Thermal energy storage

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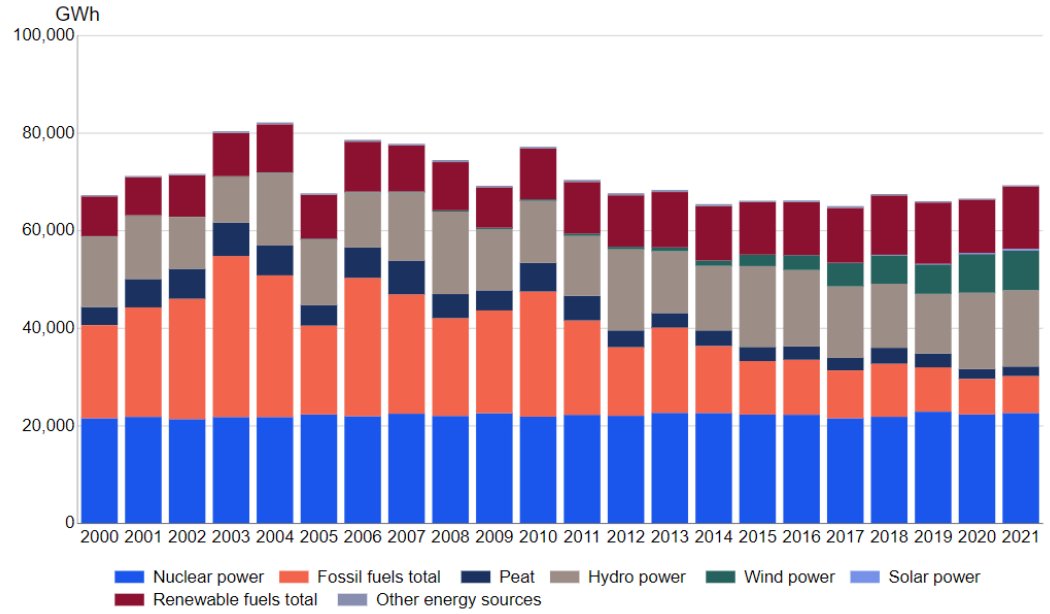
Energy statistics in Finland

1970-2021/22*

Electricity generation by energy source 2000-2021



Source: Statistics Finland, production of electricity and heat

Supply and total consumption of electricity, 2022*

Supply	GWh	%
Nuclear power	24 221	29,6
Hydro power	13 354	16,3
Wind power	11 562	14,1
Solar power	380	0,5
Net imports	12 518	15,3
Other heating power	19 679	24,0
Total	**81 714**	**100**
Total consumption	**GWh**	**%**
Industry and construction	36 341	44,5
Households and agriculture	24 307	29,7
Services and public consumption	17 825	21,8
Transmission and distribution losses	3 241	4,0
Total	**81 714**	**100**

* preliminary data

Household energy consumption, 2021

By use	GWh	%
Space heating	46 423	67,5
Heating of domestic water	10 133	14,7
Other electrical equipment	6 871	10,0
Heating of saunas	3 069	4,5
Lighting	1 482	2,2
Cooking	833	1,2
Total	**68 810**	**100**
By energy source	**GWh**	**%**
Electricity	24 261	35,3
District heat	19 688	28,6
Wood	14 753	21,4
Heat pump	7 345	10,7
Other [1)]	2 763	4,0
Total	**68 810**	**100**

