energy storage

IEA Technology Collaboration Programme

Large Thermal Energy Storage financing methods

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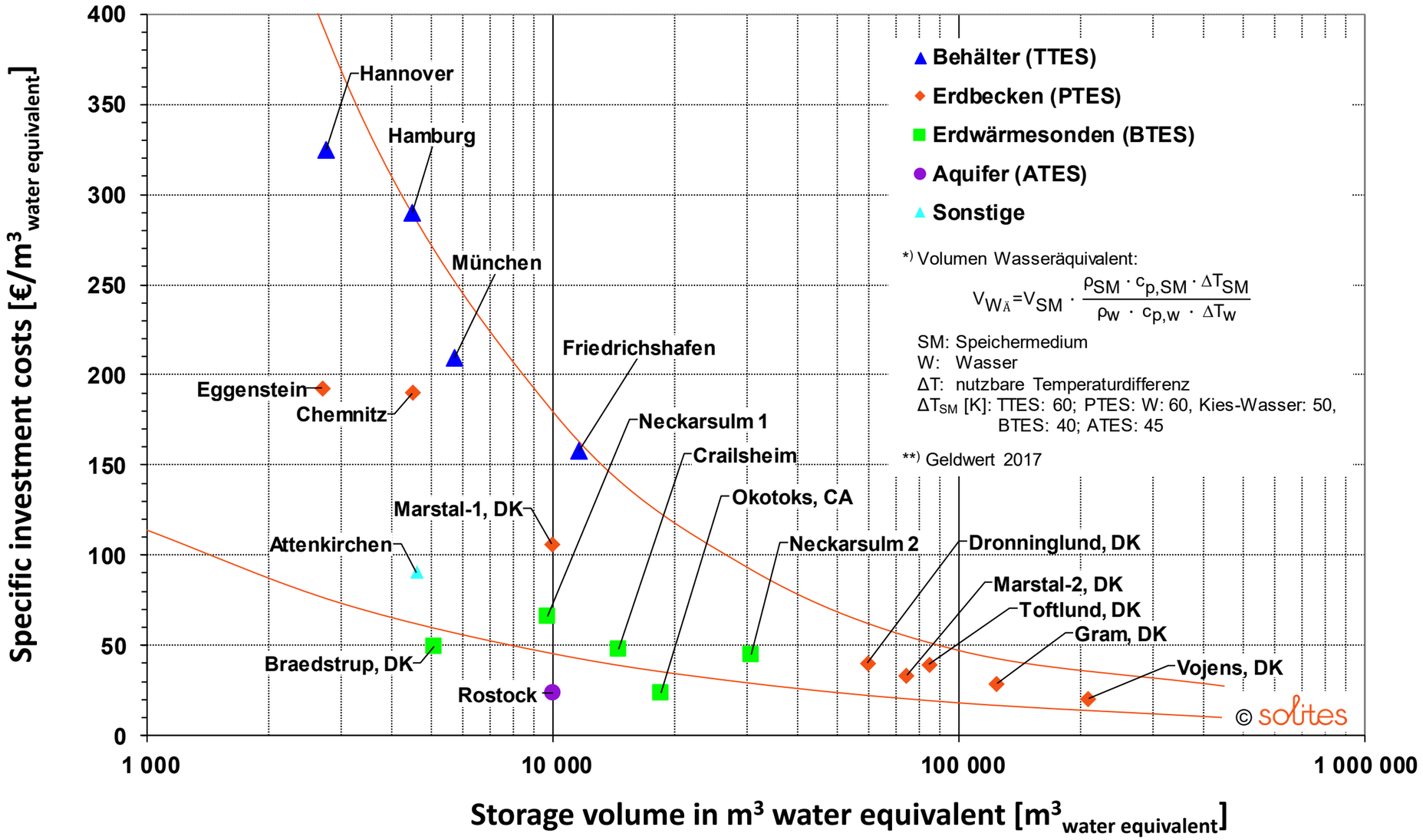
AEE INTEC

How to finance an LTES in the EU?



