

CHP “BATTERY”

-warm up with cold wind-

Patent application, Legal Assistance: Law firm Ciurtin & Associates

(if we need heat, should we always burn something ?)

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CONTENT

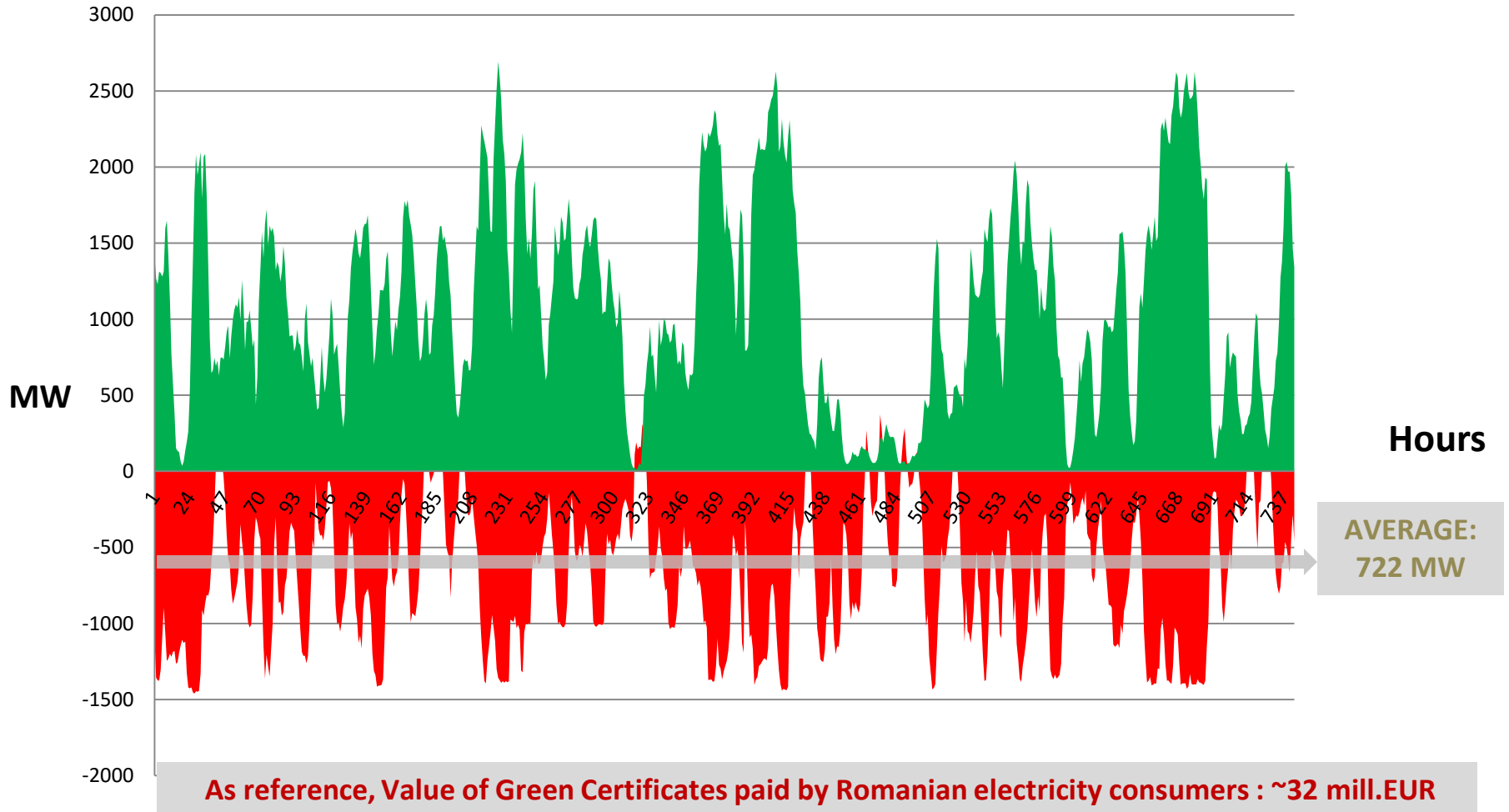
1. Wind Power operational problems vs Heat Market
2. What is “CHP Battery” ?
3. Technology and method description
4. Economic and financial impact estimation
5. Conclusions

SEN December- 2017

Source: TRANSELECTRICA

■ SOLD (Consum-Productie)

