

Present and Future of Thermal Energy Storage

Technology bGen™
by Brenmiller



Brenmiller Europe Confidential

MKET Konferencia
2025



Bevezetés – A tárolás új értelmezése



Az ipari energiafelhasználás 75%-a hő formájában jelentkezik.

- **Problémafelvetés:** A legtöbben csak az akkumulátorokra gondolnak, amikor tárolásról beszélünk. De az ipari energiafelhasználás 75%-a hő formájában jelentkezik, nem elektromos energiaként.
- **Kihívás:** Hogyan lehet hatékonyan tárolni és felhasználni az ipari hőenergiát?
- **Megoldás:** Az ipari hőtárolás lehetőséget teremt a megújuló energiaforrások hatékonyabb kihasználására és a fosszilis energia kiváltására.

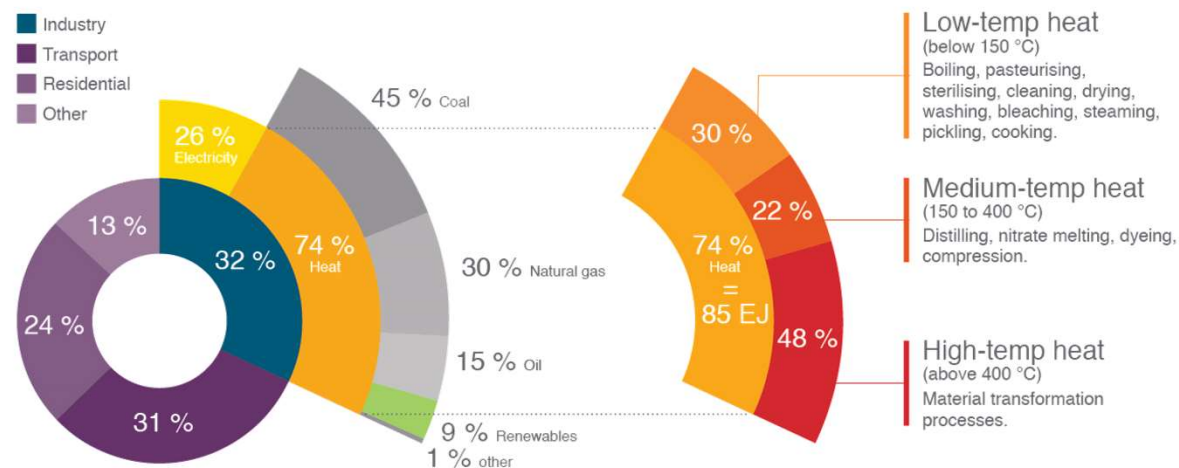


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Market insights – Industrial heat



- ✓ One third of final energy consumption goes to **industry**
- ✓ **Heat** accounts for three quarter of total **industrial** energy use
- ✓ Industrial heat demand relies heavily on **fossil fuels** heat
- ✓ Half of industrial heat is at **low and medium temperature**



Source: IRENA, 2020.  IRENA
International Renewable Energy Agency

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Túl az akkumulátoron: Az ipari hőtárolás jövője

BrenMiller innovatív megoldása



- **Hogyan működik?**
 - A BrenMiller hőtároló képes nagy mennyiségű hőenergiát tárolni, majd azt szabályozottan leadni.
 - Az ipari termelésben lehetővé teszi az energiatermelés és -felhasználás szétválasztását.
- **Működési alapelve:**
 - Elektromos vagy egyéb hőforrással töltött tároló közeg
 - Magas hatékonyságú hőleadás ipari felhasználásra
 - Moduláris felépítés és skálázhatóság
- **Alkalmazási lehetőségek:**
 - Megújuló energiaforrások (pl. nap- és szélenergia) termelésének kiegyenlítése
 - Hulladékhő visszanyerése
 - Foszilis energiahordozók kiváltása



