



IEA Technology Collaboration Programme

# Large Thermal Energy Storage financing methods



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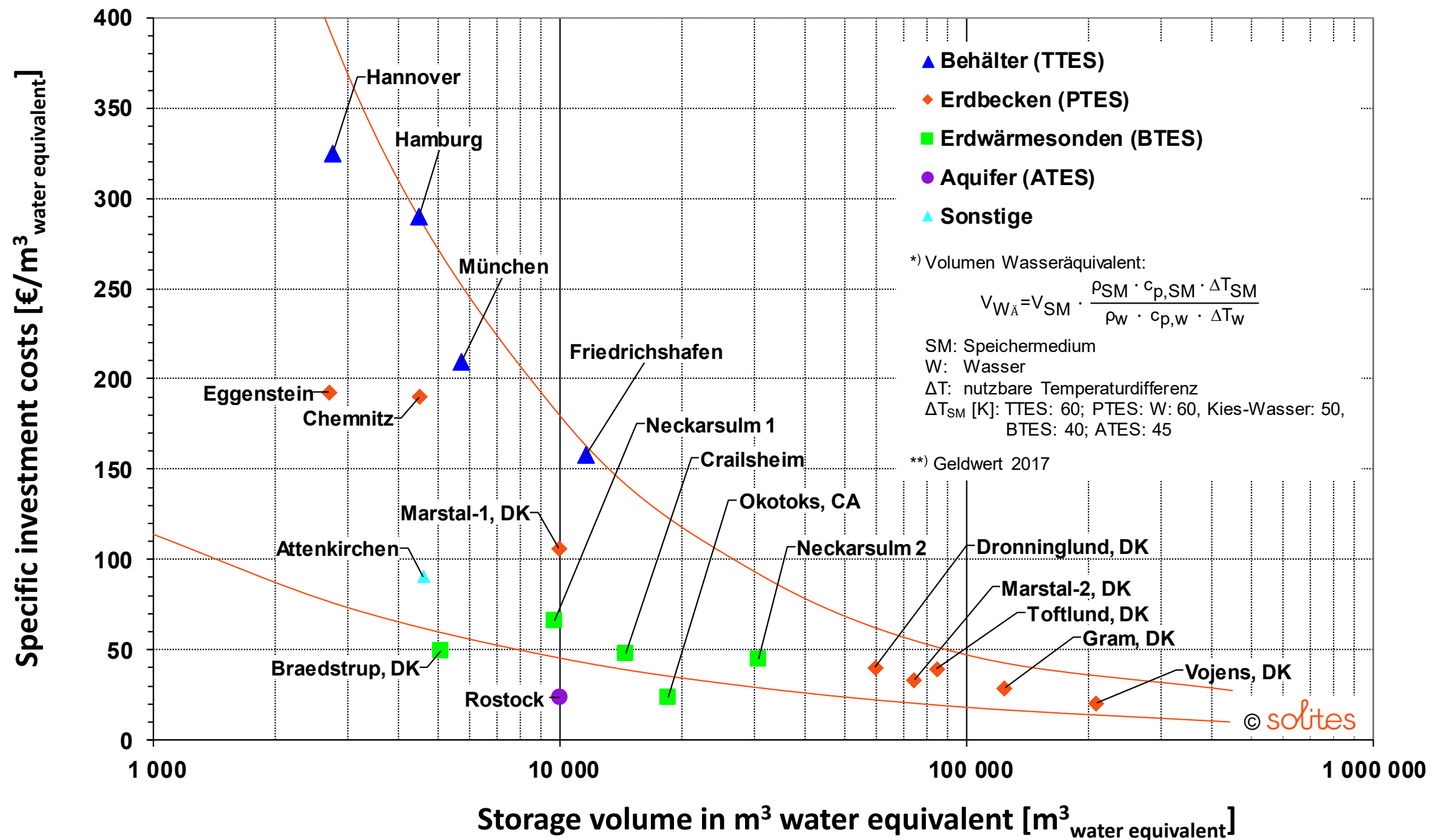


