

CELSIUS Talk: Integration of heat, power and intermittent renewables

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Thermal energy storage – enables sustainable regions and cities



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A Skanska innovation

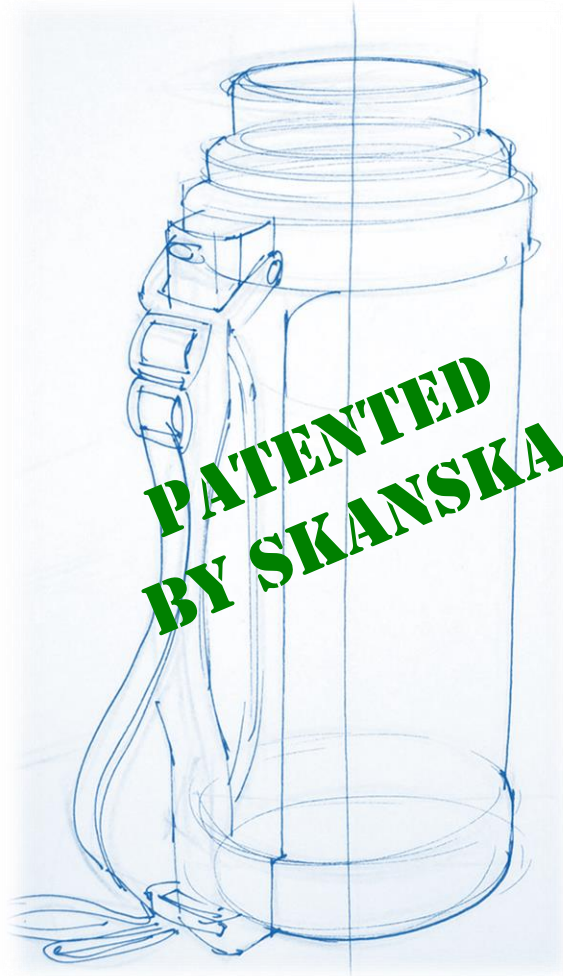
Co-operation and devotion from many different divisions of Skanska has paved the way for a new groundbreaking product – a thermal energy storage (TES in short)



Lead inventor
Hans Pilebro
Skanska Sverige AB

A Skanska innovation

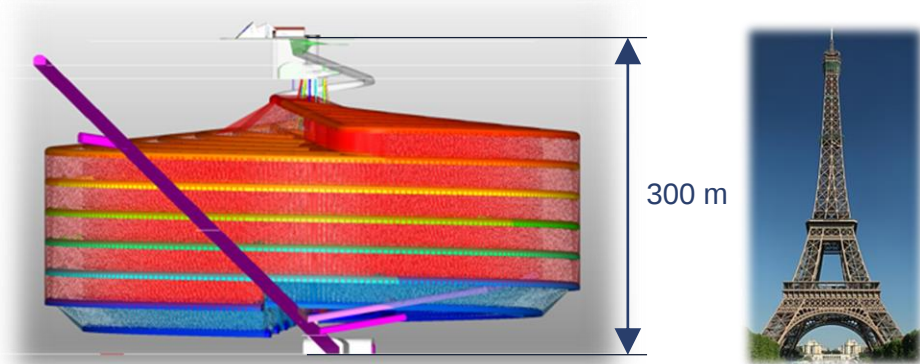
- **In essence**
A huge underground **thermos** storing both hot and cold water
- **Simple but genial**
Builds on the physical principle of hot water "floating" on cold water



- **Field of application**
Works in dynamic symbiosis with large district heating and cooling systems. Enables both short-term (hours) and seasonal energy storage (year)
- **Flexible**
Built on Scalable Product Architecture (SPA)