Túl az akkumulátoron: Az ipari hőtárolás jövője



• BrenMiller innovatív megoldása



Hybrid

Connects different
Energy Sources



Modular

From Industrial to
large-scale Power Plants



Lifetime

30+ Years

Flexibility

Decoupling generation
from demand



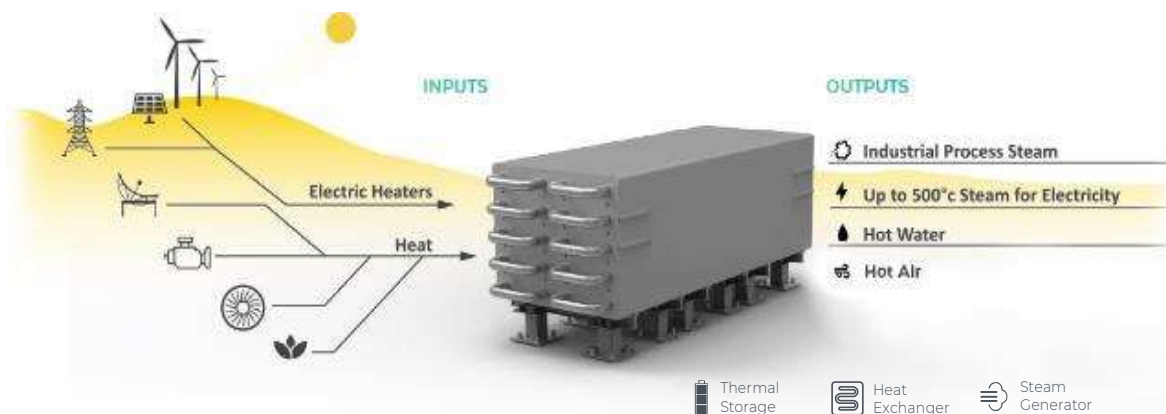
Performance

Unlimited cycles with
minimal daily losses (3%)



Clean

Environmentally friendly
materials (crushed rocks)



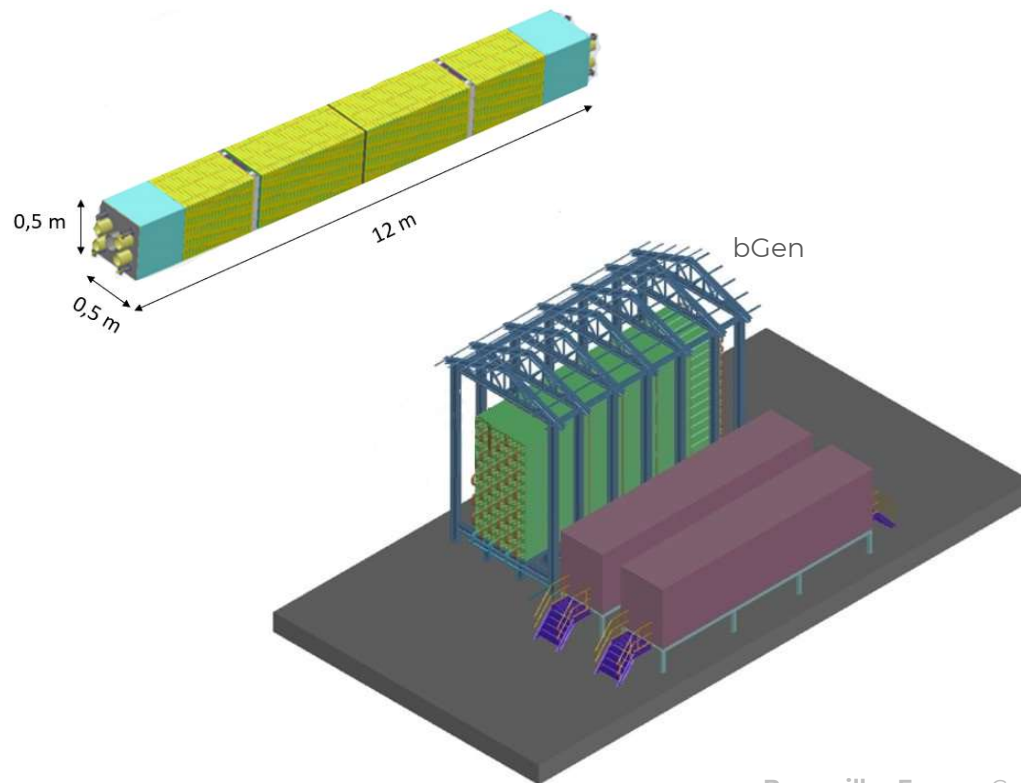
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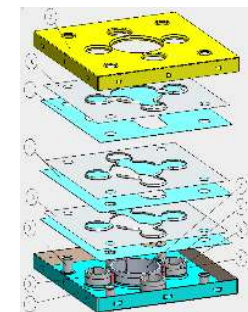
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Basic principle of the bGen™

