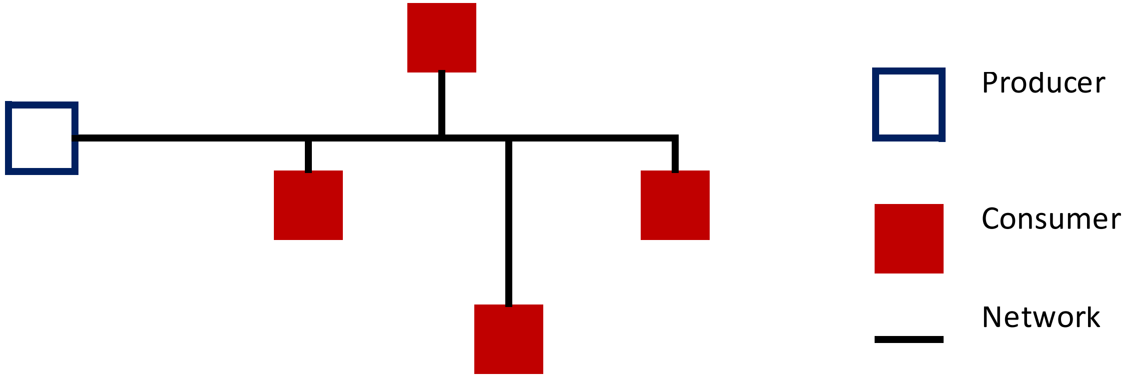

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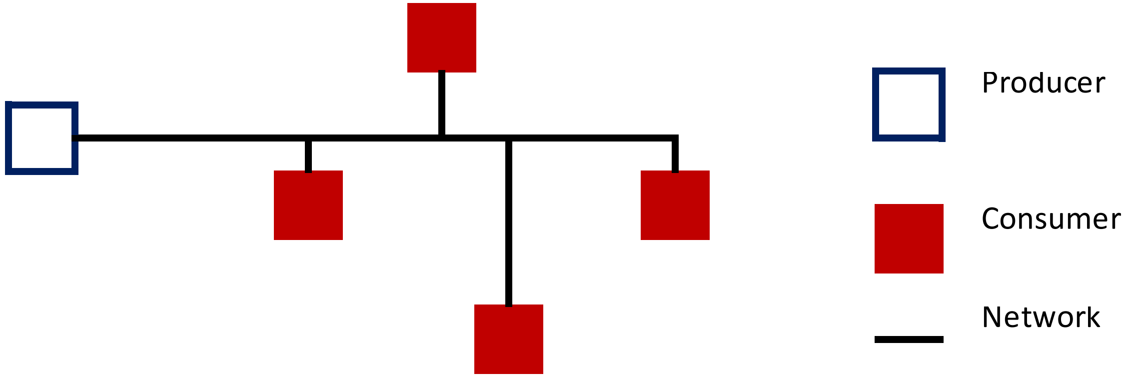

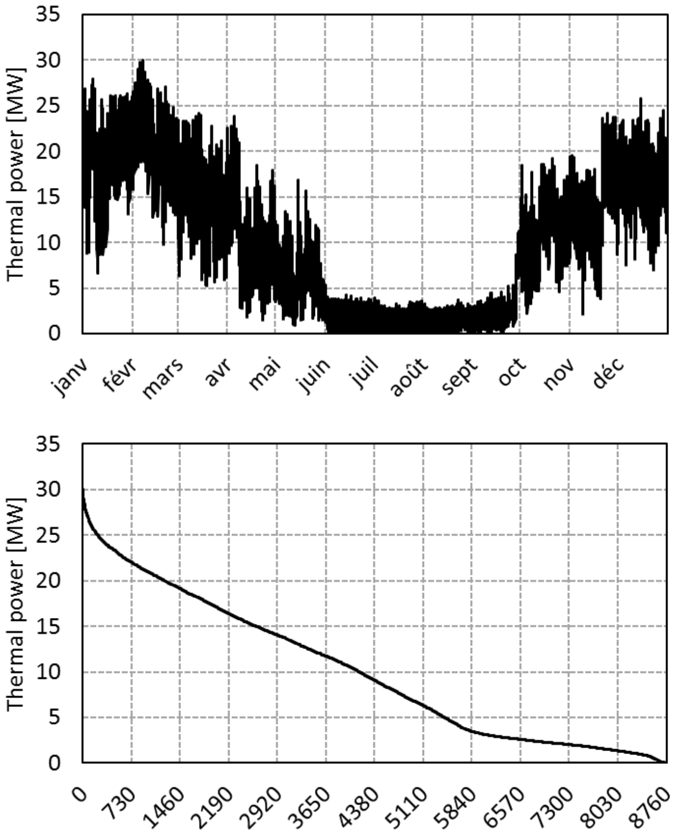

Measures at Geneva, 2015
Group «Systèmes énergétiques»

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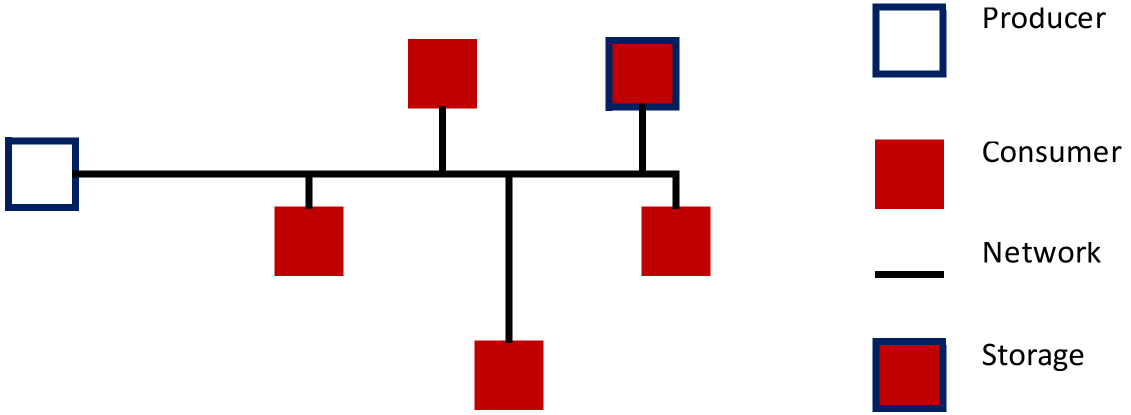

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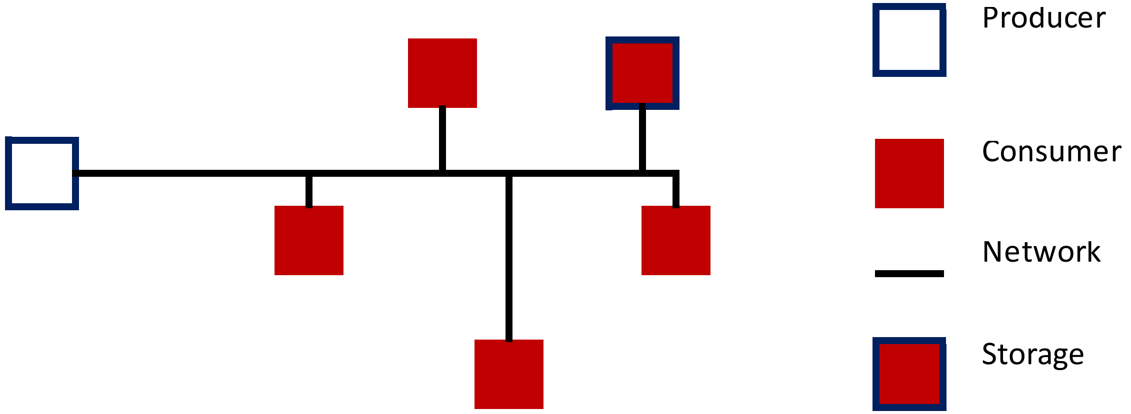