■ Productie Eoliana

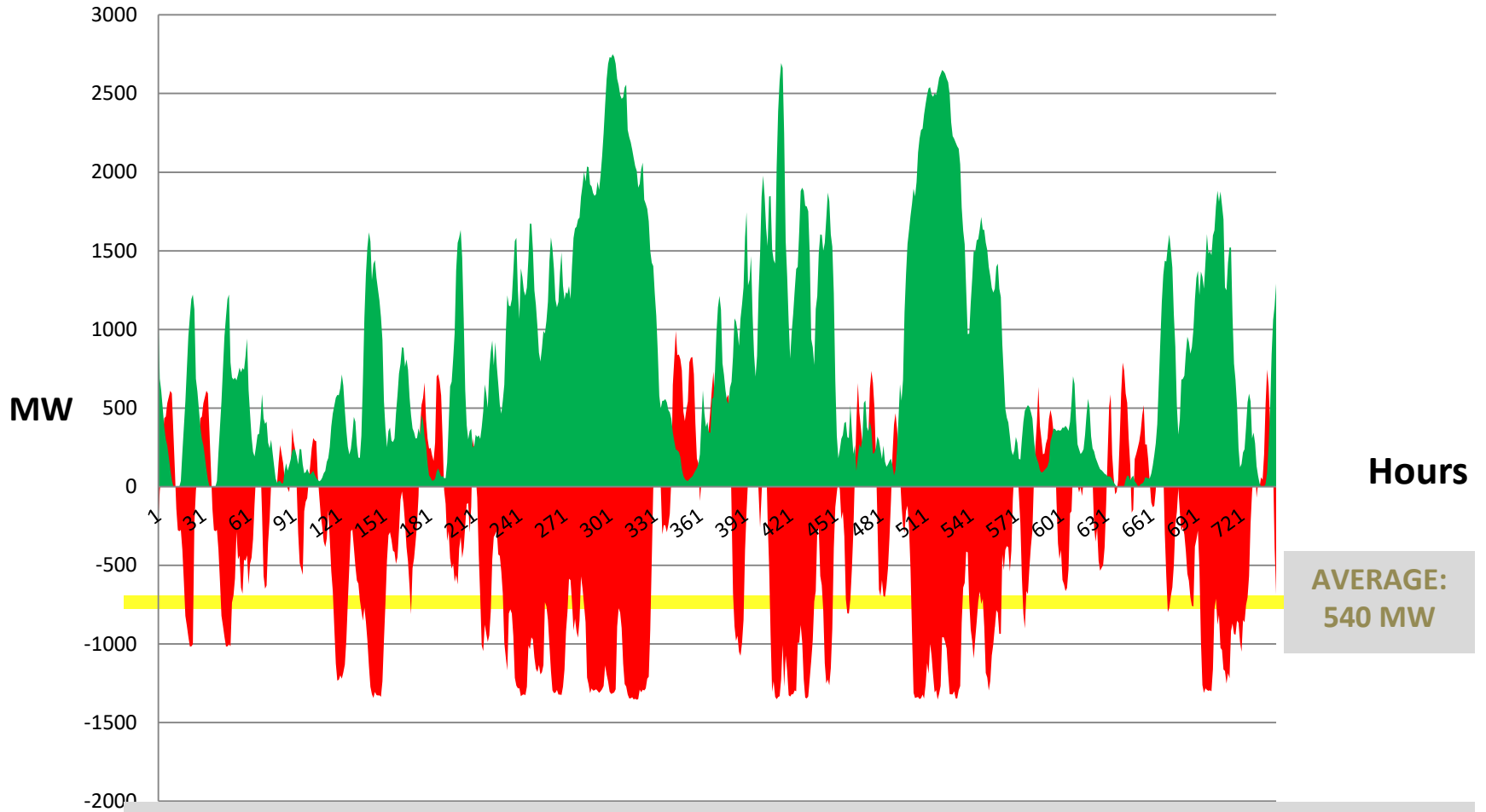


SEN January -2018

Source: TRANSELECTRICA

■ Sold = CONSUM - PRODUCTIE

■ Productie Eoliana



**AVERAGE:
540 MW**

As reference, Value of Green Certificates paid by Romanian electricity consumers : ~20 mill.EUR

2. What is CHP “Battery” ?

(Energy- Serv patent request approved by EU Patent Office)

- A method for Storage wind energy in the form of high temperature Thermal Energy (TES) to:
 - cover *heat* demands in the most efficient known way: **CHP**
 - *control totally* the wind energy throughput
 - allow the wind energy to enter the heat market as a “new fuel”
- A method *to decarbonize* the heat market
- Allows planning of Wind Farms not only from the “*electricity only*” perspective

3. Technology and Method description

- Concept
- Thermal Energy Storage
- ORC-CHP Turbogenerator

STRATEGIC PARTNERS FOR “CHP BATTERY”

- Concept & EPC: ENERGY-SERV (Romania)
- www.energy-serv.ro, (*patent pending*)

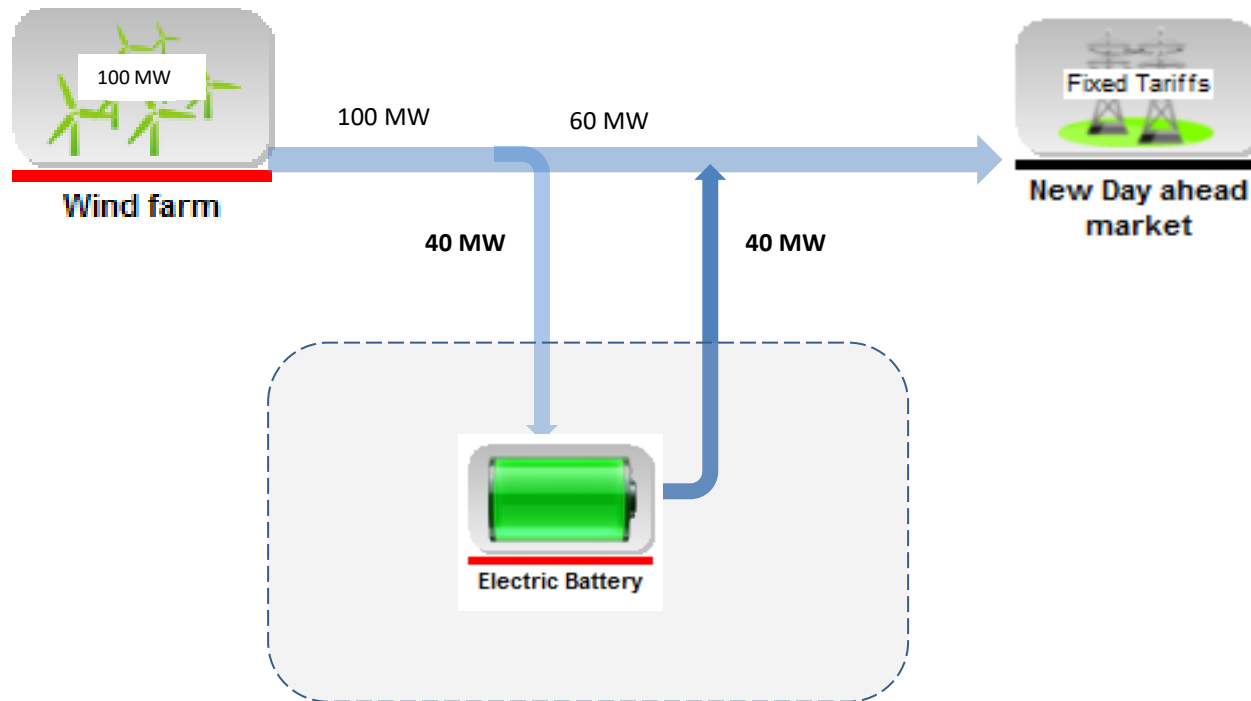
- Thermal Energy Storage: ENERGYNEST (Norway)
- www.energy-nest.com