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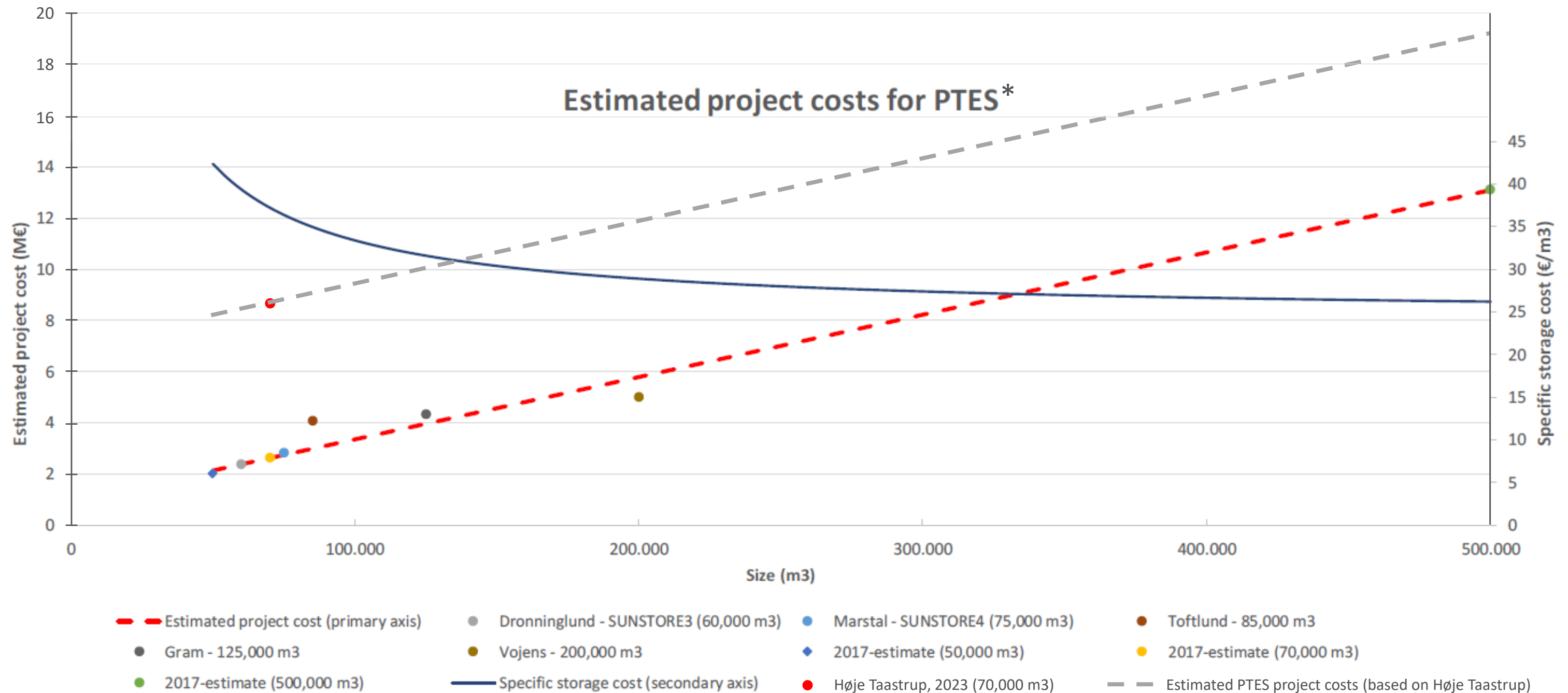


# How to finance an LTES in the EU?



Source: Epp, Bärbel. „Seasonal pit heat storage: Cost benchmark of 30 EUR/m³ Solarthermalworld.org“ May 17<sup>th</sup>, 2019. <https://www.solarthermalworld.org/news/seasonal-pit-heat-storage-cost-benchmark-30-eurm3>