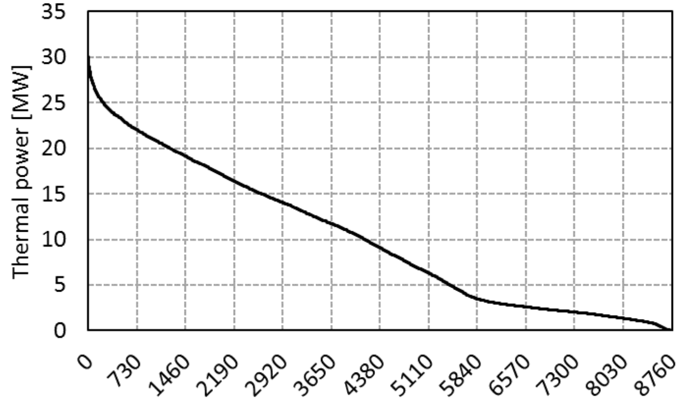

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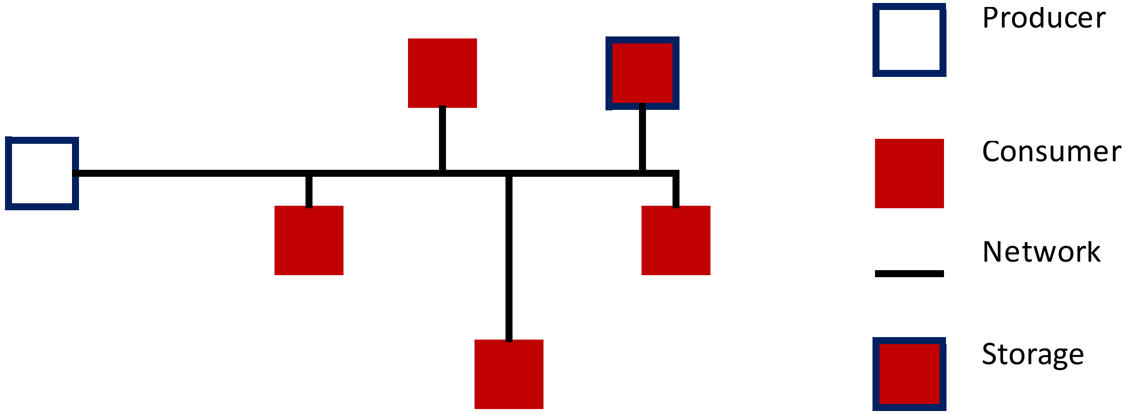

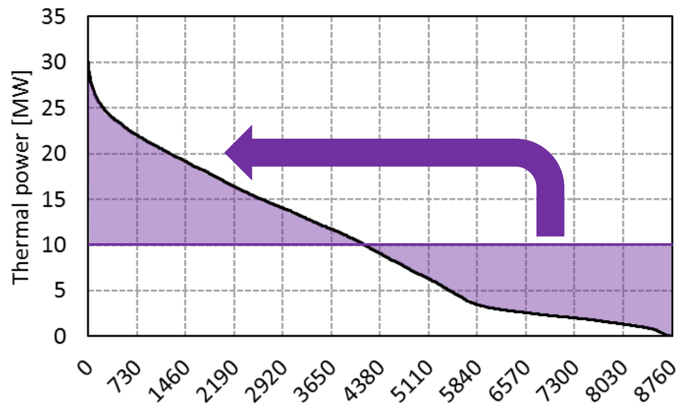

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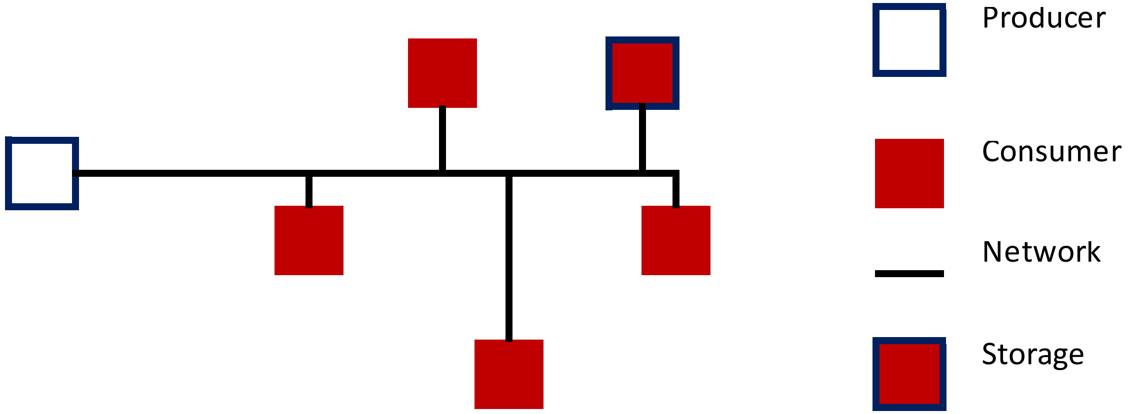
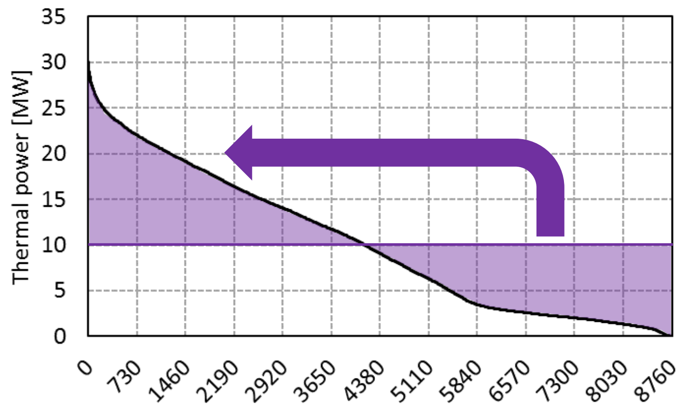
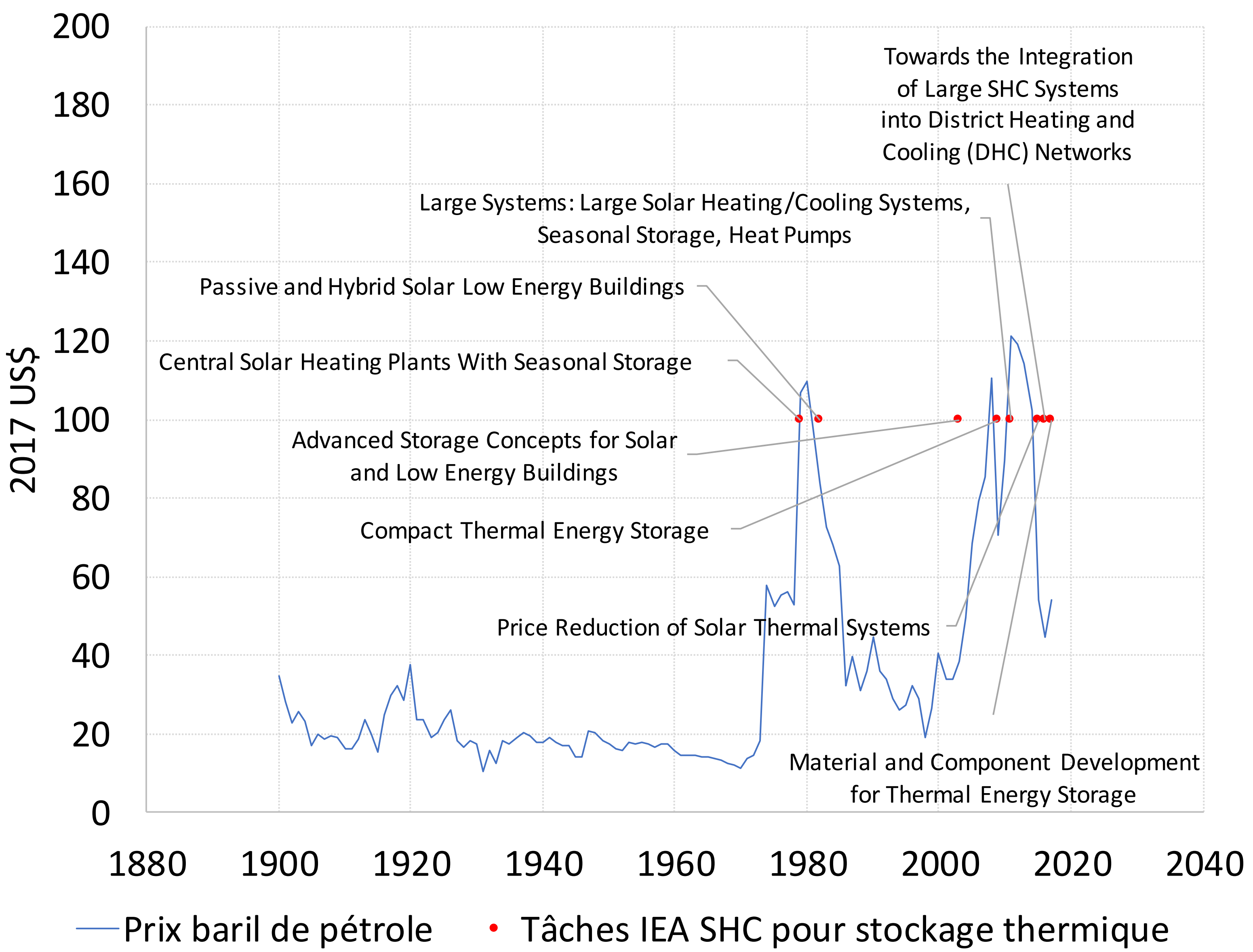




What are the benefits?