The bGen™ is comprised of multiple bCubes:



bCube

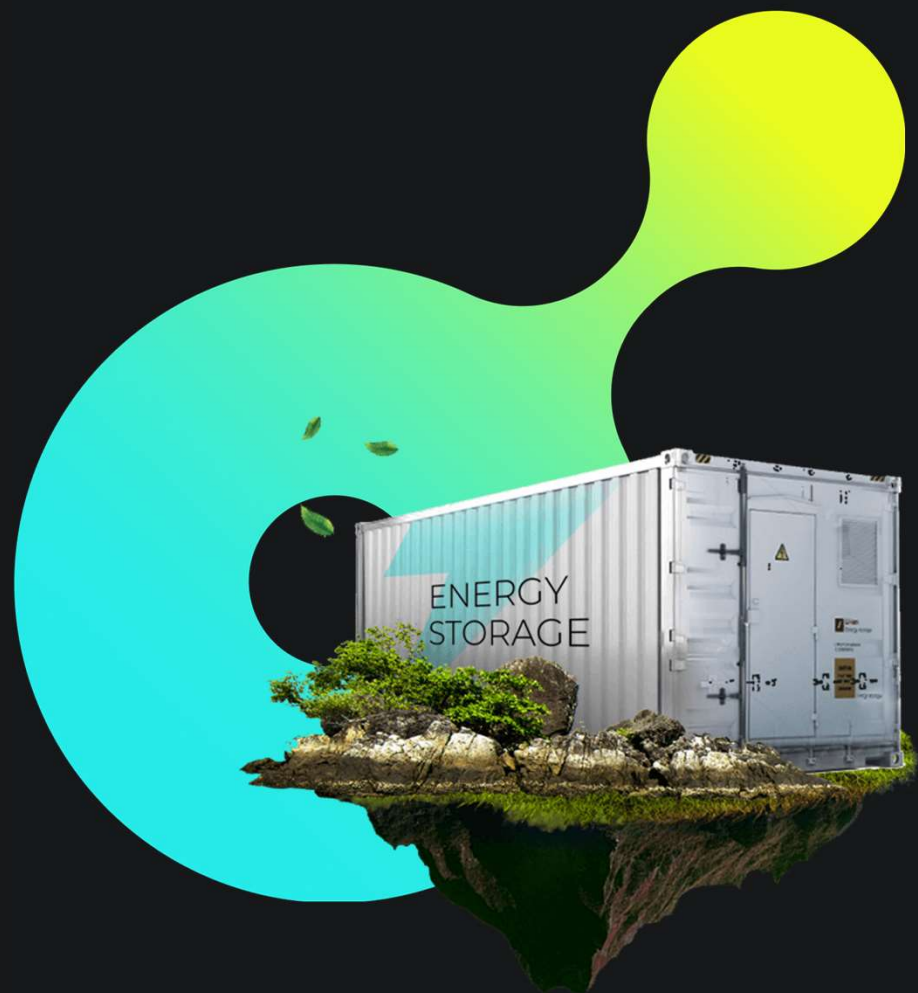


bCell



Power to Heat

Electrification / Grid services



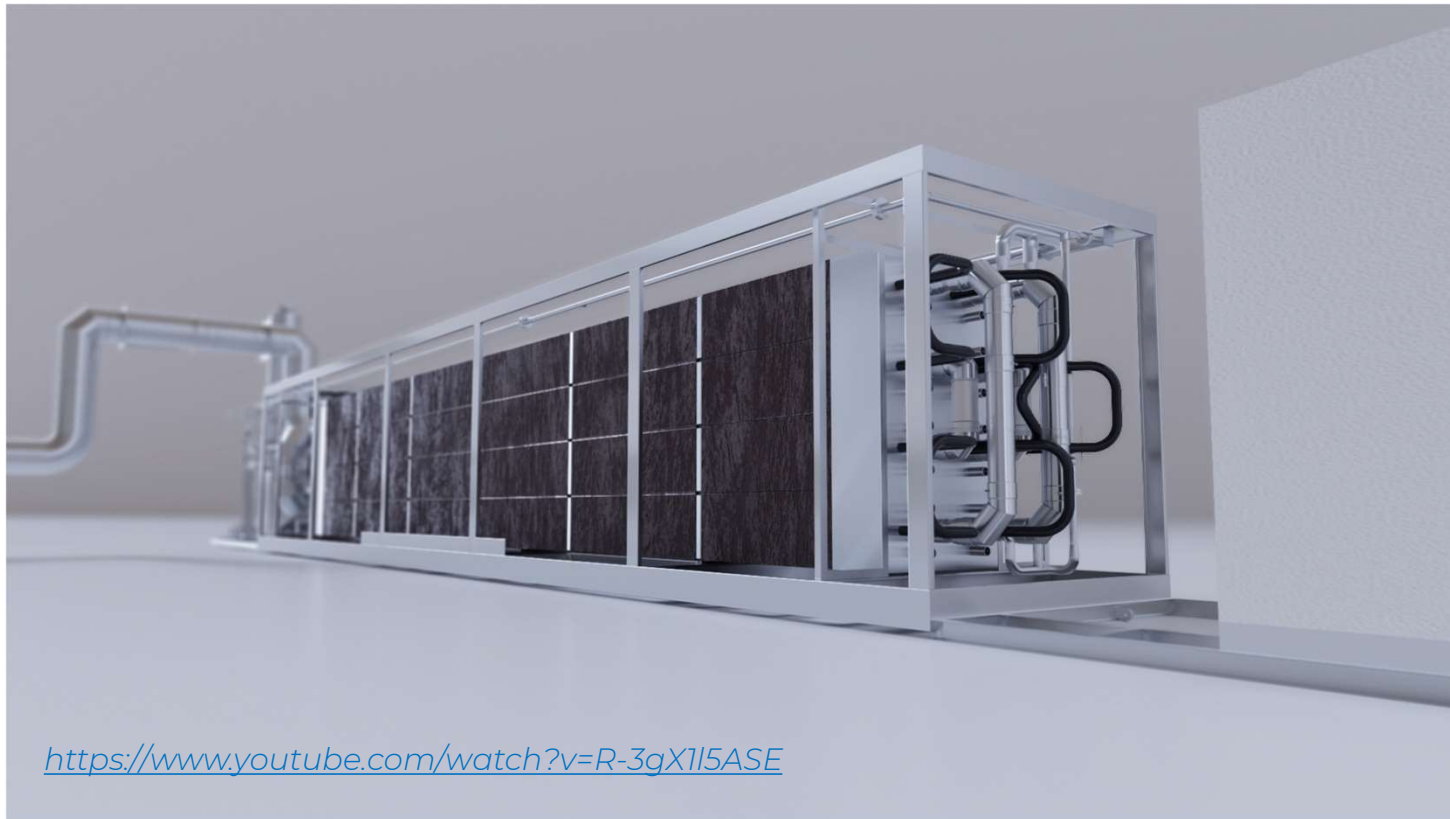


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bGen™ 3D animation (video)



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Power to Heat – Heat Electrification