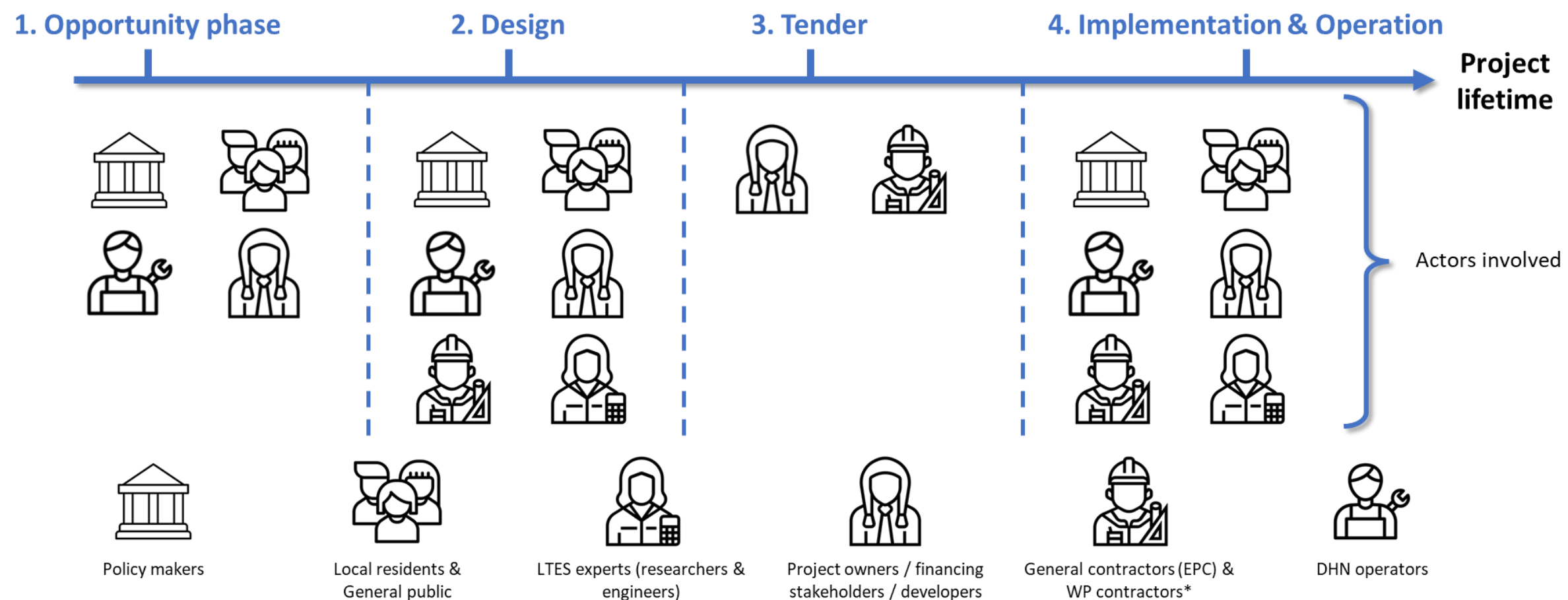
# How to finance a multi-million € project?



\*(curves based on experience of years 2012 to 2017)

# Financing is needed in all phases of LTES projects

| Phase                 | Opportunity                                                  | Design                                                           | Tender                                                   | Implementation                                               |
|-----------------------|--------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------|
| <b>Key activities</b> | Assess potential, involve stakeholders, pre-select LTES type | Analyze DHN data, run feasibility studies, define size and specs | Prepare technical specs, initiate tender, sign contracts | Build, operate, and maintain LTES under regulatory oversight |



The project owner oversees financing



# Business case of Høje Taastrup (1)

## About the PTES

Technology: PTES (Storage medium: water)