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

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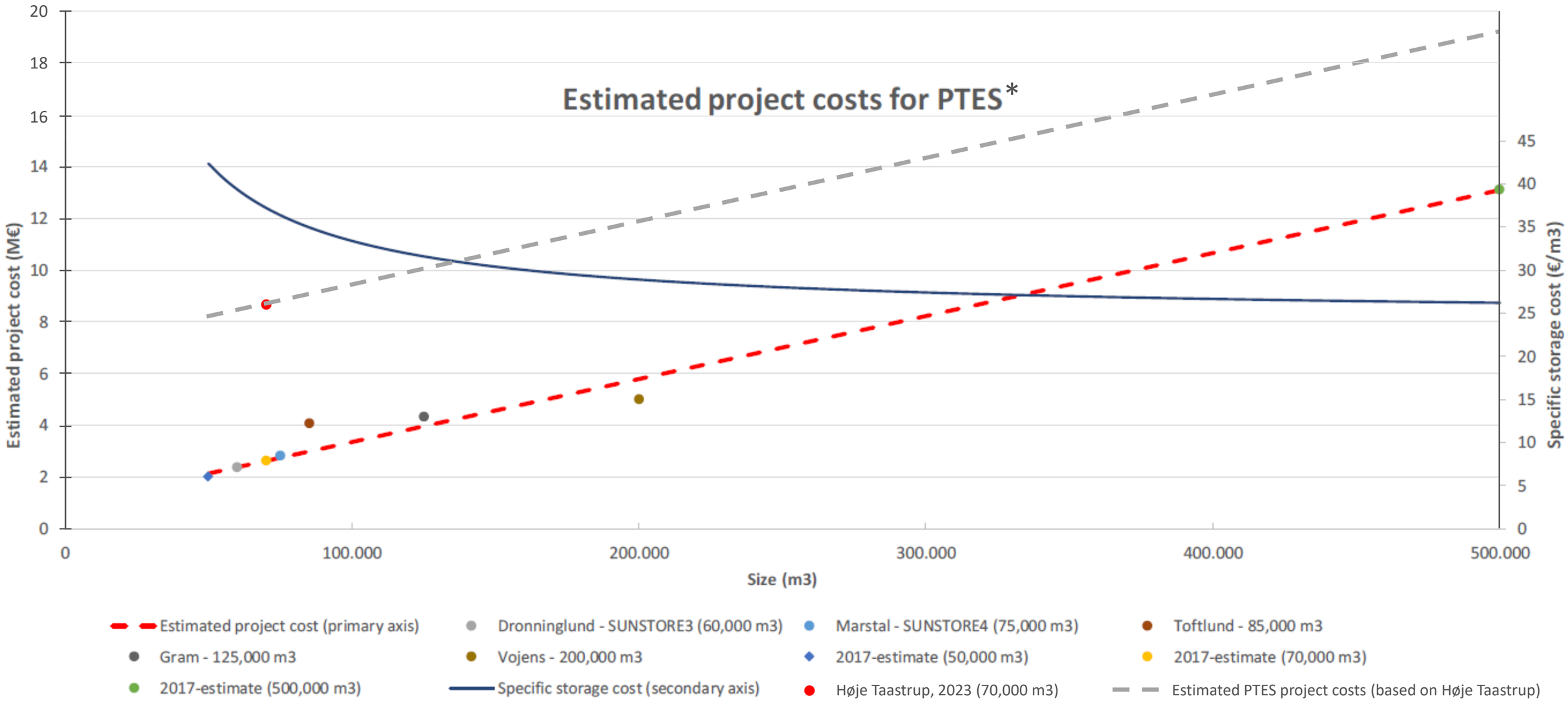
How to finance a multi-million € project?