Charging

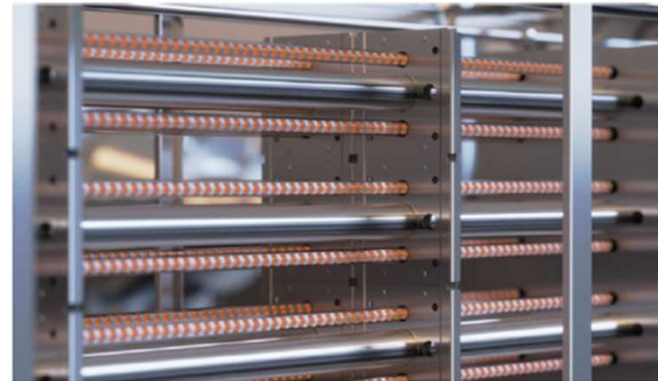
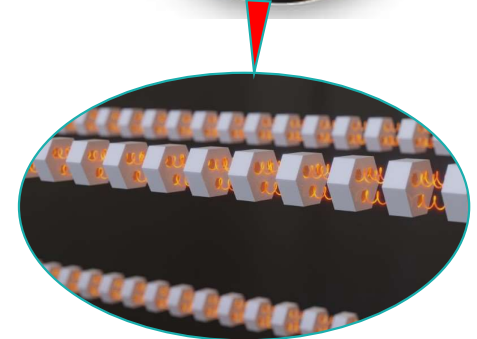
- Charging with Electricity from different sources:
 - PV or Wind
 - Grid (offpeak prices / PPA TES, ...)
- Thermal storage temperature: 750 °C

Discharging

- Steam discharging: up to 500 °C and 100 bar



Charging the bGen with electrical heaters



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Sikeres alkalmazások

- **Esettanulmányok és szimulációk.**

- ✓ **Gazdasági és környezeti előnyök**

- ✓ **Költségmegtakarítás:** Az energiacsúcsok kezelése és az ipari folyamatok energiahatékonyságának javítása.

- **Fenntarthatóság:** CO₂-kibocsátás csökkentése és zöld hő alkalmazása.



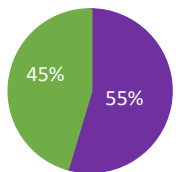
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Power to Heat – Industry decarbonization (Grid Services)



PPF, Dombovar (Hungary) - 30 MWh TES

- ✓ Partner in Pet Food (PPF)
- ✓ TES charged with negative aFRR balancing energy + PV * and grid off-peak prices
- ✓ 12-year Heat as a Service agreement (HaaS)
- ✓ Charge: 5 MWe from the grid
- ✓ Discharge: max steam flow 1 tn/h at 10 bara - 180 °C



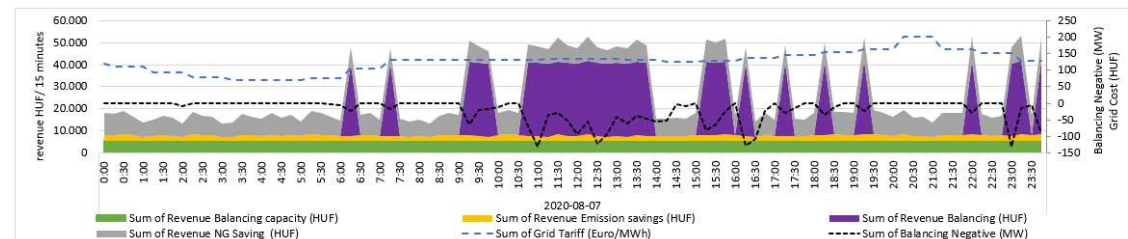
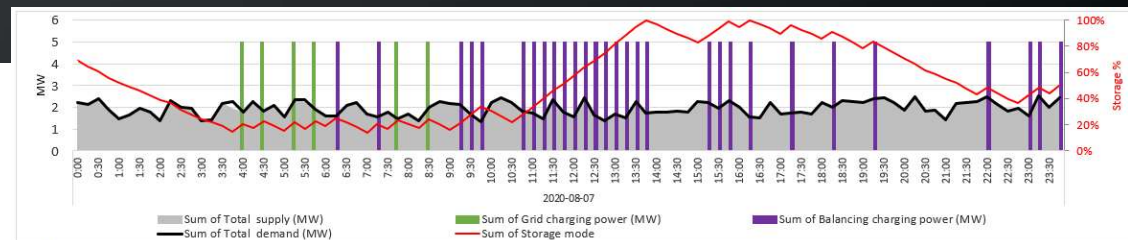
Energy Sources (MWh)