Type of usage: weekly storage of heat

Year commissioned: 2022

Main heat source: transmission DHN

Owners: VEKS & Høje Taastrup (Denmark, respectively transmission & distribution DHN operators) 50%/50%

## Technical details

Water volume: 70'000 m<sup>3</sup>

Lid dimensions: 180 m x 62 m

Storage capacity: 3'300 MWh

Charge-discharge capacity: 30 MW<sub>th</sub>

25-30 cycles of charge/discharge per year (design figure)

Max operational temperature: 90°C (all year)

## About the transmission DHN

Name: VEKS

Type of ownership: joint local-authority-owned (& non-profit)

Network length: **135** km

Consumers connected: **150'000** households

Total heat production: **2'500** GWh/year



Photo: Ioannis Sifnaios

## About the distribution DHN

Name: Høje Taastrup District Heating

Type of ownership: consumer-owned (& non-profit)

Network length: **279** km

Consumers connected: **7'900** buildings & industries

Total heat production\*: **350** GWh/year

Total heat sold: **306** GWh/year

This project is a first-of-its kind: it is the first PTES in the world not coupled to a solar thermal plant  
For more information about this project please visit <https://www.veks.dk/en/publications>

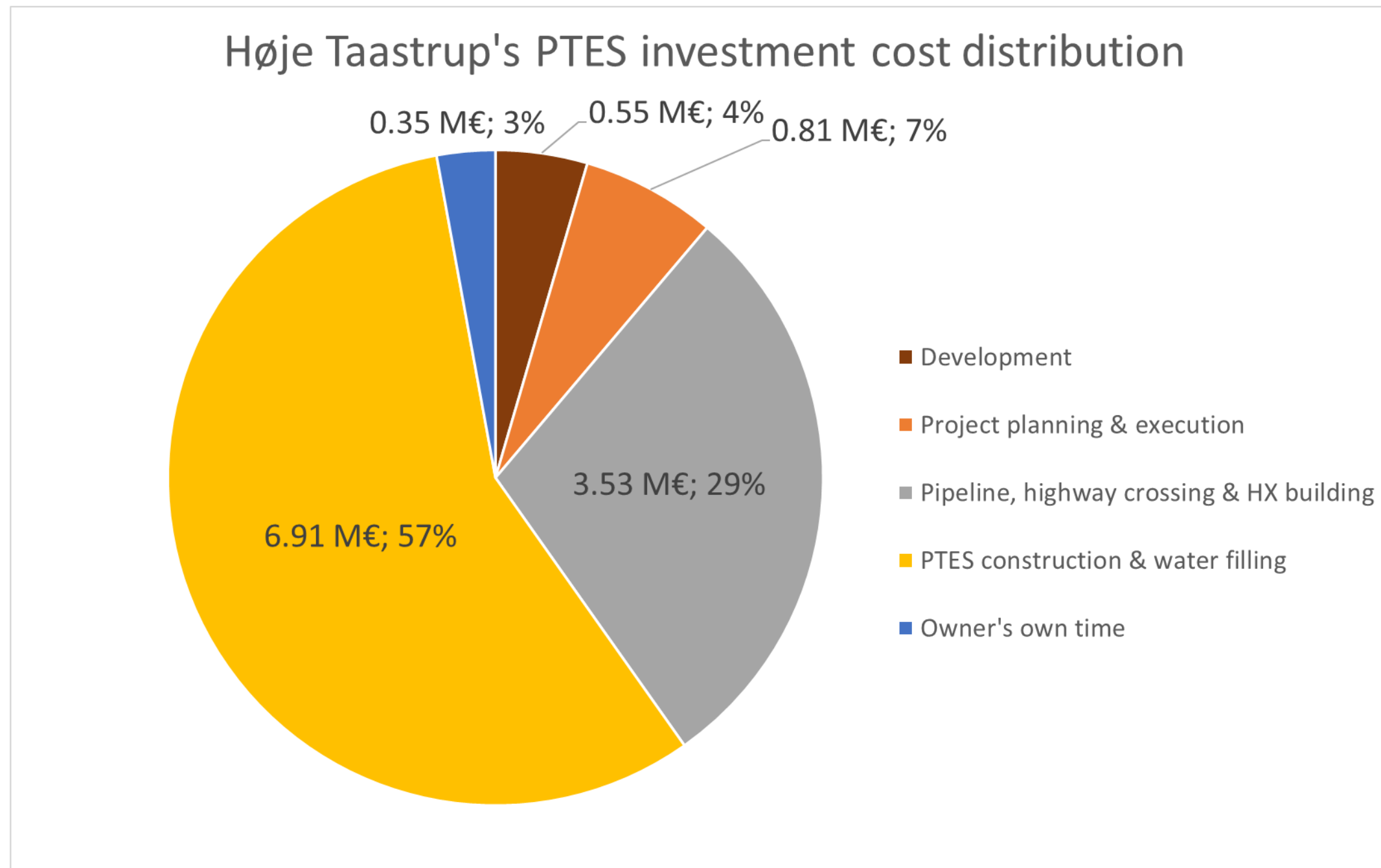
\*Including heat bought from transmission grid & self-production from Høje Taastrup District Heating