- ORC Turbogenerator: TURBODEN (Italy)
- www.turboden.eu

CONCEPT OF CHP-BATTERY

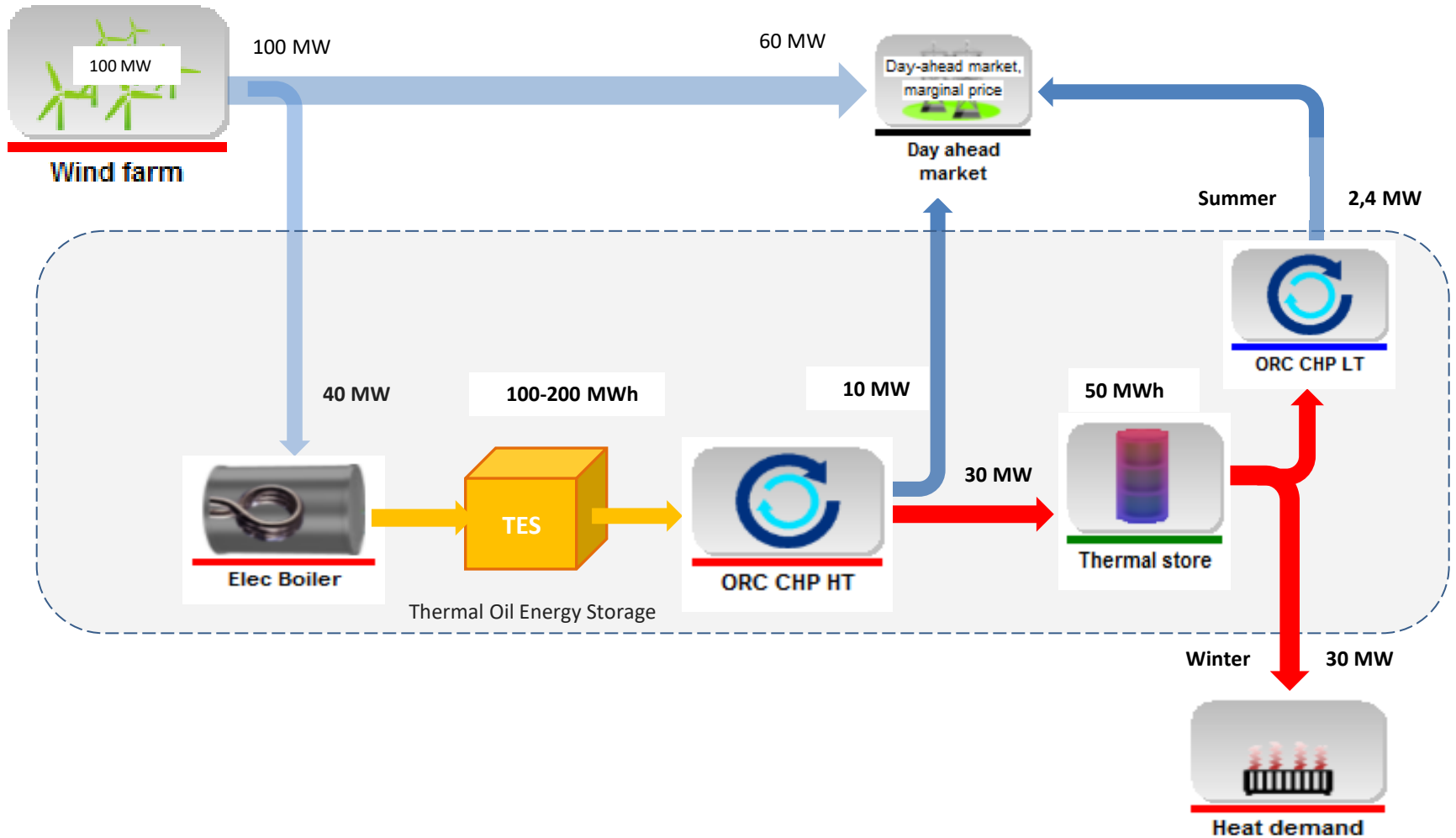
UNTIL NOW, STANDARD CONCEPT OF “ELECTRIC BATTERY”