- Balancing
- Grid off peak



Revenue Breakdown

- Balance capacity payments
- Revenue Balancing services
- Saving on natural gas
- Saving on Emissions



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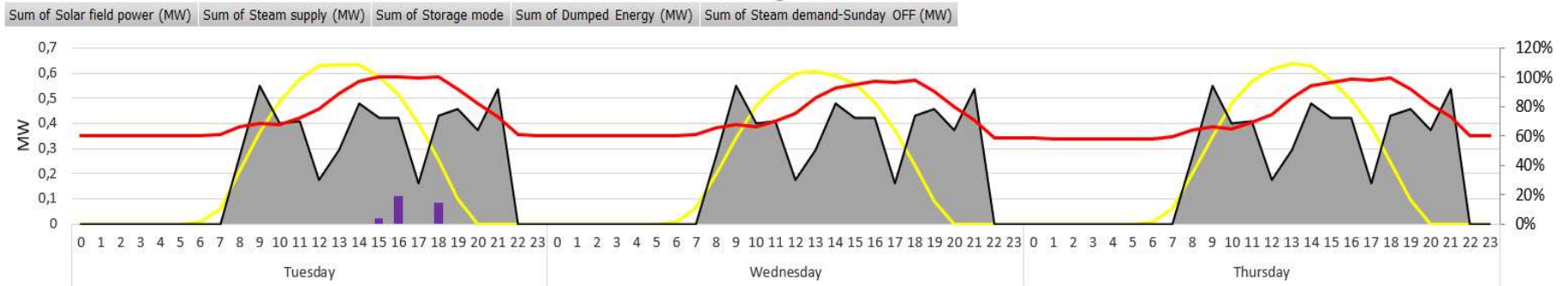
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Thermal energy storage from PV plant

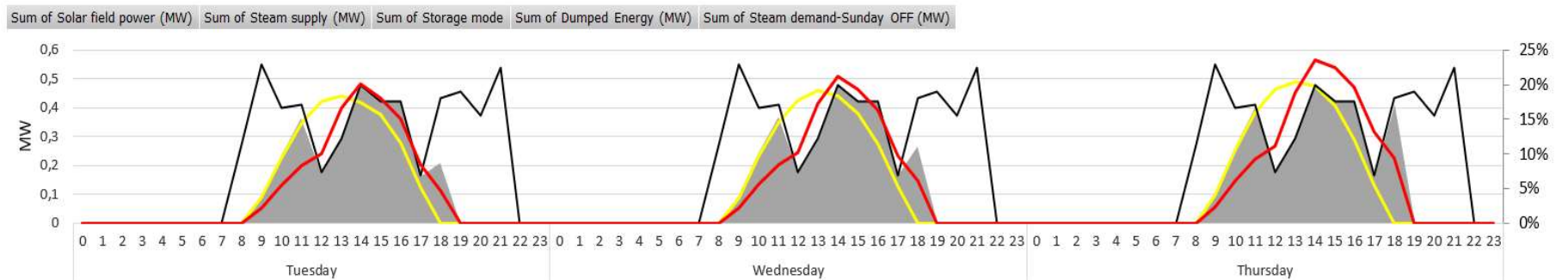


Sum of Steam supply (MW) Sum of Dumped Energy (MW) Sum of Solar field power (MW) Sum of Steam demand-Sunday OFF (MW) Sum of Storage mode