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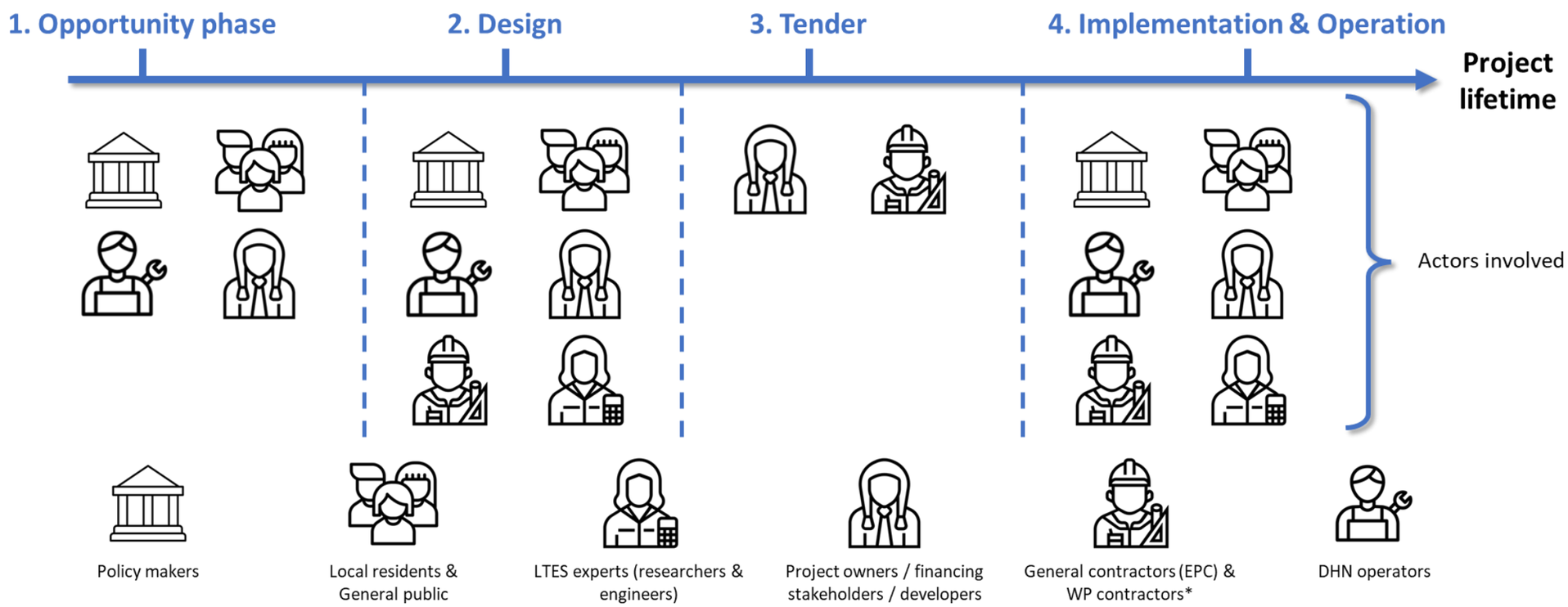
*(curves based on experience of years 2012 to 2017)

Financing is needed in all phases of LTES projects

Phase	Opportunity	Design	Tender	Implementation
Key activities	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

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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^3
Lid dimensions: 180 m x 62 m
Storage capacity: 3'300 MWh
Charge-discharge capacity: 30 MW_{th}
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

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Extract from: IEA-ES Task 39 deliverables