(electricity only storage and generation)
Ex. TESLA – Elon Musk



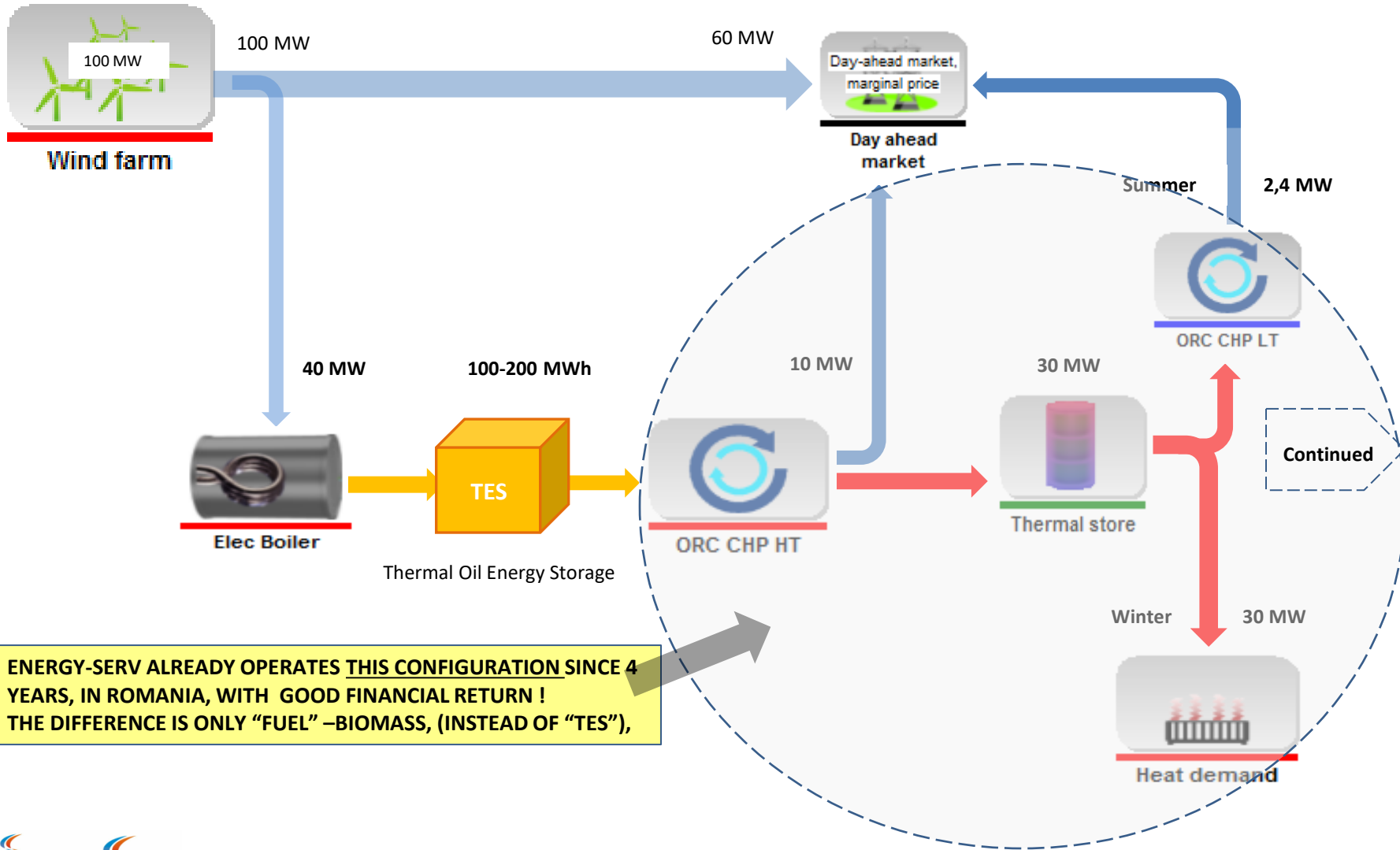
CONCEPT OF “CHP BATTERY” (Note: figures are for example only purposes)

Operating Strategy Winter/Summer
(Patent Application from Energy-Serv)



CONCEPT OF "CHP BATTERY"

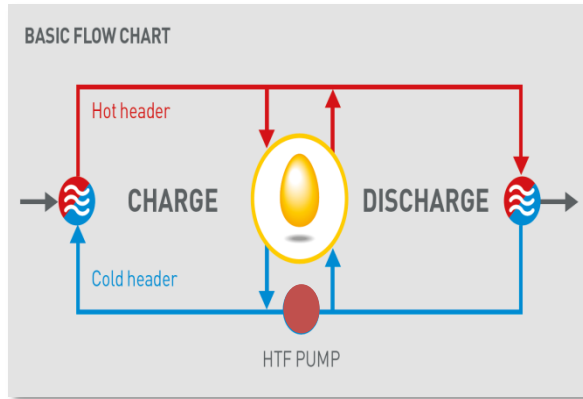
Operating Strategy Winter/Summer
(Patent Application from Energy-Serv)



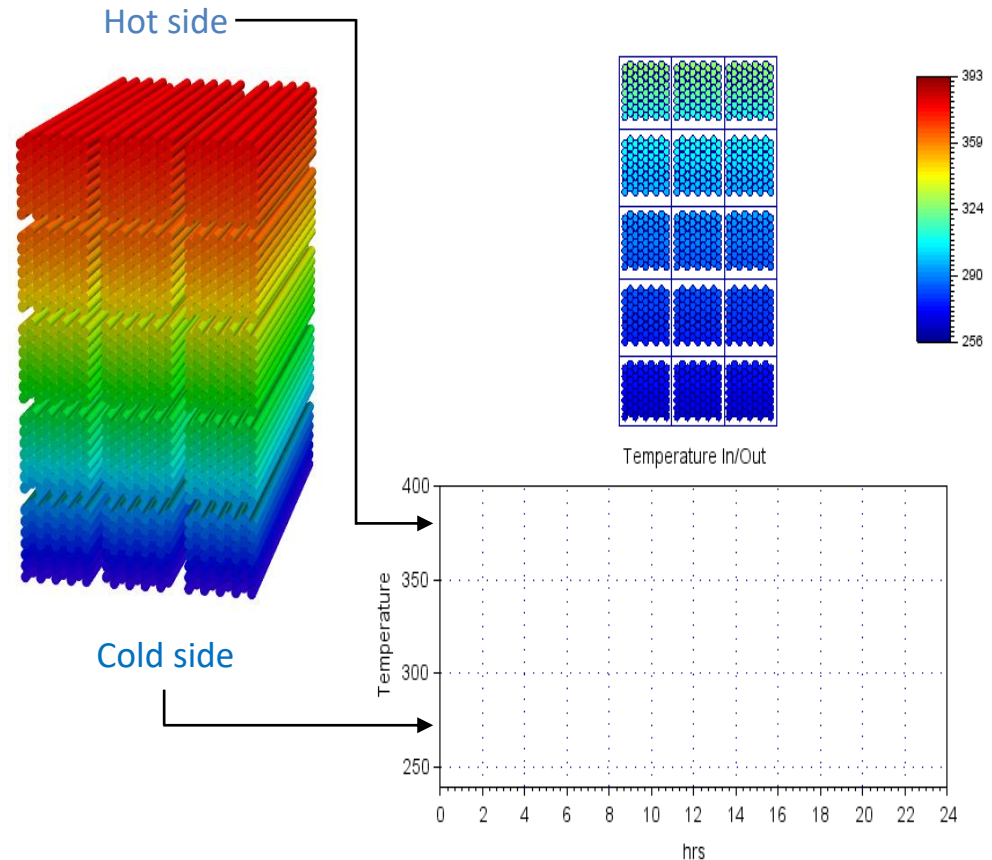
THERMAL ENERGY STORAGE

How charging and discharging works

(1 Module 40' Container 2x2x12 m, ~2-2,4 MWh Storage Capacity)