Research history



www.bp.com/statisticalreview

http://mojo.iea-shc.org/tasks-topic

Since 1979

Since 1978
active since 2006

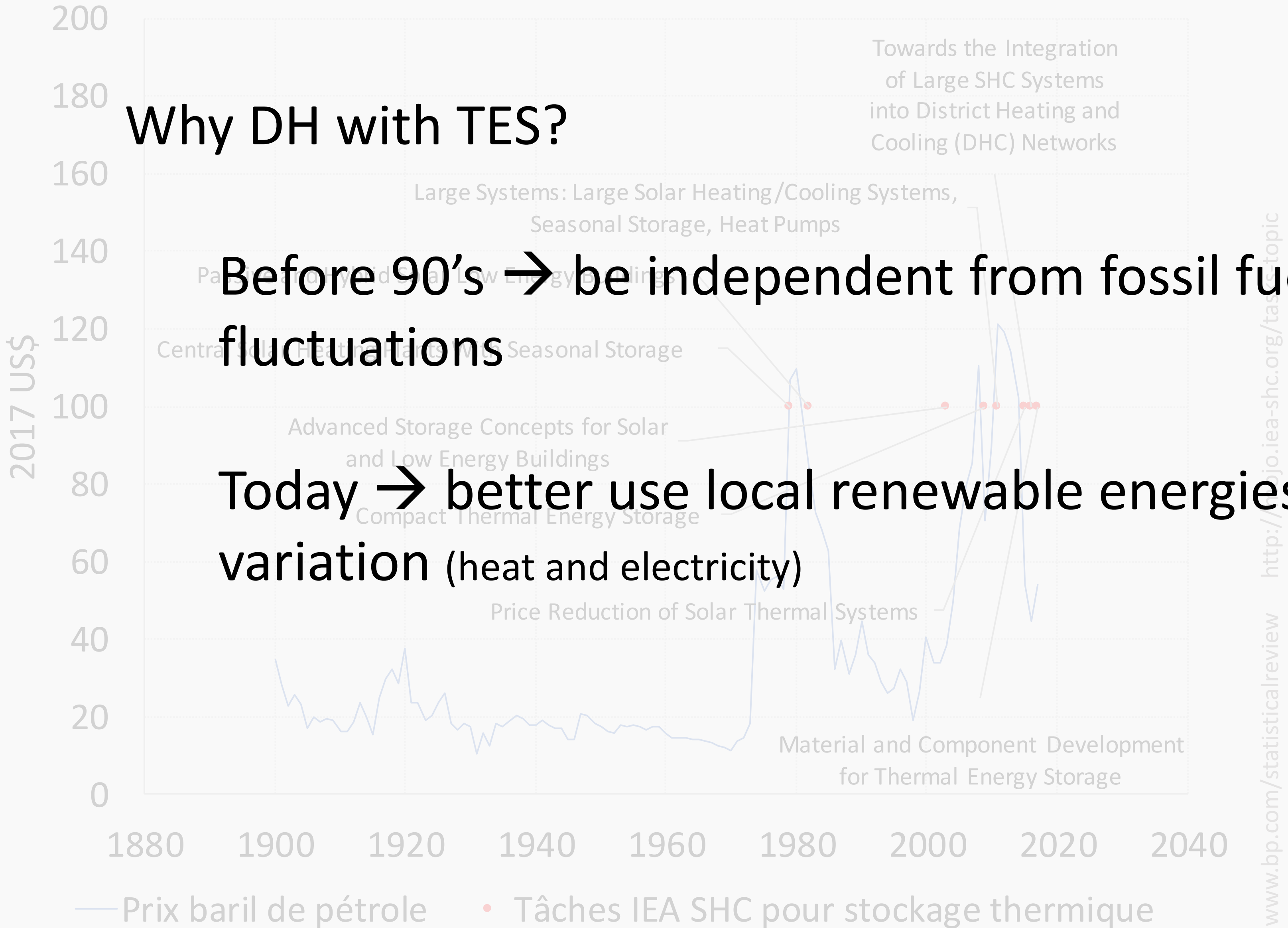
2017-2021

Research history

Why DH with TES?

Before 90's → be independent from fossil fuel prices fluctuations

Today → better use local renewable energies and reduce load variation (heat and electricity)



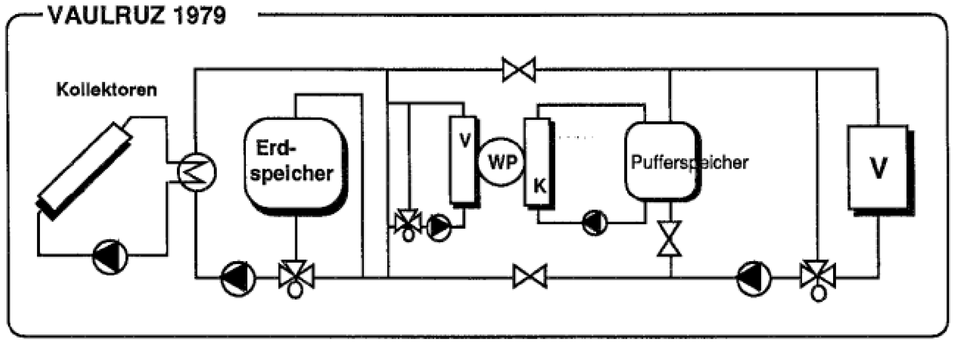
SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY — Since 1979

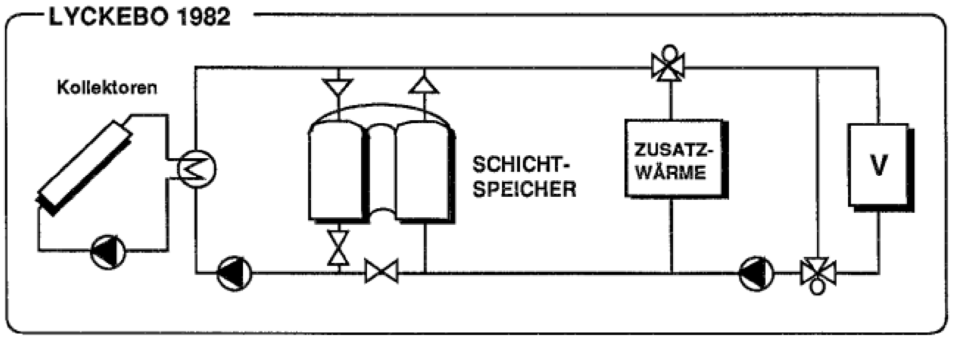
ECES — Since 1978, active since 2006

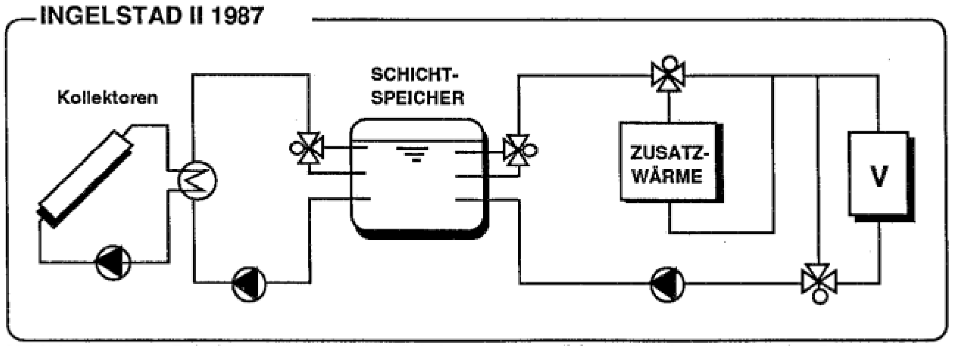
heatstore — High Temperature Underground Thermal Energy Storage — 2017-2021

DH with a TES?