Extract from: IEA-ES Task 39 deliverables

# Business case of Høje Taastrup (2)

The storage itself is more than half of the investment cost



Data from "FLEX\_TES - Design and Construction of the Pit Thermal Energy Storage in Høje Taastrup". See: [https://planenergi.eu/wp-content/uploads/2024/01/FLEX\\_TES-Implementationreport\\_final\\_23.12.23.pdf](https://planenergi.eu/wp-content/uploads/2024/01/FLEX_TES-Implementationreport_final_23.12.23.pdf)

# Different business models correspond to different organizational structures

Different business models observed so far:

- “Traditional” ownership (by the DHN operator)
- Co-ownership (Høje Taastrup)
- Heat purchase agreement/private actor (NewHeat)

Potential business models going onwards:

- Crowdfunding (as for some wind or PV projects)
- Investment funds
- Leasing

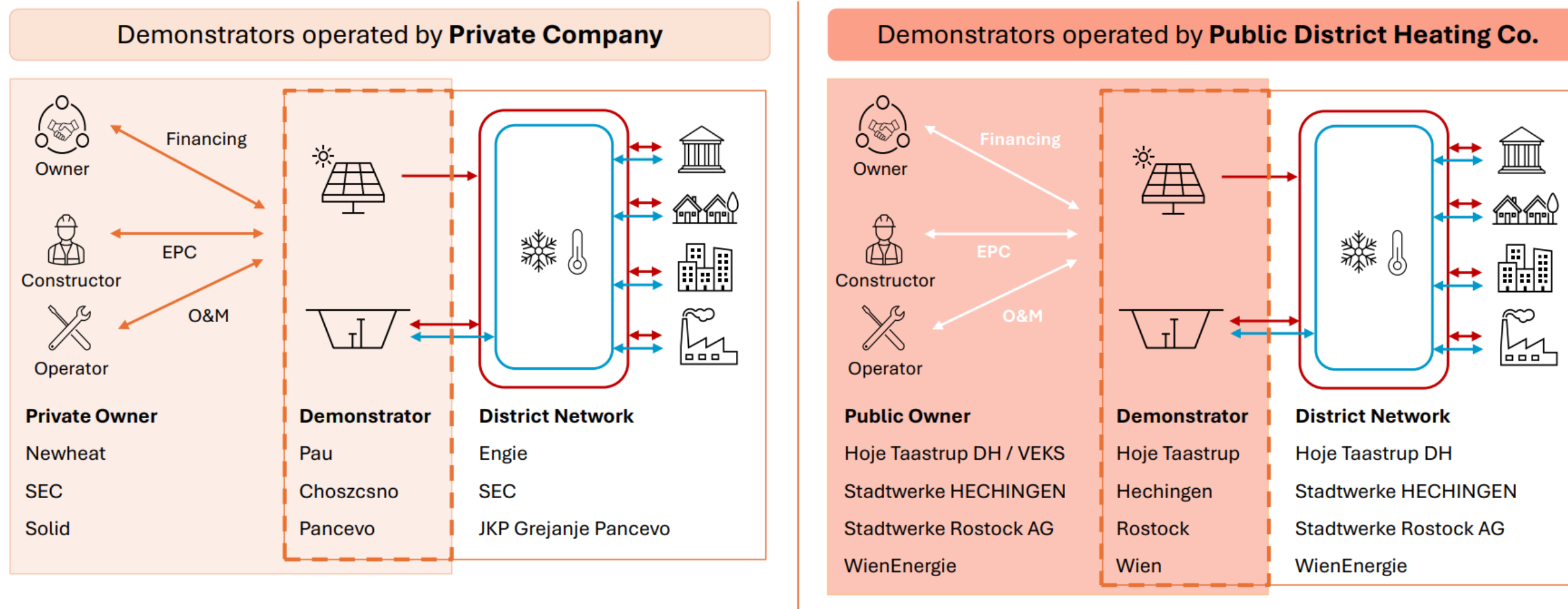
# Different business models correspond to different organizational structures