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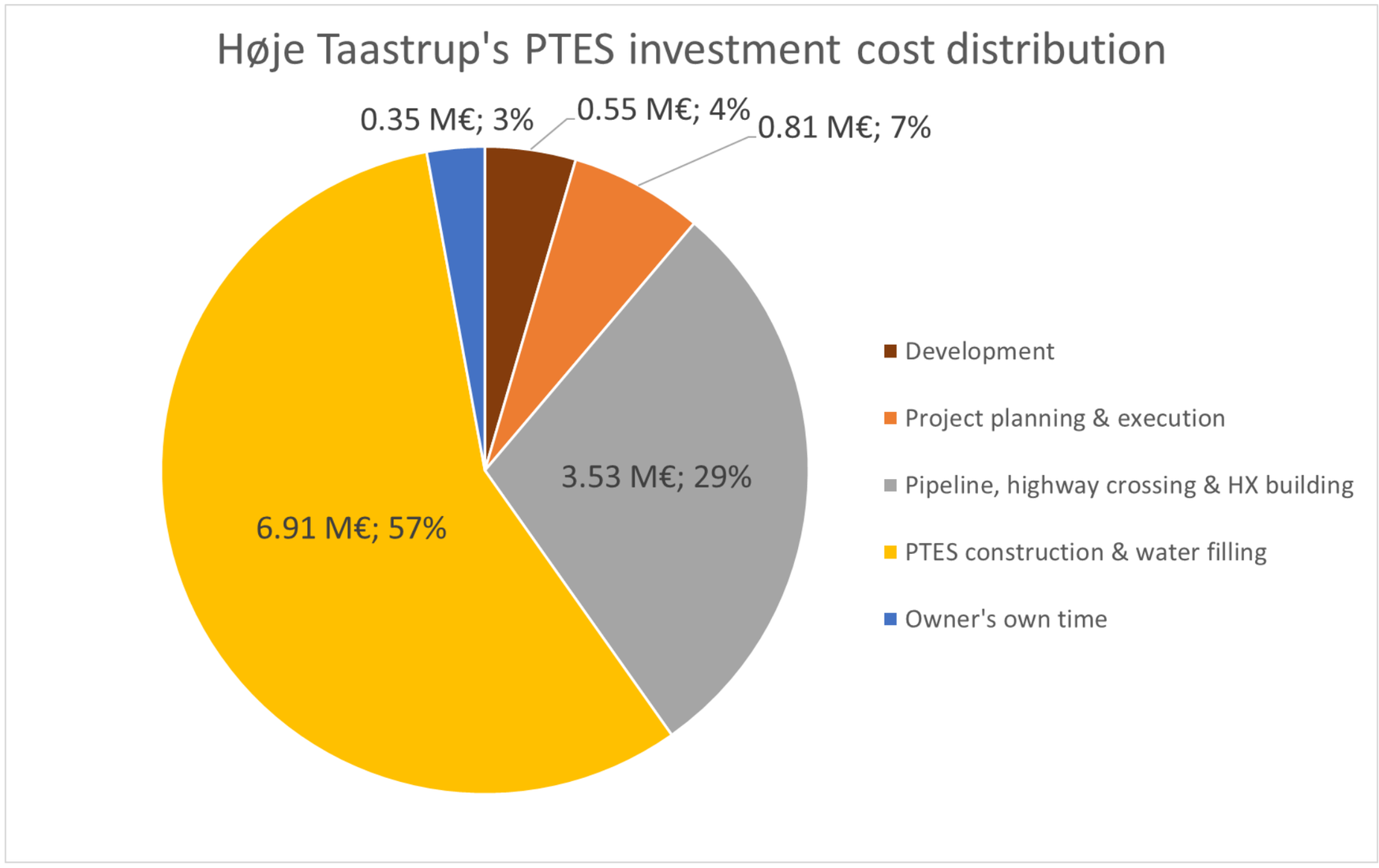
Financial support from: EUDP

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

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Financial support from: EUDP

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

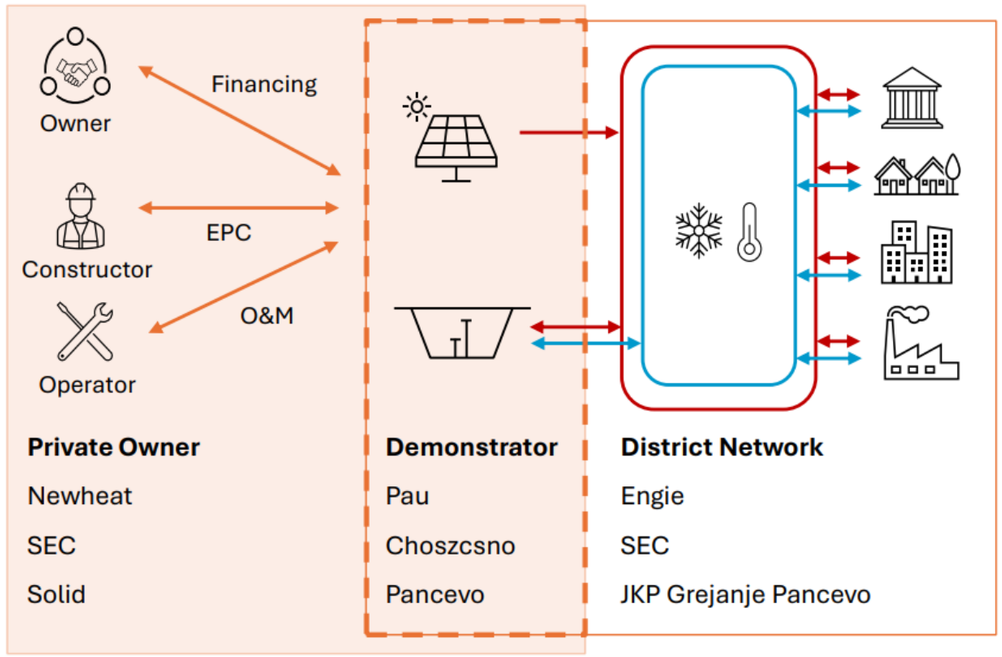
Different business models correspond to different organizational structures