Yesterday







SIA D 028, 1989

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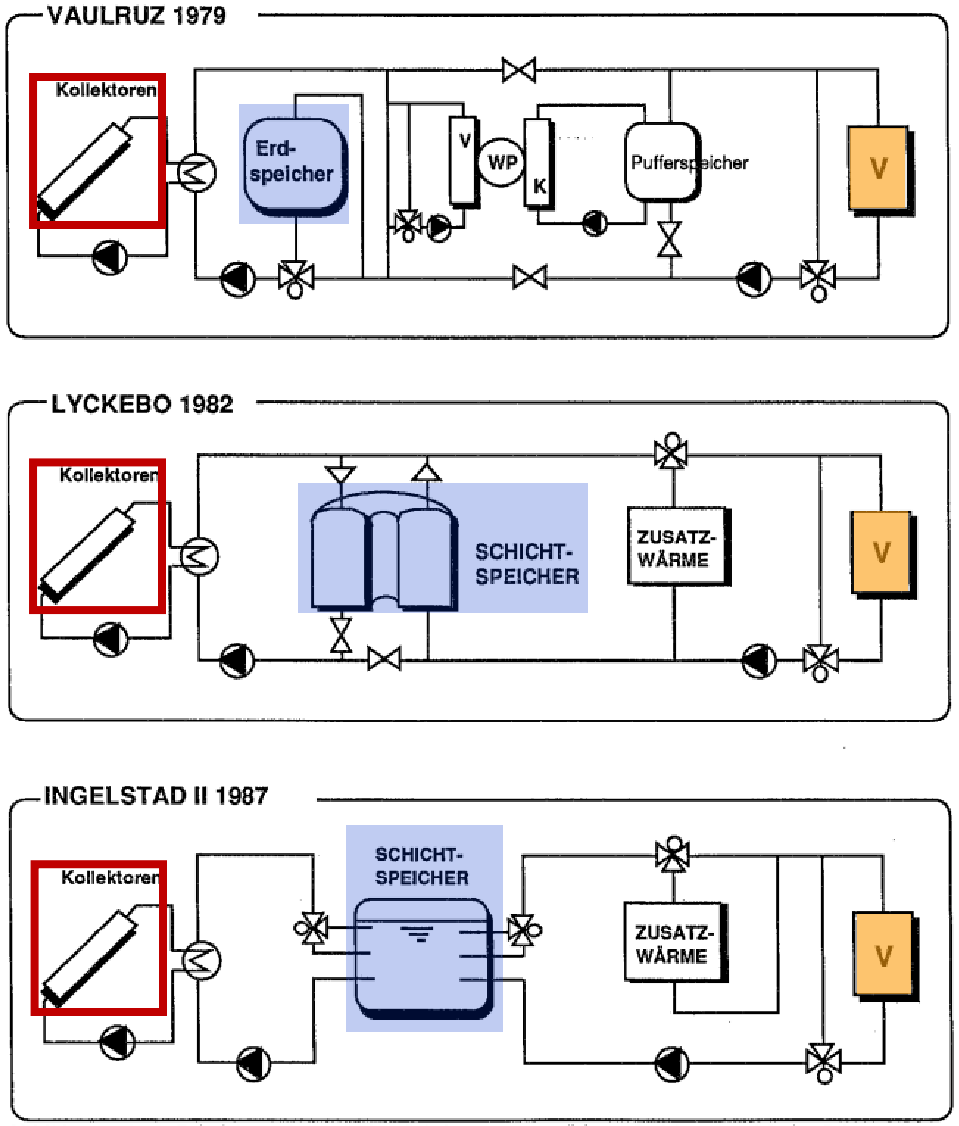

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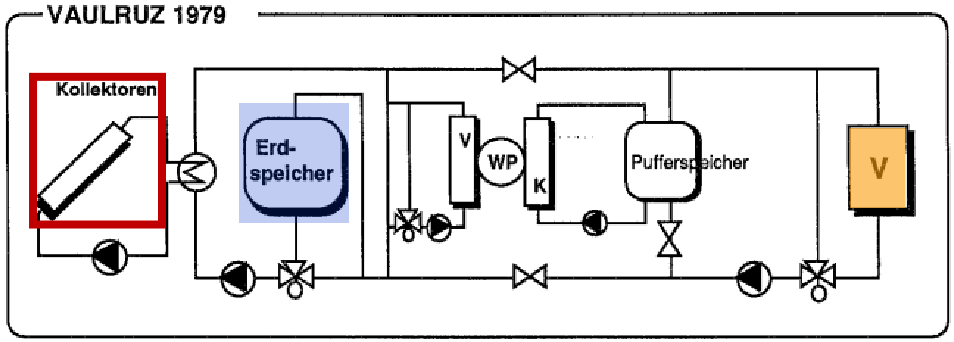
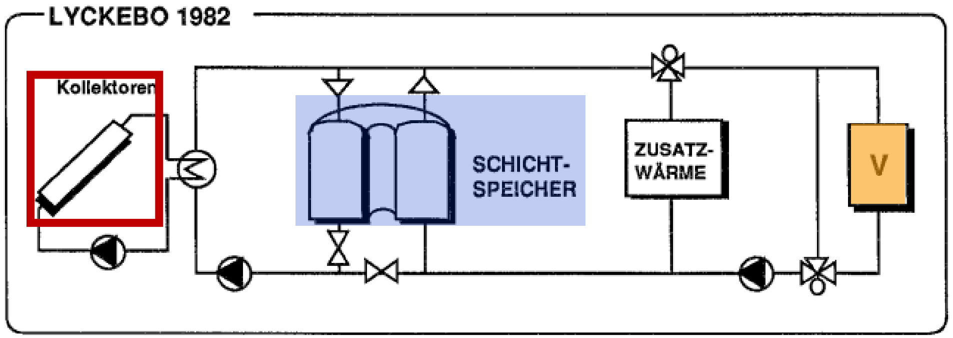
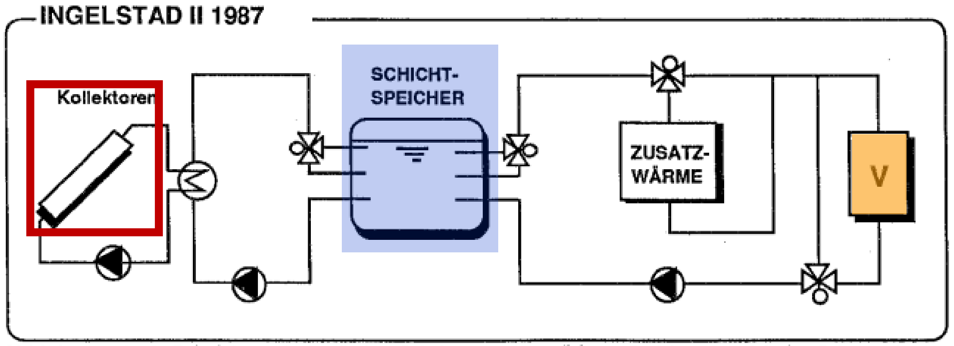
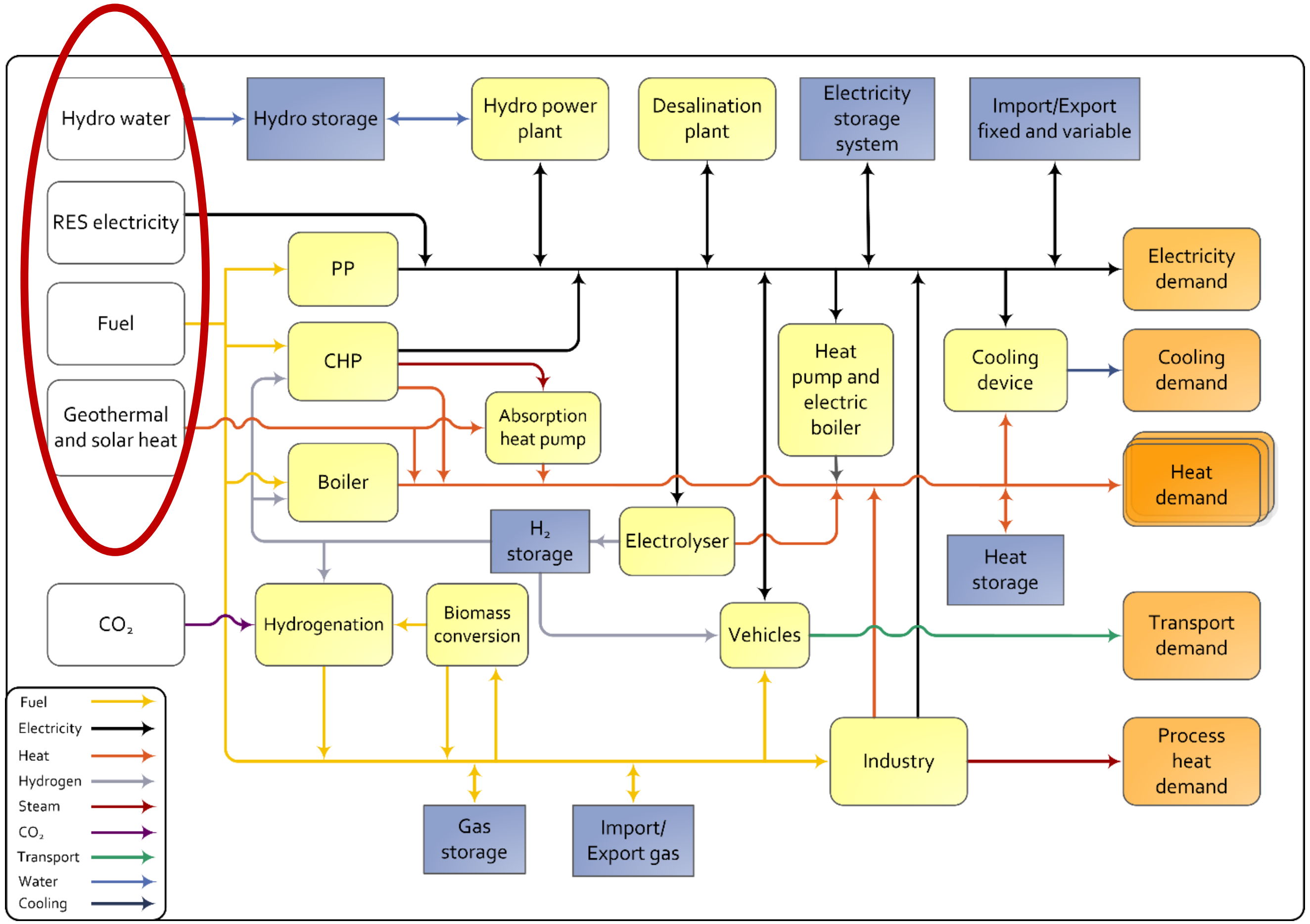