## Example with the 7 demonstrators of TREASURE

### Private vs Public Owner

The organizational structure of the owner of the plant / PTES will drive its financing strategy and conditions.

The financing structure of the project will be very different if it is a **Private Company** or a **Public related entity**.



Extract from a presentation by NewHeat in a TREASURE workshop



# Business case of Høje Taastrup (4)

A more expensive PTES can be justified when it generates more benefits to the users

| Parameter                           | Value                           |
|-------------------------------------|---------------------------------|
| CAPEX                               | 12.15 M€ <sub>2023</sub>        |
| OPEX                                | 227,000 € <sub>2023</sub> /year |
| Simple payback time                 | 12 years*                       |
| IRR                                 | 7.5 %                           |
| Subsidies                           | 1.745 M€ <sub>2023</sub> **     |
| (estimated) Operating profit        | 1.04 M€/year                    |
| (estimated) CO <sub>2</sub> savings | 6,200 tons/year                 |

\* Excluding subsidy

\*\* From EUDP

# Business case of Høje Taastrup (5)

The PTES benefits are distributed between the actors of the greater Copenhagen DH system

| Heat producers: | 4 CHP plants             | 3 waste-to-energy plants | Peak boilers                              |
|-----------------|--------------------------|--------------------------|-------------------------------------------|
| Owners          | Ørsted, HOFOR & VEKS     | Municipalities           | Transmission companies (VEKS & CTR/HOFOR) |
| Total capacity  | 2,500 MW <sub>heat</sub> | 400 MW <sub>heat</sub>   | 1,900 MW <sub>heat</sub>                  |
| Benefits share  | 30-35%                   | 10-30%                   | 35-60%                                    |