Example with the 7 demonstrators of TREASURE

Private vs Public Owner

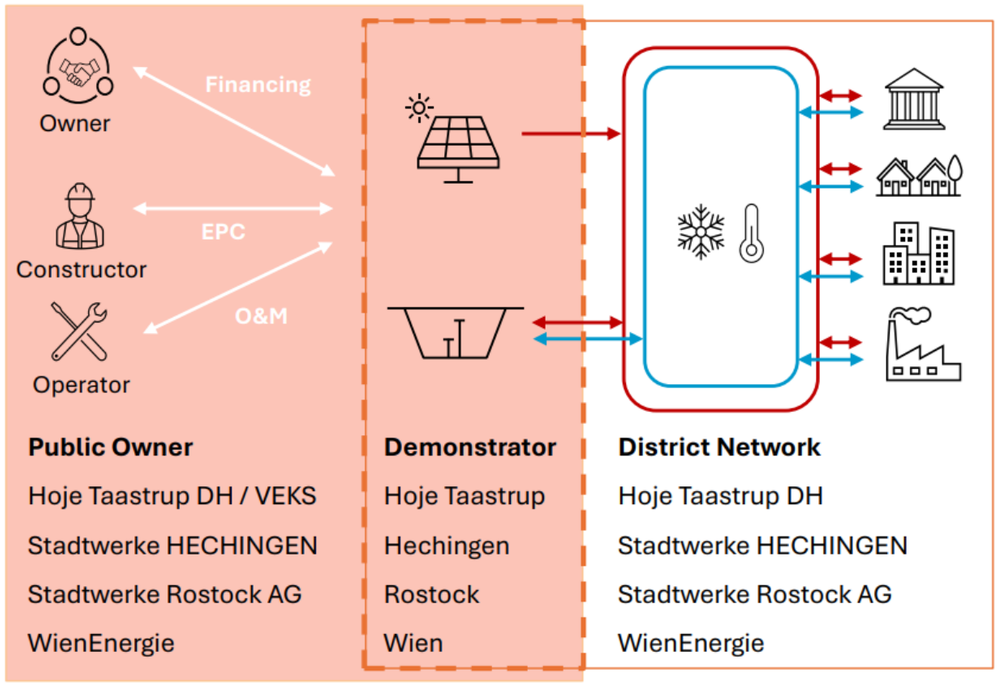
The organizational structure of the owner of the plant / PTES will drive its financing strategy and conditions.
The financing structure of the project will be very different if it is a **Private Company or a Public related entity.**

Demonstrators operated by **Private Company**



Private Owner	Demonstrator	District Network
Newheat	Pau	Engie
SEC	Choszcsno	SEC
Solid	Pancevo	JKP Grejanje Pancevo

Demonstrators operated by **Public District Heating Co.**



Public Owner	Demonstrator	District Network
Hoje Taastrup DH / VEKS	Hoje Taastrup	Hoje Taastrup DH
Stadtwerke HECHINGEN	Hechingen	Stadtwerke HECHINGEN
Stadtwerke Rostock AG	Rostock	Stadtwerke Rostock AG
WienEnergie	Wien	WienEnergie