SIA D 028, 1989

Tomorrow



energyplan.eu

DK example – Braedstrup Fjernvarme

Heat demand : 40 GWh/yr.

Thermal solar panels : 18’000 m^2

CHP (gas) : 2 x 3.9 MW_{th}

Gas boiler : 24 MW $_{th}$

Heat pump : 1.2 MW_{th}

Elec. boiler : 10 MW_{th}

Borehole TES : 19’000 m^3

Hotwater TES : 7’500 m^3

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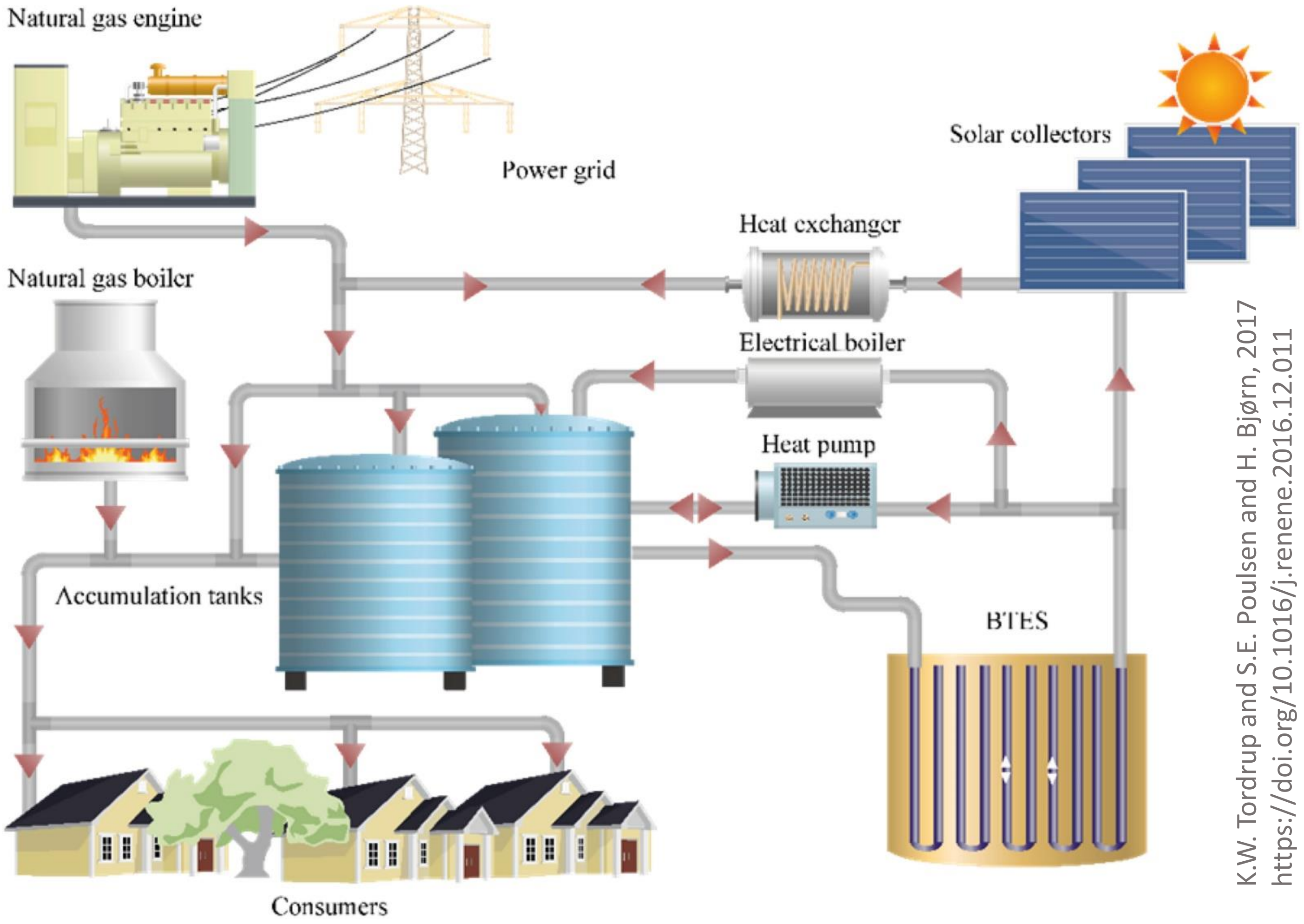

K.W. Tordrup and S.E. Poulsen and H. Bjørn, 2017
https://doi.org/10.1016/j.renene.2016.12.011