# Business case of Høje Taastrup (6)

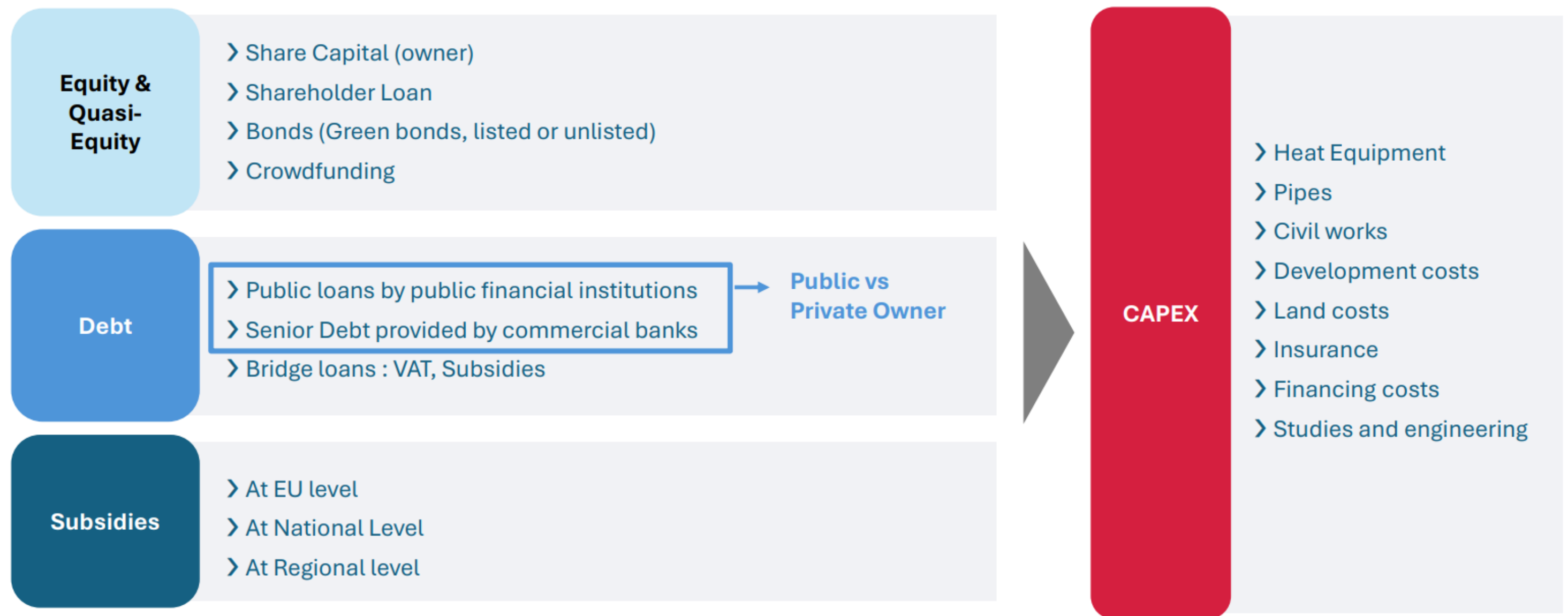
The PTES is co-owned by a distribution network operator and a transmission network operator

| Company                                    | Høje Taastrup Fjernvarme (HTF)                                                                                                                                                             | VEKS                              |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Share                                      | 50%                                                                                                                                                                                        | 50%                               |
| Deal                                       | VEKS has bought the right to HTF's share of the storage capacity for 20 years by paying an annual compensation. The partners have made a cooperation agreement in which it is stated that: |                                   |
| Responsibility for operation & maintenance | Daily operation & monitoring is managed by HTF, with inputs on the charge-discharge profile given by Varmelast (greater Copenhagen area district heating system optimization program)      | VEKS covers the maintenance costs |

The loan for the investment into the PTES is guaranteed by the municipality (Høje Taastrup)

# Existing financing methods

Investment can be funded by equity, debt and/or subsidies



Extract from a presentation by NewHeat in a TREAUSURE workshop

# Existing financing methods

Depends a lot on the country the LTES project is being developed:

- Different subsidy schemes (subsidy vs. tax credits)
- Different available loans
- EU framework