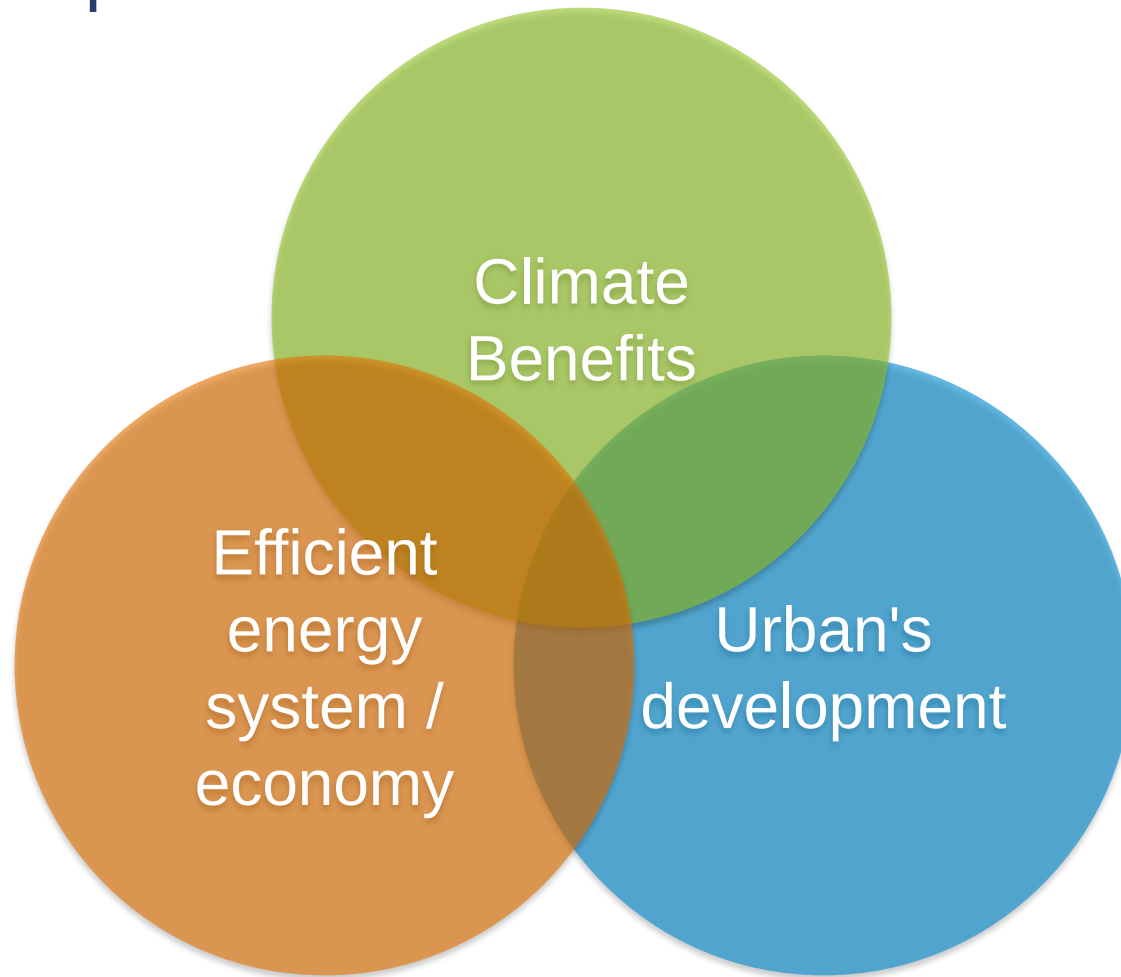
TES – quick facts

- TES is a scalable product that can store energy hourly, daily, weekly or seasonally
- TES is placed approx. 100 m below ground level in an optimal position in a district heating and district cooling network
- Energy is stored in a combination of rock and water to optimize the energy storage capacity in relation to the investment

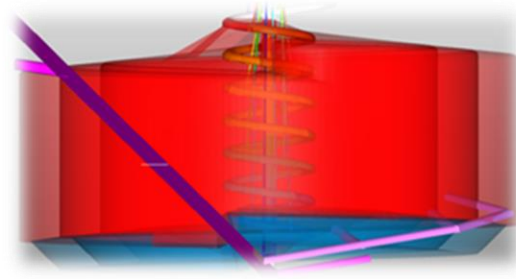
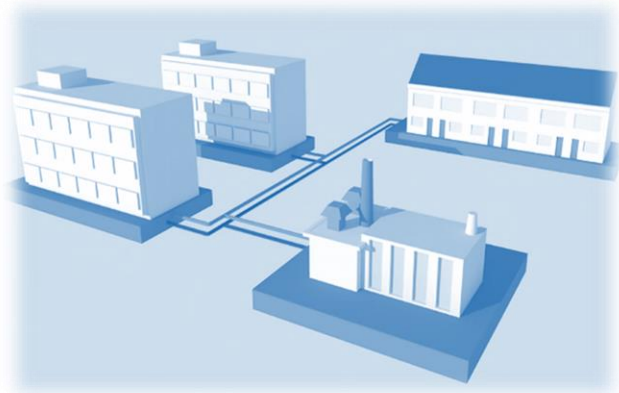


TES version 7	
Seasonal Stored Energy	50 - 500 GWh/year
Turnover Energy	300 - 1 500 GWh/year
Power Out / In (thermal)	800 / 1 000 MW
Temperature	+4 to +99 °C
Approx. size (diameter)	200 - 600 Meters

TES contributes to sustainable social development!