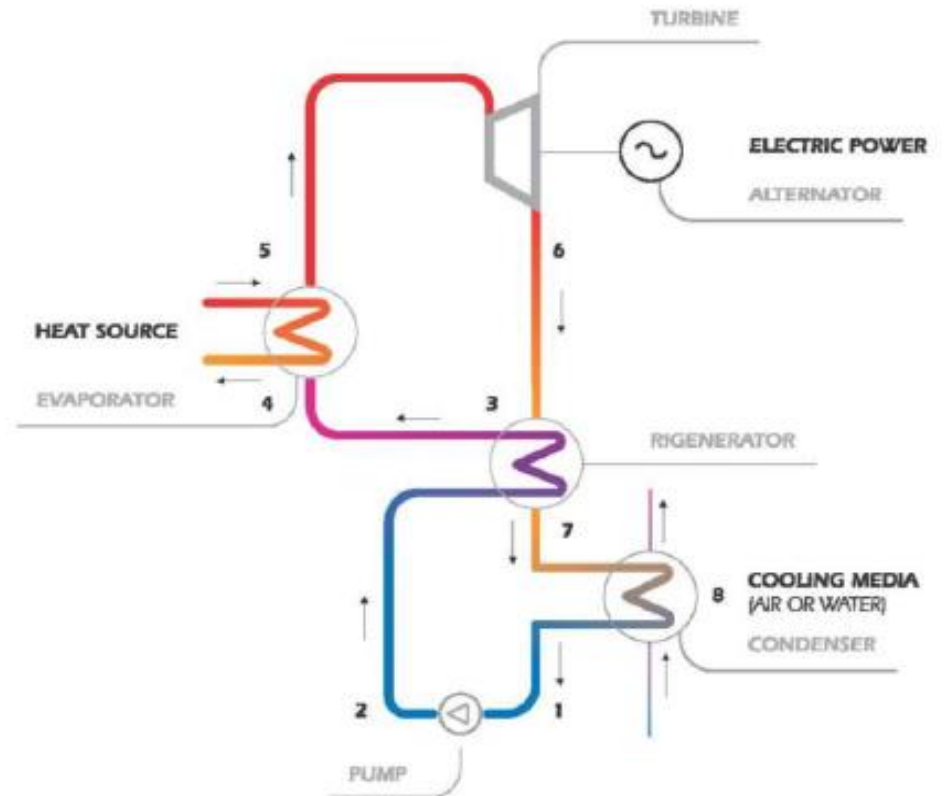
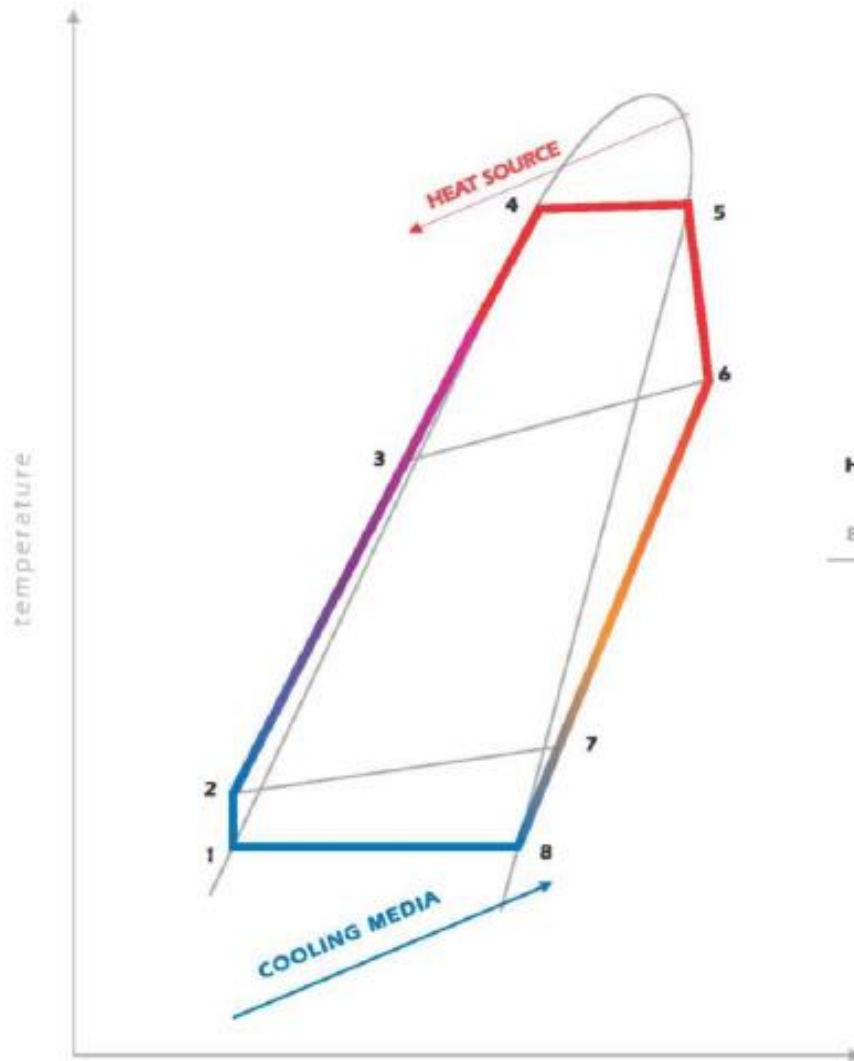


- During charge, hot HTF comes in at the top of the TES and gradually heats up the block by flowing in and out of each HEATCRETE® element, as illustrated.
- During discharge, the flow of HTF is reversed. The HTF exits the TES from its hot side at the exact same temperature as the nominal charging temperature.



ORC-CHP TURBOGENERATOR

HOW IS ORC WORKING ?



TURBODEN CHP TURBOGENERATOR

Range size: up to 20 MWe per single shaft

Applications: biomass, geothermal, waste heat recovery, oil&gas, waste to energy, concentrated solar power, steam&power



Technical Features of Equipment

Why CHP-BATTERY is technically feasible and economic ?