Extract from a presentation by NewHeat in a TREAUSURE workshop

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newheat renewable heat supplier
TREASURE
Funded by the European Union

Business case of Høje Taastrup (4)

A more expensive PTES can be justified when it generates <u>more benefits</u> to the users

Parameter	Value
CAPEX	12.15 M€$_{2023}$
OPEX	155,500 €$_{2023}$/year*
Simple payback time	12 years**
IRR	7.5 %
Subsidies	1.745 M€$_{2023}$***
(estimated) Operating profit	1.04 M€/year
(estimated) CO_2 savings	6,200 tons/year

* If 25 cycles/year
** Excluding subsidy
*** From EUDP

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Financial support 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_{heat}	400 MW_{heat}	1,900 MW_{heat}
Benefits share	30-35%	10-30%	35-60%

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Financial support from: EUDP

Business case of Høje Taastrup (6)

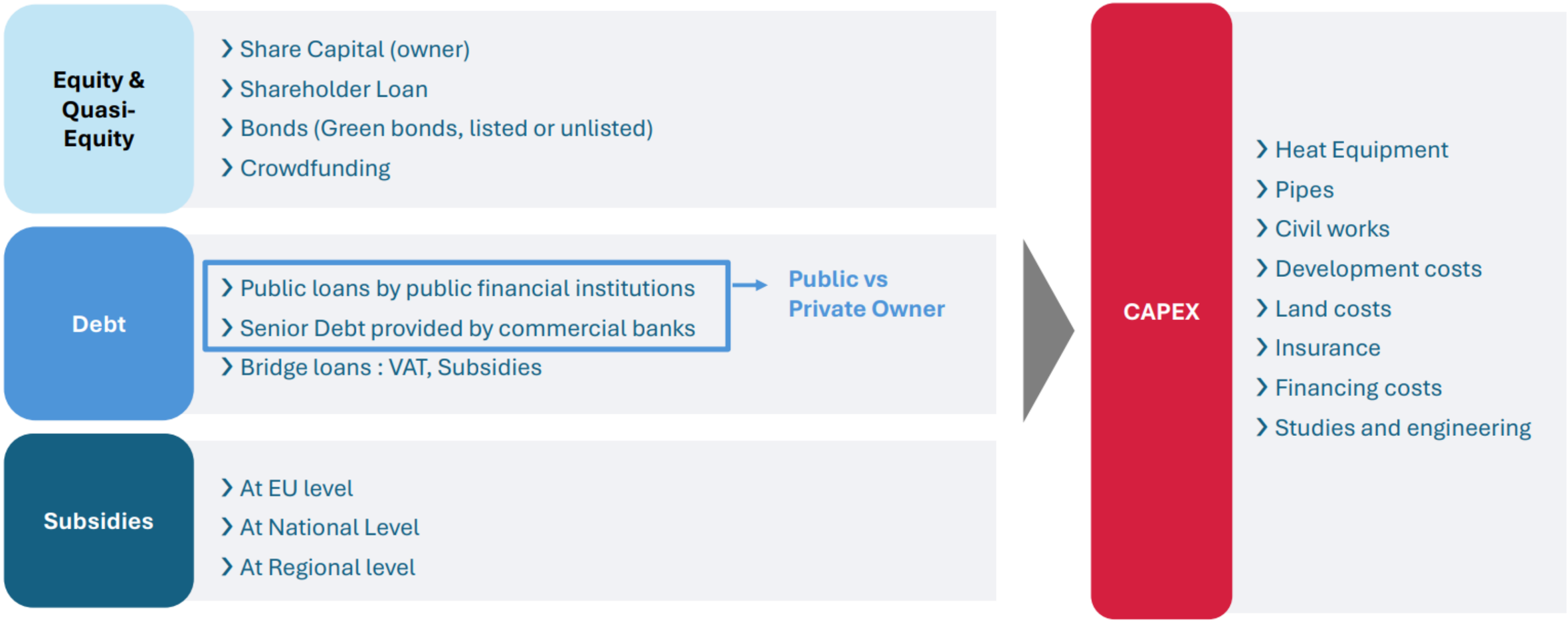
The PTES is co-owned by a distribution network operator and a transmission network operator