SUMMER



WINTER



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PROJECT	LOCATION	SIZE	APPLICATION	CHARGE	DISCHARGE	STATUS	COD
<u>IDF</u>	Israel	1 MWh	Heat to Heat	Flue Gases	Hot Water	Operation	2020
<u>Fortlev</u>	Brazil	2 MWh	Heat to Heat	Biomass	Hot Air	Operation	2021
<u>NYP</u>	USA	1 MWh	Heat to Heat	Flue Gases	Hot Water	Operation	2023
			Power to Heat	Electricity			
<u>ENEL</u>	Italy	23 MWh	Heat to Power	Steam	Steam	Commissioning	2024
<u>Tempo Beverage</u>	Israel	32 MWh	Power to Heat	Electricity	Steam	Construction	2025
<u>Wolfson Hospital</u>	Israel	12 MWh	Power to Heat	Electricity	Steam	Construction	2025
<u>Partner in Pet Food</u>	Hungary	30 MWh	Power to Heat	Electricity	Steam	Engineering	2026
<u>SolWinHy Cadiz</u>	Spain	55 MWh	Power to Heat	Electricity	Steam	Development	2027

Technology Maturity Level - BRENMILLER: TRL 9 (1-9 levels. 27 MWh commercial plants in operation)



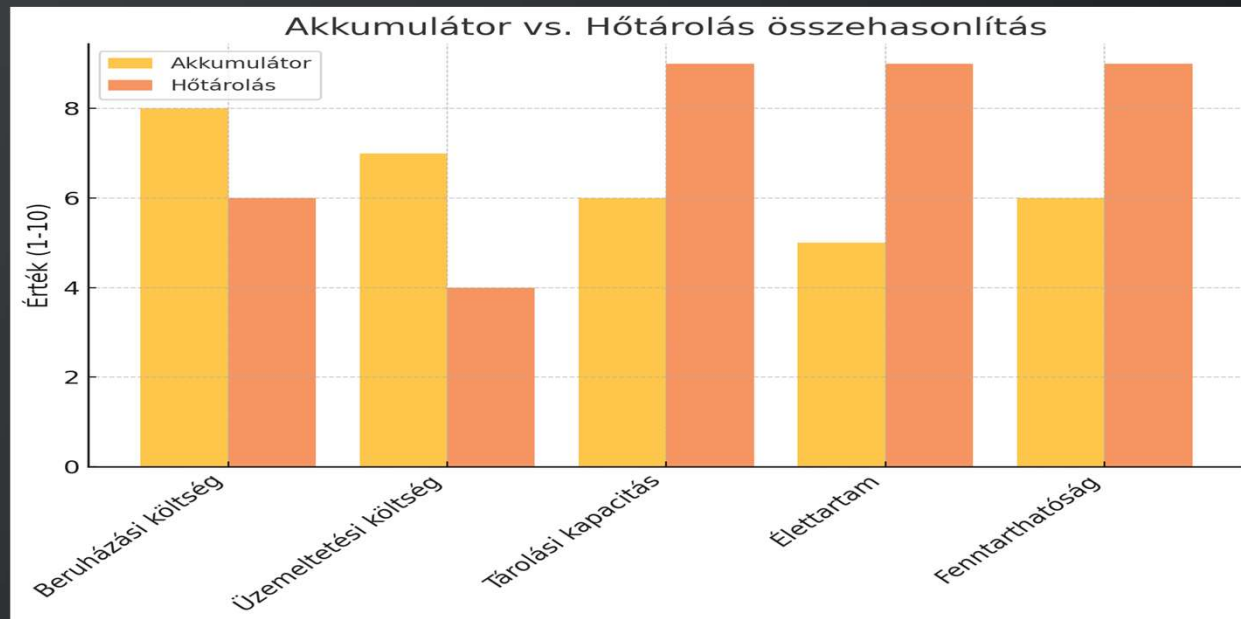
Alkalmazási lehetőségek

Megújuló energiaforrások kiegyenlítése.

Hulladékhő visszanyerése.

Fosszilis energiahordozók kiváltása.

- ✓ Összehasonlító ábra az akkumulátorok és a hőtárolás gazdasági és műszaki előnyeiről





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Thank you

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