○ Key elements of the “CHP Battery”:

- All the equipment use “thermal-oil” as **the same** main energy agent (it is a well known and used energy media, possible to operate at ~450 C);
- All the equipment are tested and commercially available since many years;

○ The Electric Boiler:

- The Electric Boiler, which will heat-up the thermal oil has a very quick response capability to power load variations ;

○ HeatCrete (TES - Thermal Energy Storage):

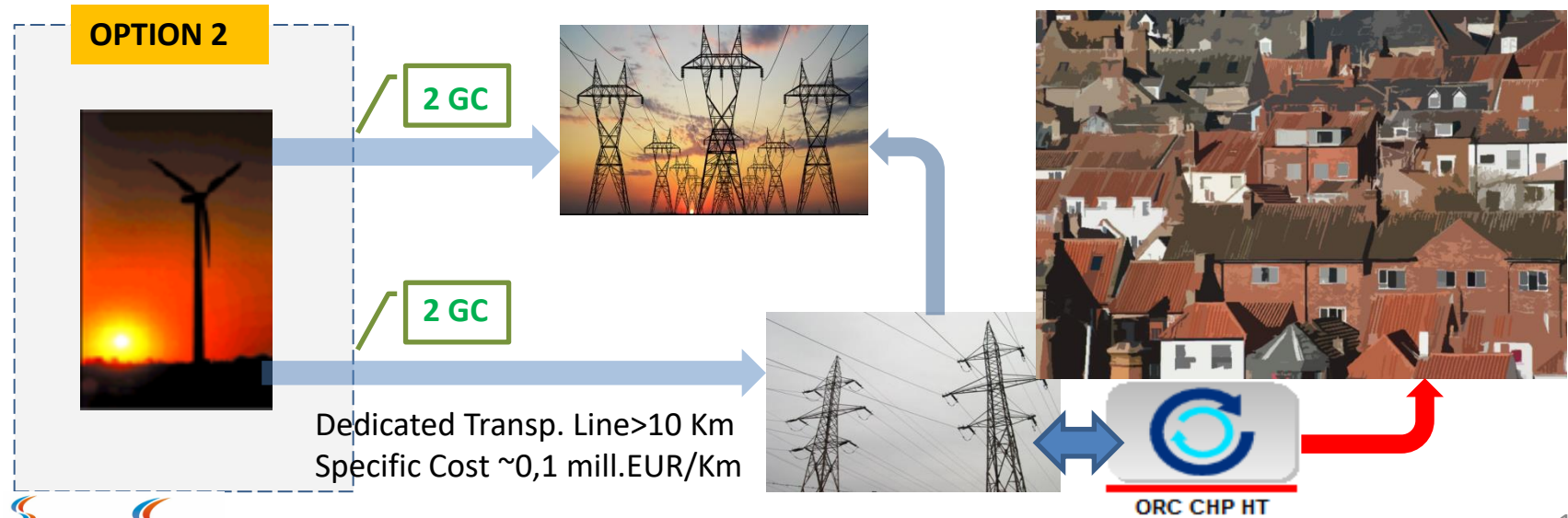
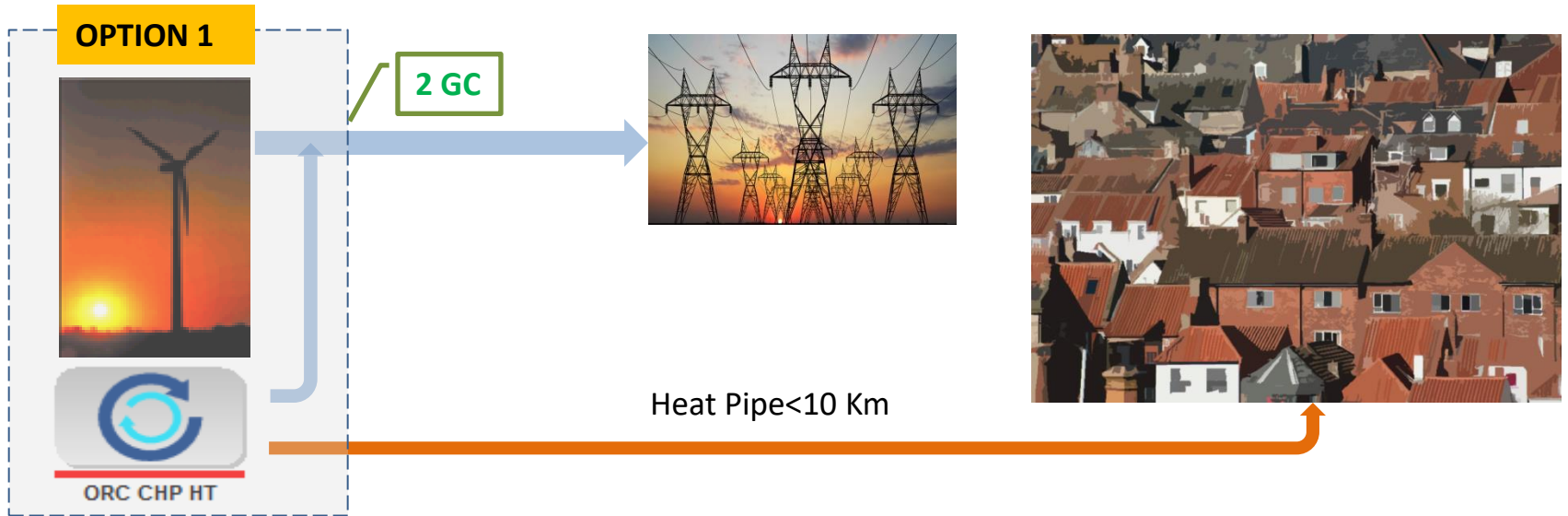
- It can store heat energy, from thermal-oil, up to 420 C;
- It is already patented, tested, certified and commercially available

○ CHP ORC:

- Thermal-Oil was and it is always one of the main best “heat sources” for ORC technology;
- The ORC turbo-generators have a very quick capability response to load variations and can be manufactured in ranges up to 20 MW/unit, or more;
- They can be used also, (due to their intrinsic capabilities) for providing “power system services”
- One of the best applications of the ORC is the CHP mode
- There are already operating thousands of MW capacities worldwide, Romania included