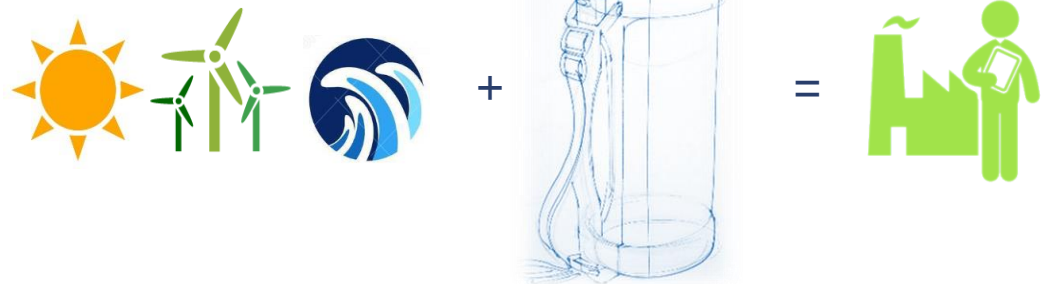
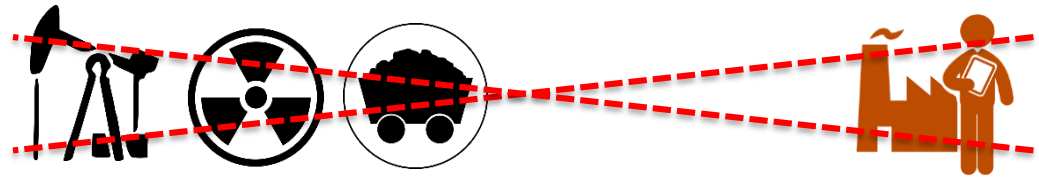
Market making with purpose



TES makes district heating and cooling systems **greener** and more efficient by:

- Cutting power spikes
- Minimizing energy loss within the system by balancing surpluses with deficits
- Reusing and bringing waste heat into the system (e.g industrial "prosumers")
- Enabling efficient storage of renewable energy

The big picture – global trends



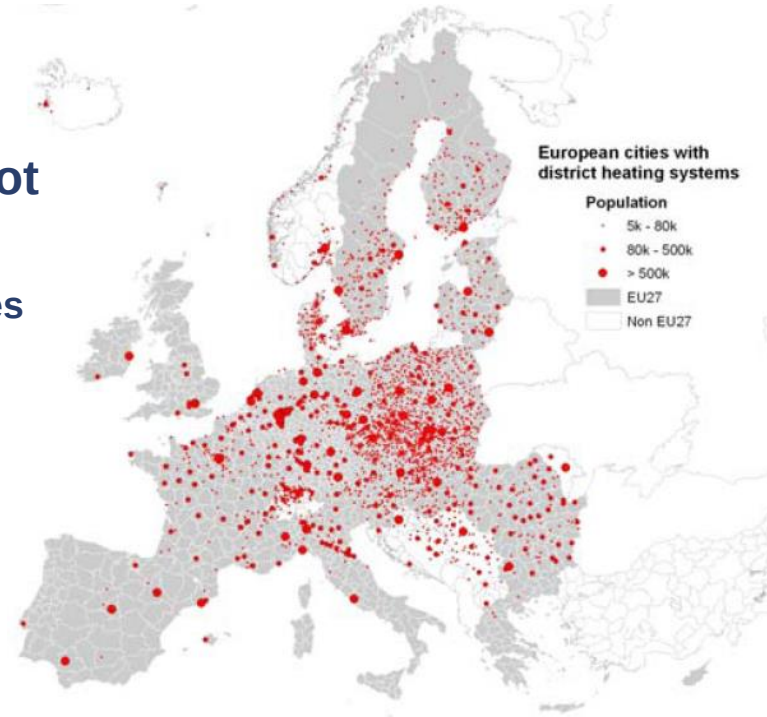
Market potential

Skanska takes the lead – worldwide!