[1)] Peat, coal, natural gas, light and heavy fuel oil

https://www.stat.fi/tup/suoluk/suoluk_energia_en.html

Thermal energy storage: Behind the scene

Wind / Solar / Bio

Industry recycled

Geo-thermal

Electricity from x

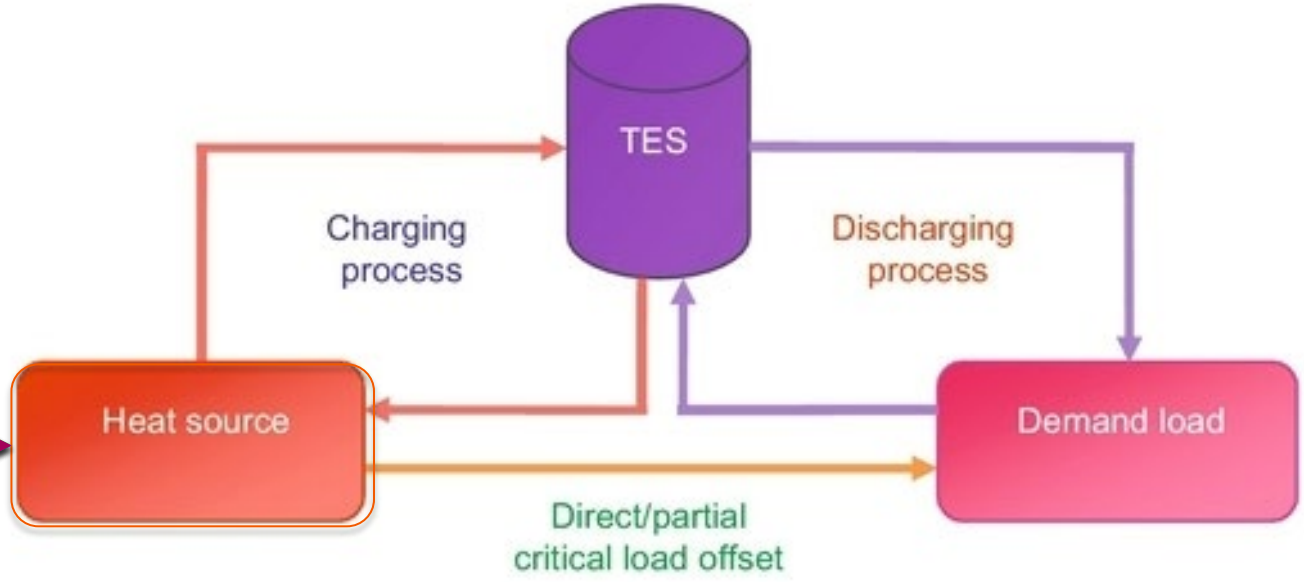


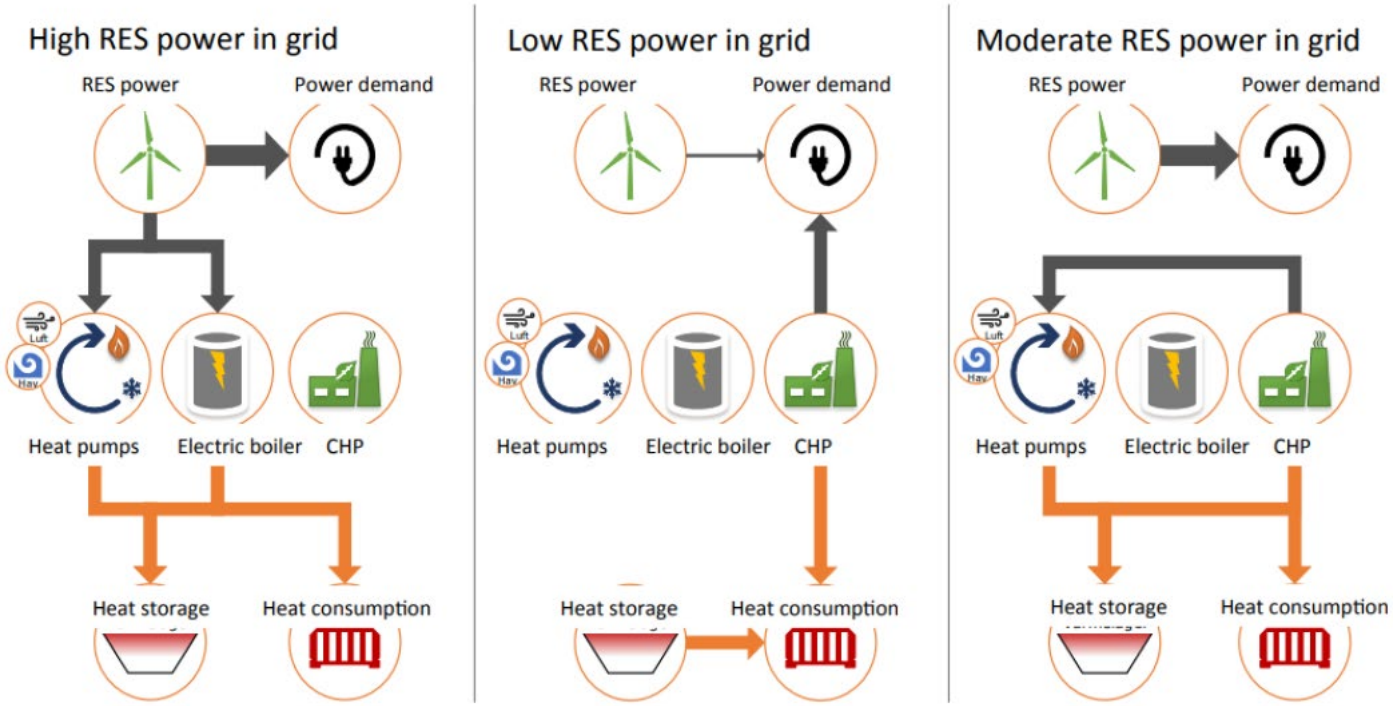
FIGURE 3.1 Simple schematic representation of TES integration and operation.

Kalaiselvam, S. & Parameshwaran, R. 2014. Thermal Energy Storage Technologies

Diaz, P.M., 2016. Analysis and comparison of different types of thermal energy storage systems: A review. Journal of Advances in Mechanical Engineering and Science, 2(1), pp.33-46.

Importance of thermal energy storage

1. To overcome the problem of lack of coincidence between energy supply and demand.
2. Emissions reductions demands have increased focus on renewables for energy generations
3. Renewable energy fluctuates (Solar, wind). Cannot be “Made available when needed”.
4. Stored thermal energy can level demand by storing energy when there is less demand and releasing it when there is high demand.



Bacquet, A., et.al., 2021. Overview of district heating and cooling markets and regulatory frameworks under the revised renewable energy directive.

Case: Vaskiluodon voima

- Finland's biggest district heating storage

- https://www.vaasansahko.fi/ajankohtaista/vaasaan-suuri-energiavarasto/
- https://www.vaasanvoima.fi/lammon-varastointi/
- https://youtu.be/OYGLmbG9tQE
- **Volume *210 000 m3***
- ***Energy storage 7000 to 9000 Mwth***
- ***Can provide district heat to Vaasa city residential needs for up to 4 days (Discharge power 100MW)***

Suomen suurin kaukolämpövarasto otettiin käyttöön Vaasassa - rakennettiin 1970-luvun öljysäiliöihin

Tuula Laatikainen 29.9.2020 14:08 | päivitetty 1.10.2020 11:25 ENERGIA RAAKA-AINEET TEKNIIKKA TEOLLISUUS

Vaasan Sähkön lämpöenergiavarastoa voidaan lämmittää myös tuuli- ja aurinkovoimalla.