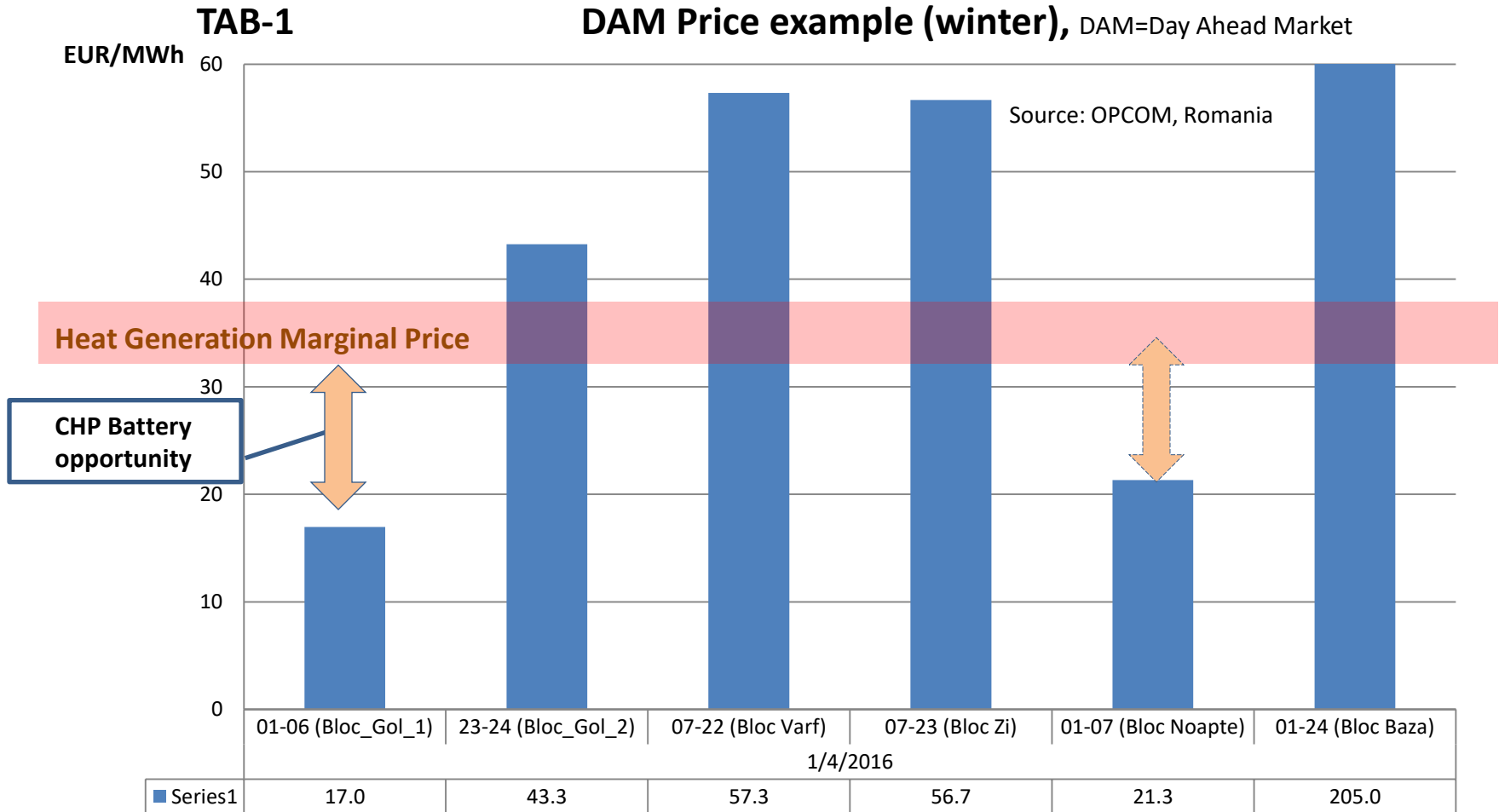
4. Economic and financial impact

Possible Configuration Arrangements (to meet the GC- Green Certificates- regulations)