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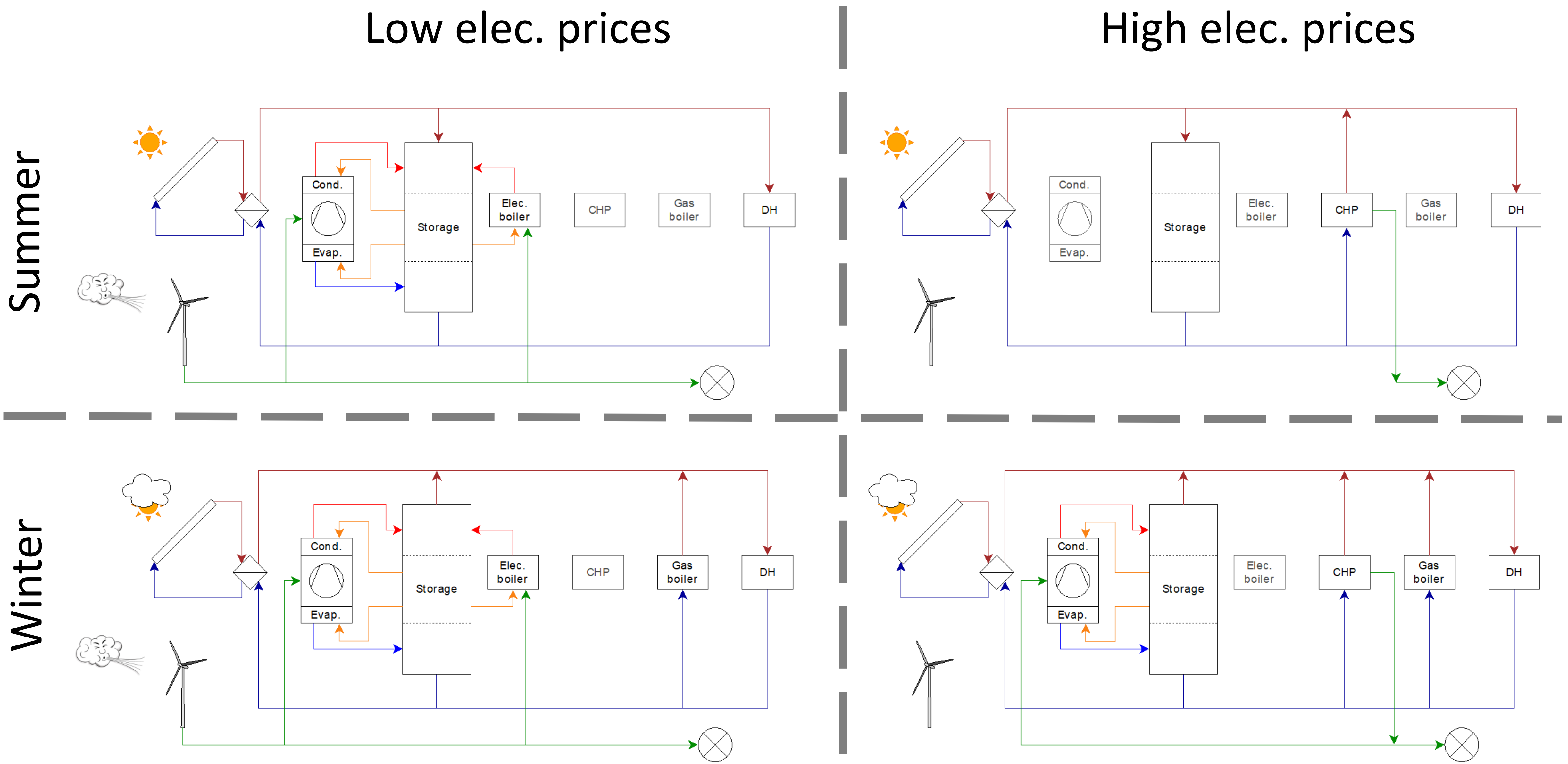
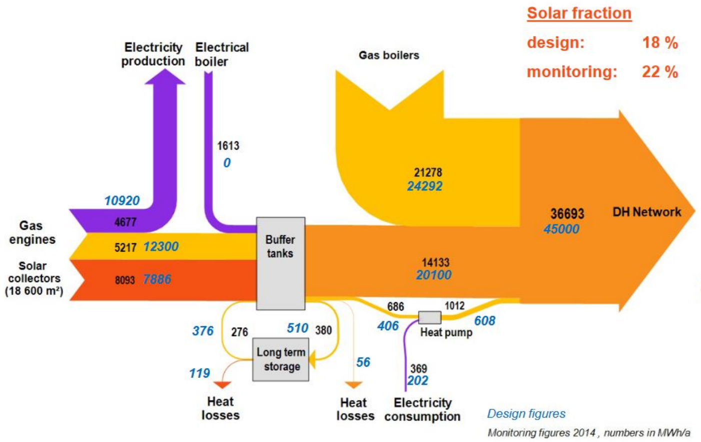


Based on HEATSTORE D3.2, 2019

DK example – Braedstrup Fjernvarme

2014



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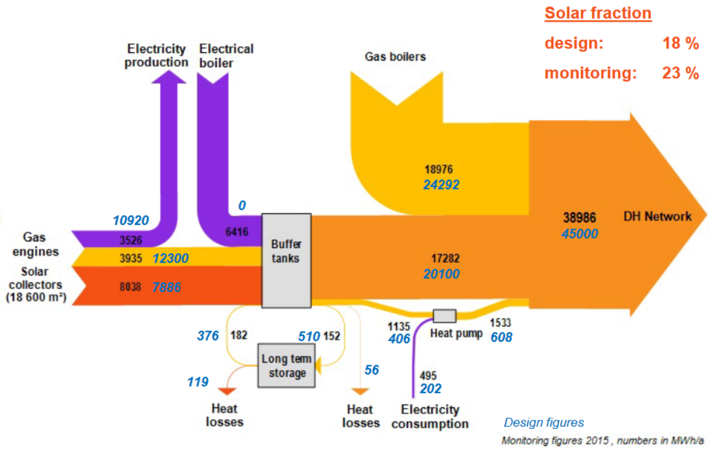

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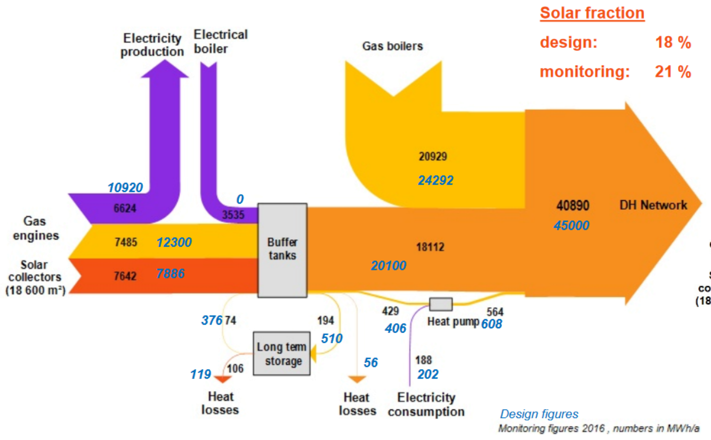
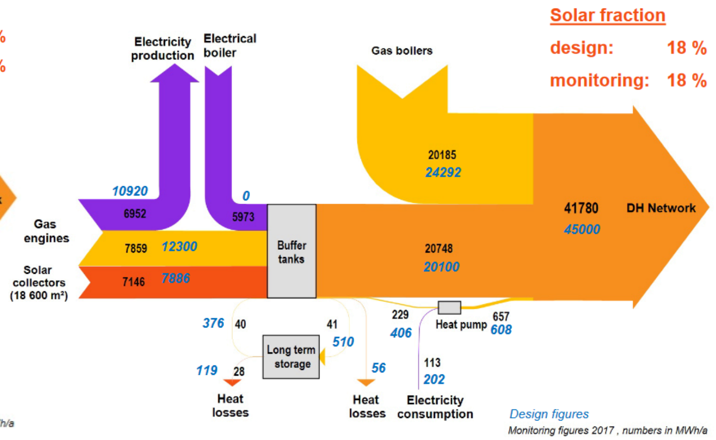


2017



http://www.varmelagre.dk/

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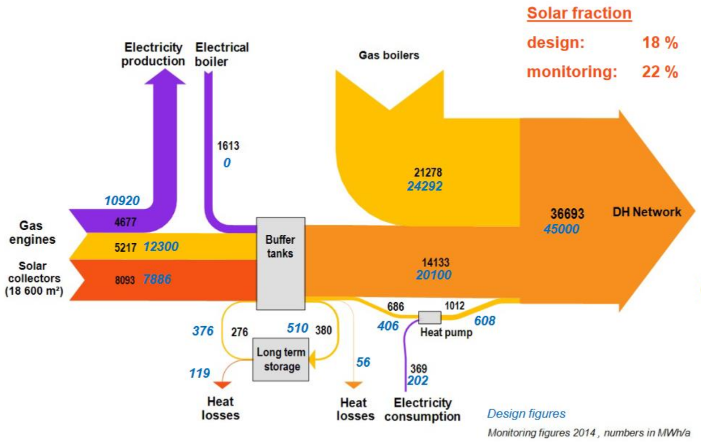