Prospect Europe – district heating is hot

- Increasing investments
- Overall potential between 100-200 storages
- Germany especially interesting

Great potential in large Cities and Regions



Current project status



It's ongoing work together with customers analyzing the benefits of a TES in a city's energy system



Multiple application processes around the world



Next step: To build a demonstration facility in Sweden

Summary



Skanska has developed a new product for storing energy – TES



The ground-breaking innovation is a result of our people with technical skills teaming up

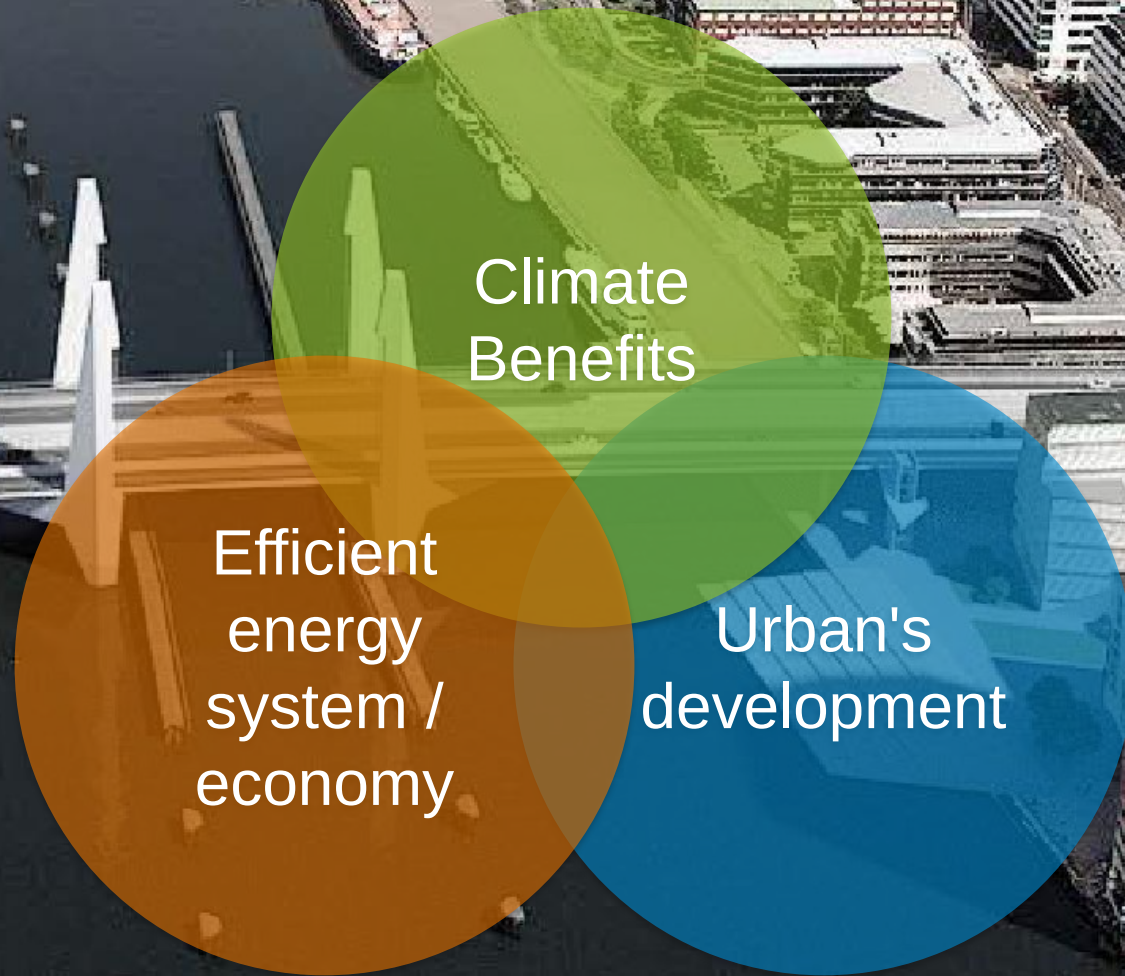


TES meets important needs in the industry, opening up new markets for Energy Storage – worldwide



TES is not just a product with great potential, it is an opportunity for Cities and Region to do well, by doing sustainable solutions for the world

DISCUSSION



SKANSKA