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

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TREASURE
Funded by the European Union

Existing financing methods

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

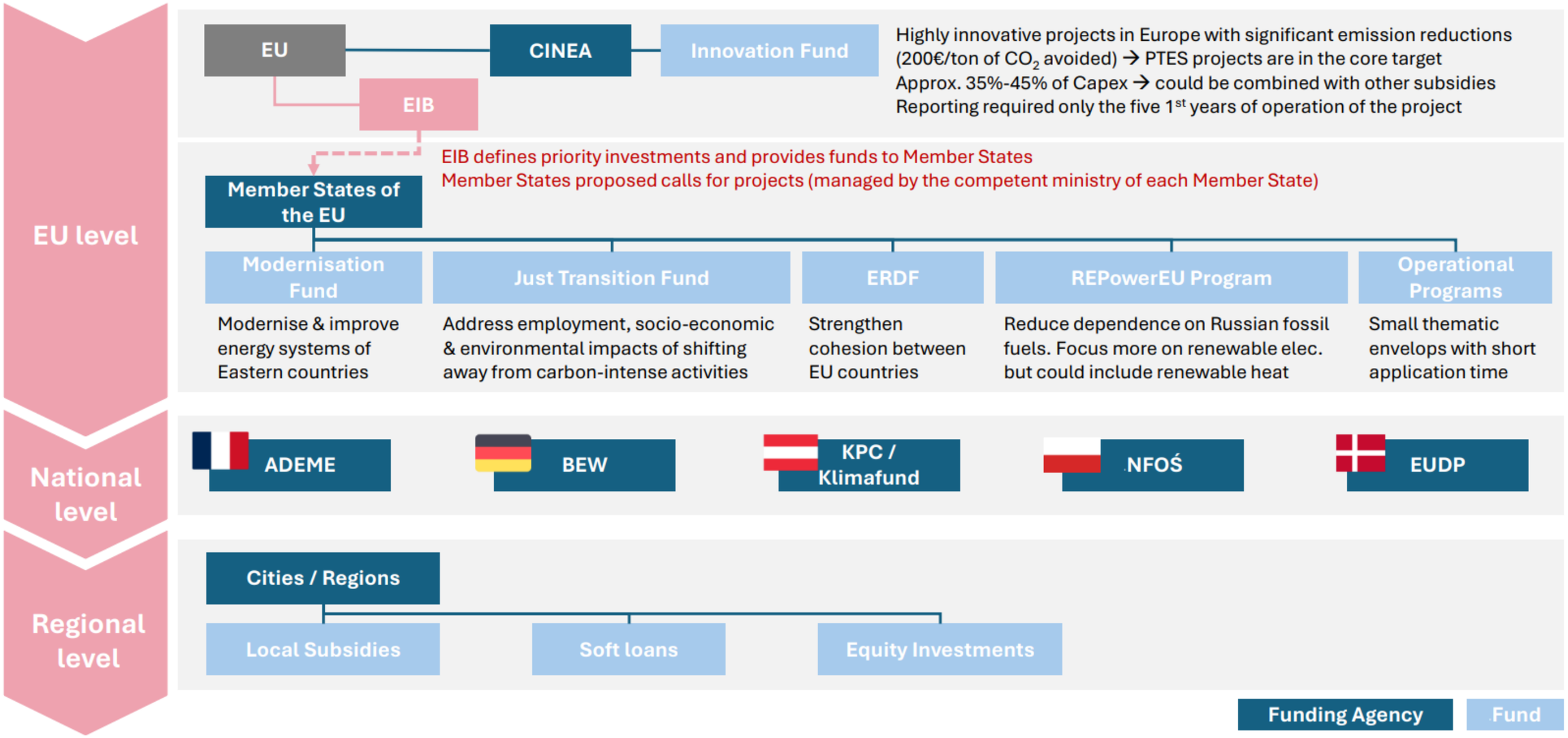
- Different subsidy schemes (subsidy vs. tax credits)
- Different available loans
- EU framework

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 TREAUSURE workshop

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Thanks for your attention !

Geoffroy Gauthier

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

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