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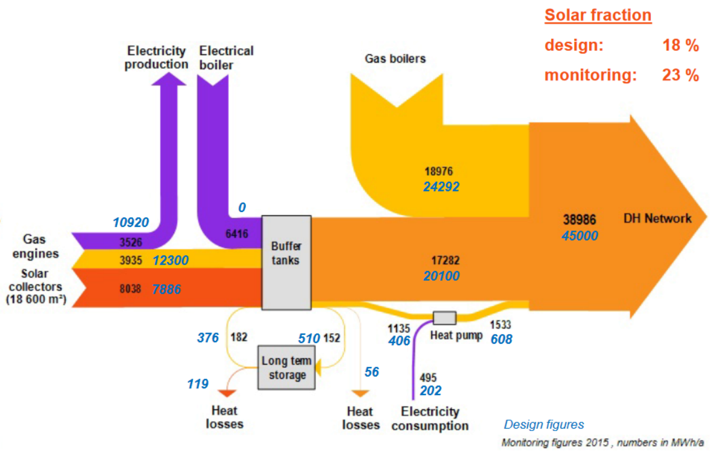

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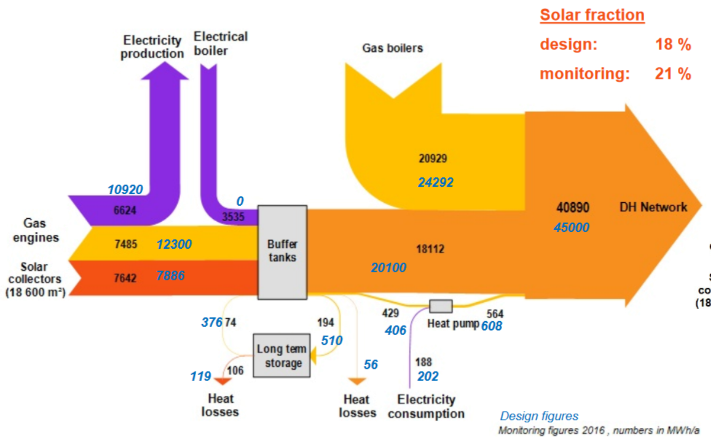

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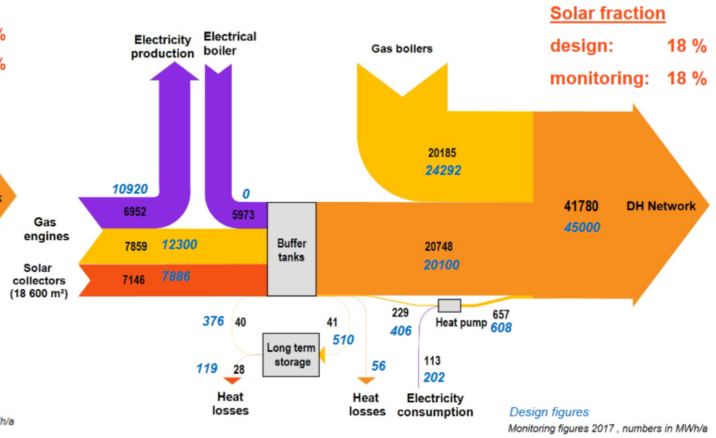

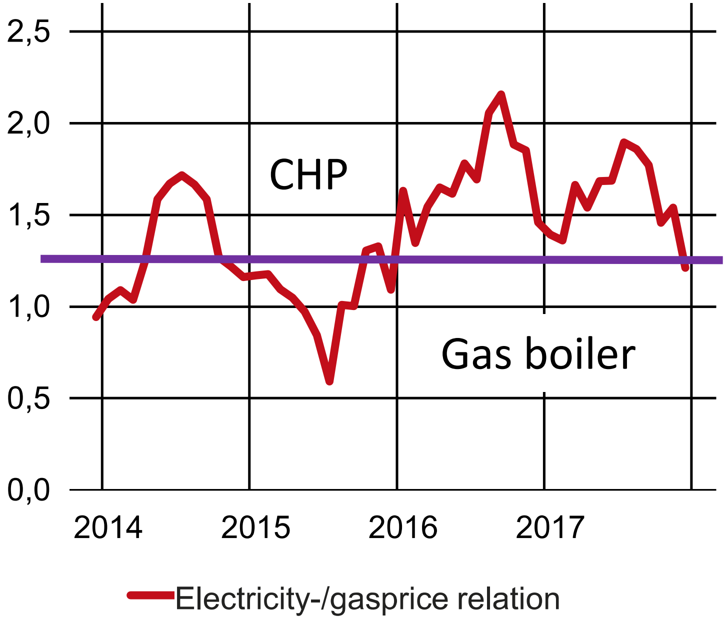

Dansk Energi, Electricity price outlook, 2018

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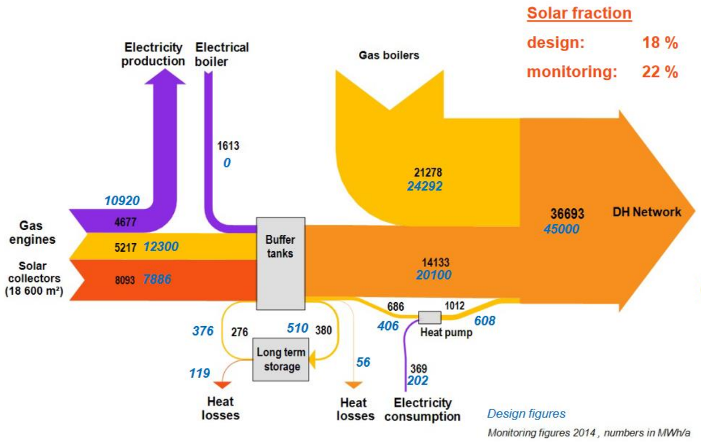

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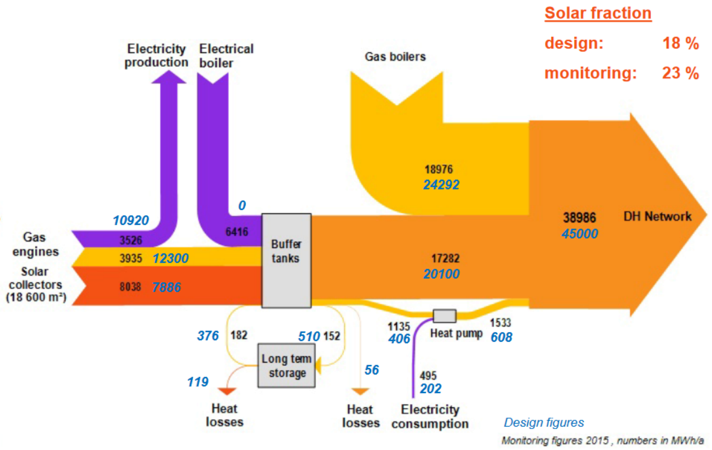

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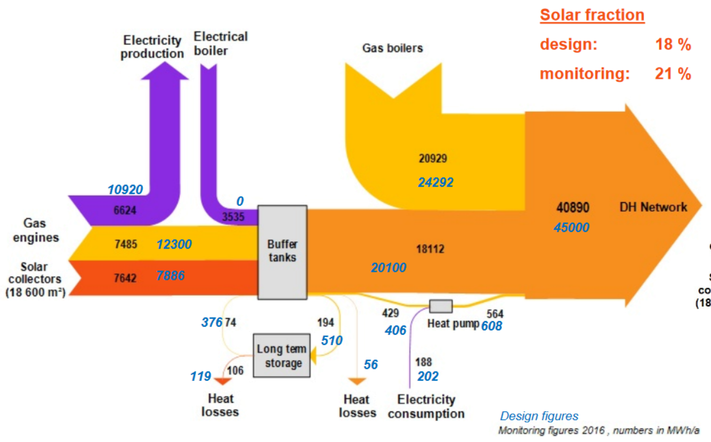

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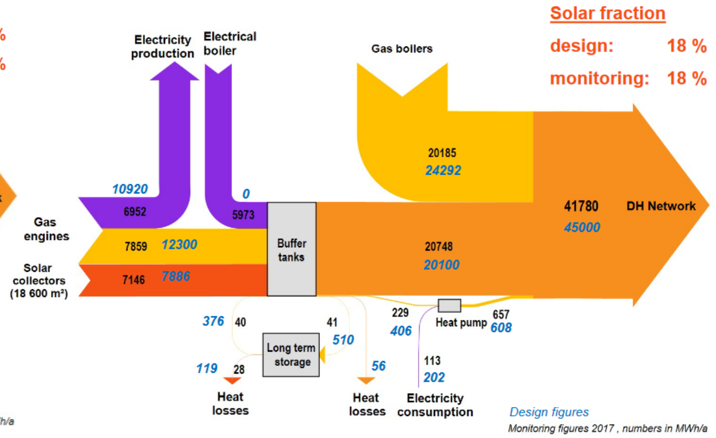