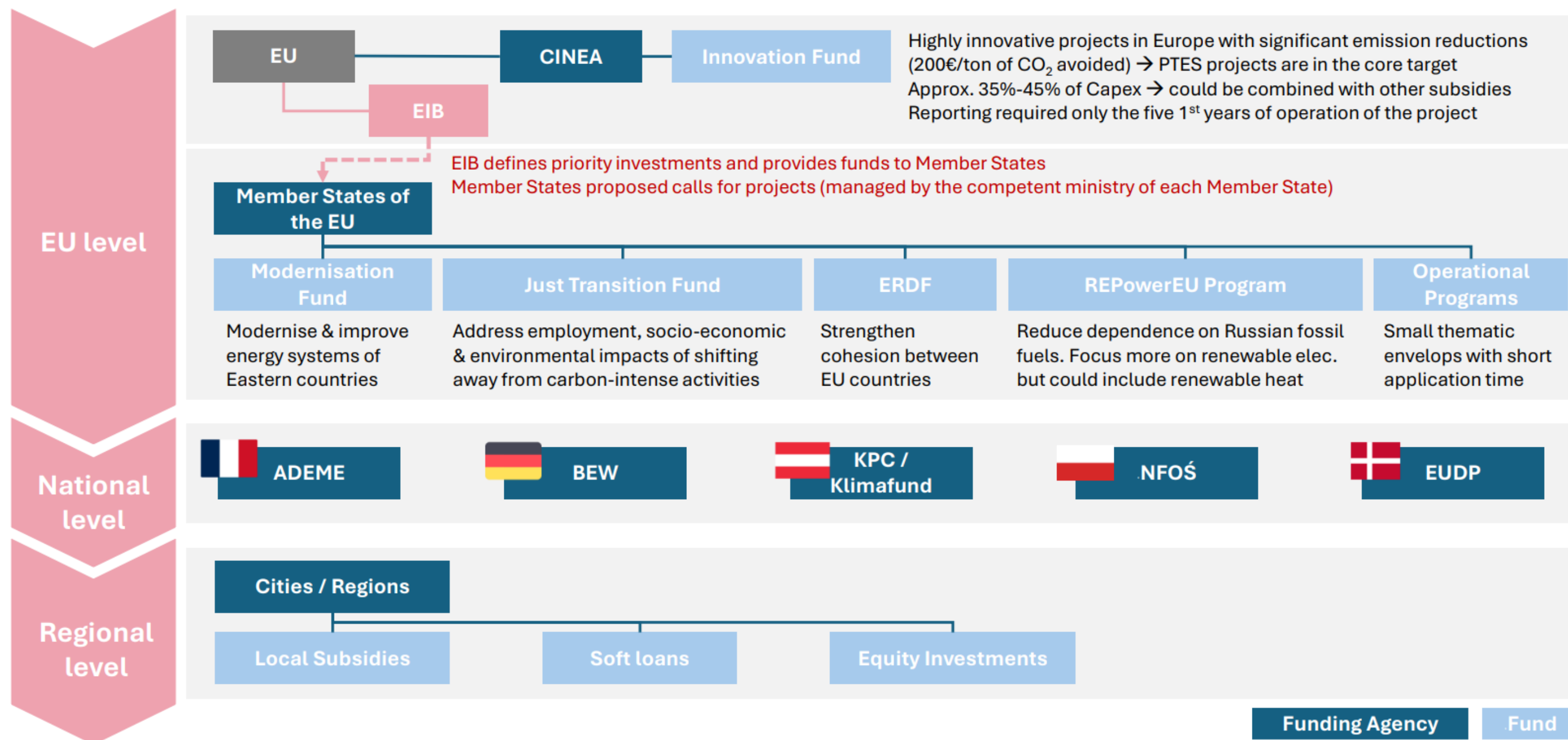
More specifically:

- Some subsidies are available at EU, national or regional level
  - In the EU, several program are available
  - National subsidies are available in AT, DE, FR, PL
  - Some regions also offer subsidy programs



# Existing financing methods

## Subsidies are available at 3 levels



Extract from a presentation by NewHeat in a TREASURE workshop



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# Thanks for your attention !



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Learn more at <https://iea-es.org/task-39/> & <https://iea-es.org/task-45/>