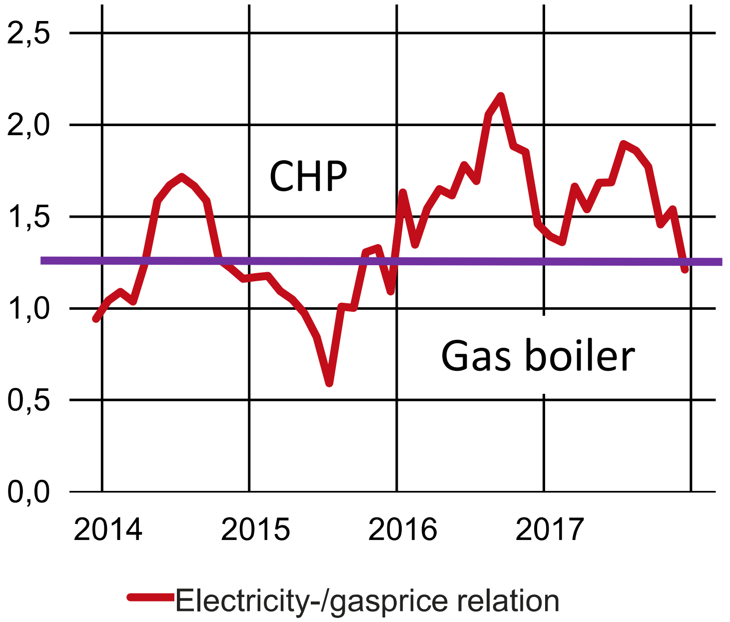

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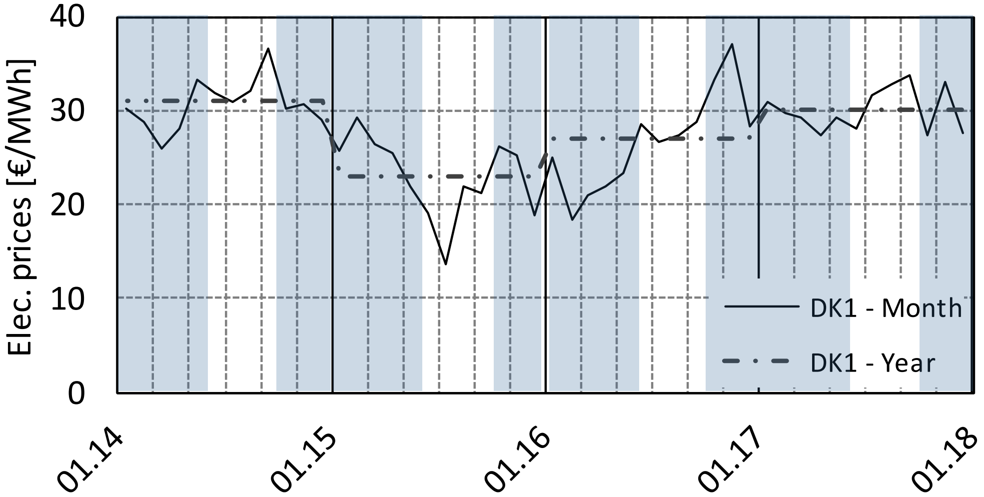


NordPool spot price

http://www.varmelagre.dk/

Conclusions

DH and TES

- Better use of renewable production
- Stability of electric and thermal grids (gas grid also ?)
- Enhance energy system flexibility (not only heating systems)

€

- Enhance economic flexibility for the heat producer

Underground TES

- Lower investment costs when compared to other technologies
- Possibility to access great volumes at low cost (aquifers)
- Low-tech
- Usage and integration already known

HEATSTORE (170153-4401) is one of nine projects under the GEOTHERMICA – ERA NET Cofund aimed at accelerating the uptake of geothermal energy by 1) advancing and integrating different types of underground thermal energy storage (UTES) in the energy system, 2) providing a means to maximise geothermal heat production and optimise the business case of geothermal heat production doublets, 3) addressing technical, economic, environmental, regulatory and policy aspects that are necessary to support efficient and cost-effective deployment of UTES technologies in Europe. The three-year project will stimulate a fast-track market uptake in Europe, promoting development from demonstration phase to commercial deployment within two to five years, and provide an outlook for utilisation potential towards 2030 and 2050.

This project has been subsidized through the ERANET cofund GEOTHERMICA (Project n. 731117), from the European Commission, RVO (the Netherlands), DETEC (Switzerland), FZJ-PtJ (Germany), ADEME (France), EUDP (Denmark), Rannis (Iceland), VEA (Belgium), FRCT (Portugal), and MINECO (Spain).

Group « Systèmes énergétiques »

UNIVERSITÉ DE GENÈVE

Background

- 40 ans d’expertise dans l’analyse de systèmes énergétiques innovants
- Perspective intégrée demande/production

Ligne directrice

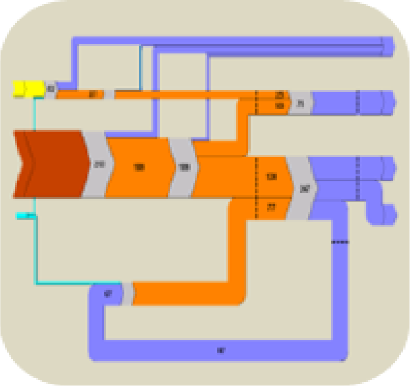
- Approche par problème, sur la base de projets en situation d’usage

Equipe

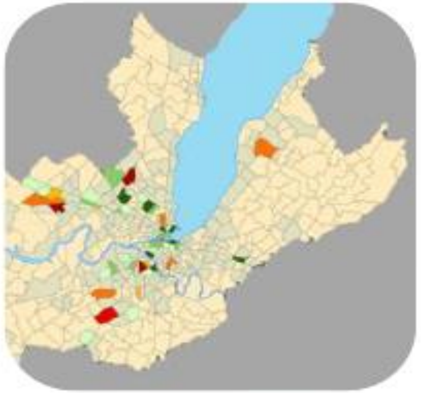
- Une dizaine de collaborateurs de divers disciplines (physique, sciences de l’environnement, ingénierie de l’énergie, …)
- Direction: Dr. Pierre Hollmuller (depuis 2017)

Financement

- 30% Université, 70% projets (SIG, OCEN, OFEN …)
- Partenariat industriel avec SIG



Innovative
energy systems



Regional energy planning
District heating & cooling

Energy efficiency and
demand-side management

Solar energy: resource
and transformation

Ligne de recherche

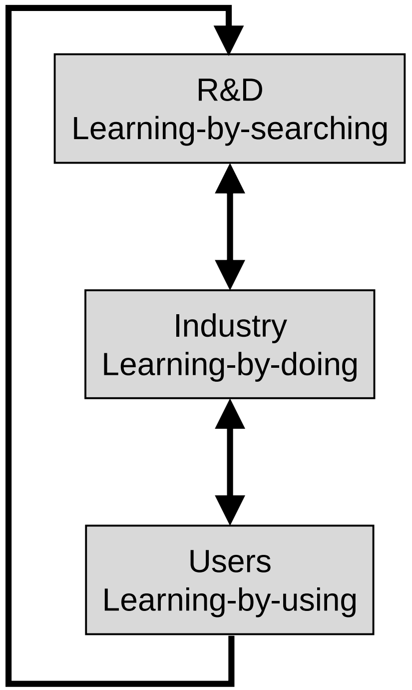
Objectifs

- Analyse et diffusion des meilleures pratiques
- Optimisation de l'efficacité par innovation incrémentale

Méthodes

- Suivi d'installations en situation d'usage réel (retours d'expérience)
- Généralisation / analyse de sensibilité (recommandations)
- Prise en compte des aspects techniques, économiques, commerciaux et organisationnels (analyse système)
- Collaboration étroite avec les acteurs du domaine de l'énergie (ingénieurs, propriétaires, utilisateurs, autorités, …)

"Ce n'est pas parce qu'une technologie est efficace qu'elle est utilisée, c'est parce qu'elle est utilisée qu'elle devient efficace"



Based on Neij et al.