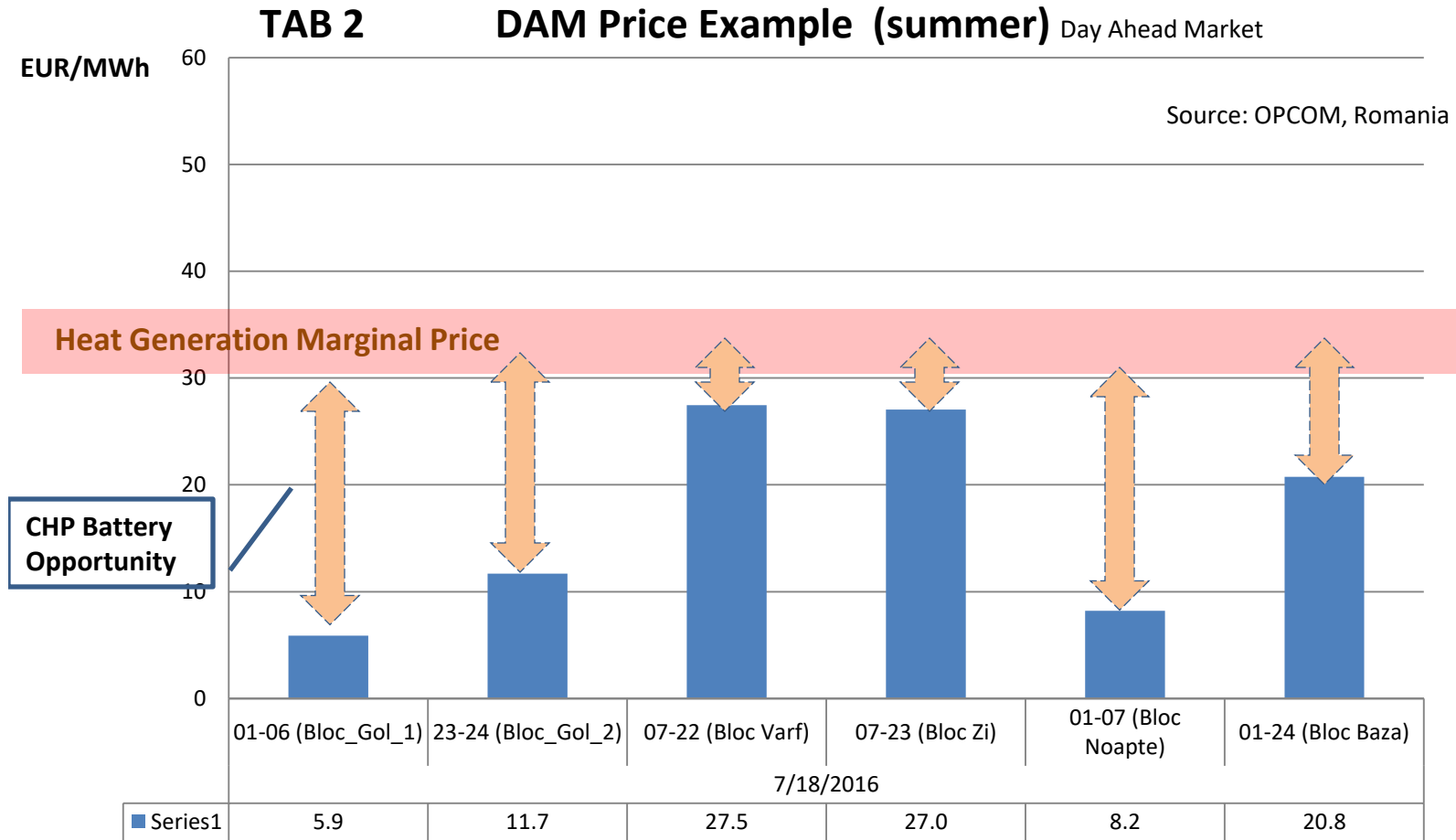
Electricity Market Prices vs. Fossil Fuel Heat Generation Prices (winter, Romania)

Wind farm should choose the “best strategy” for Heat market as well

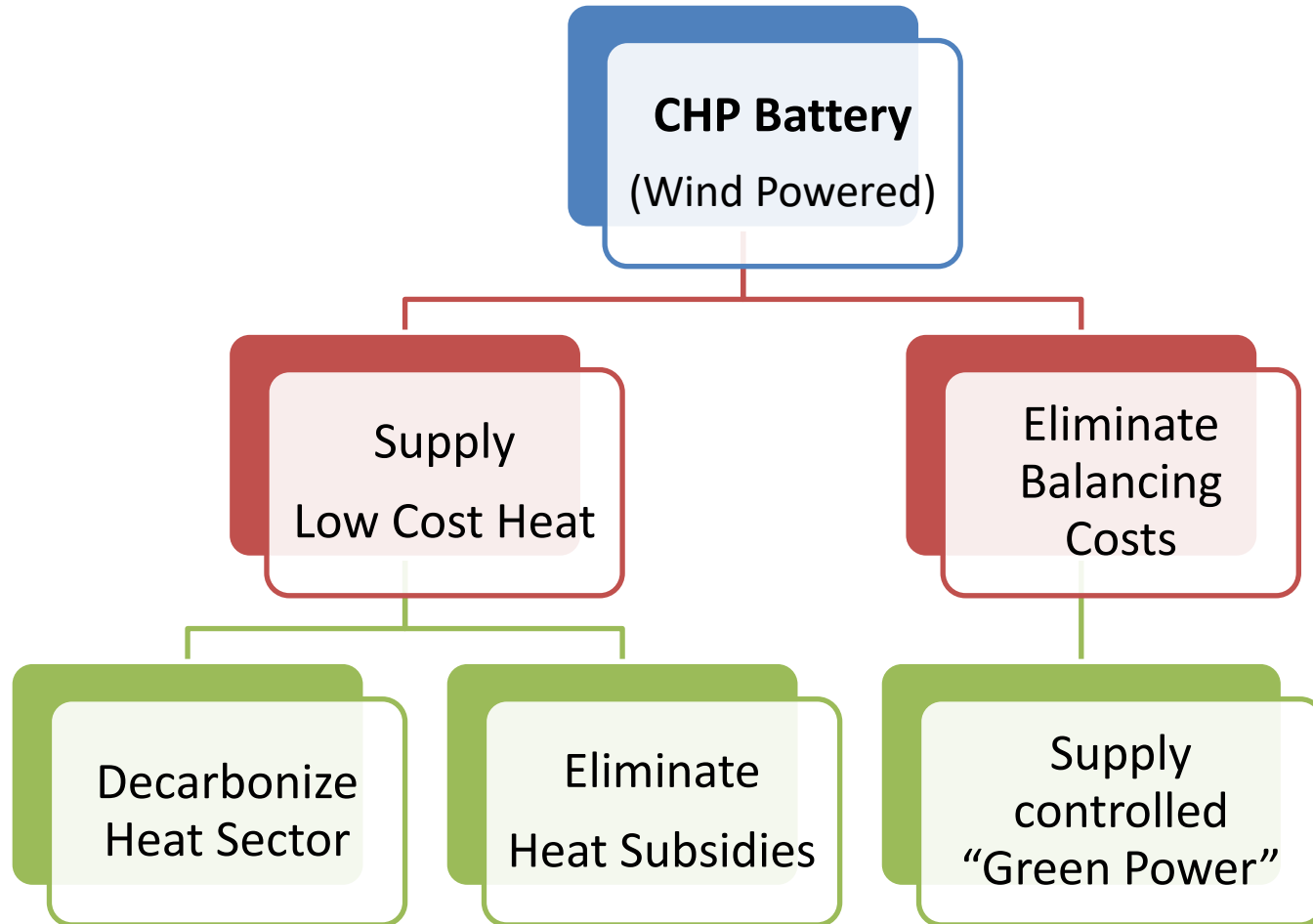


Electricity Market Prices vs. Fossil Fuel Heat Generation Prices (summer, Romania)

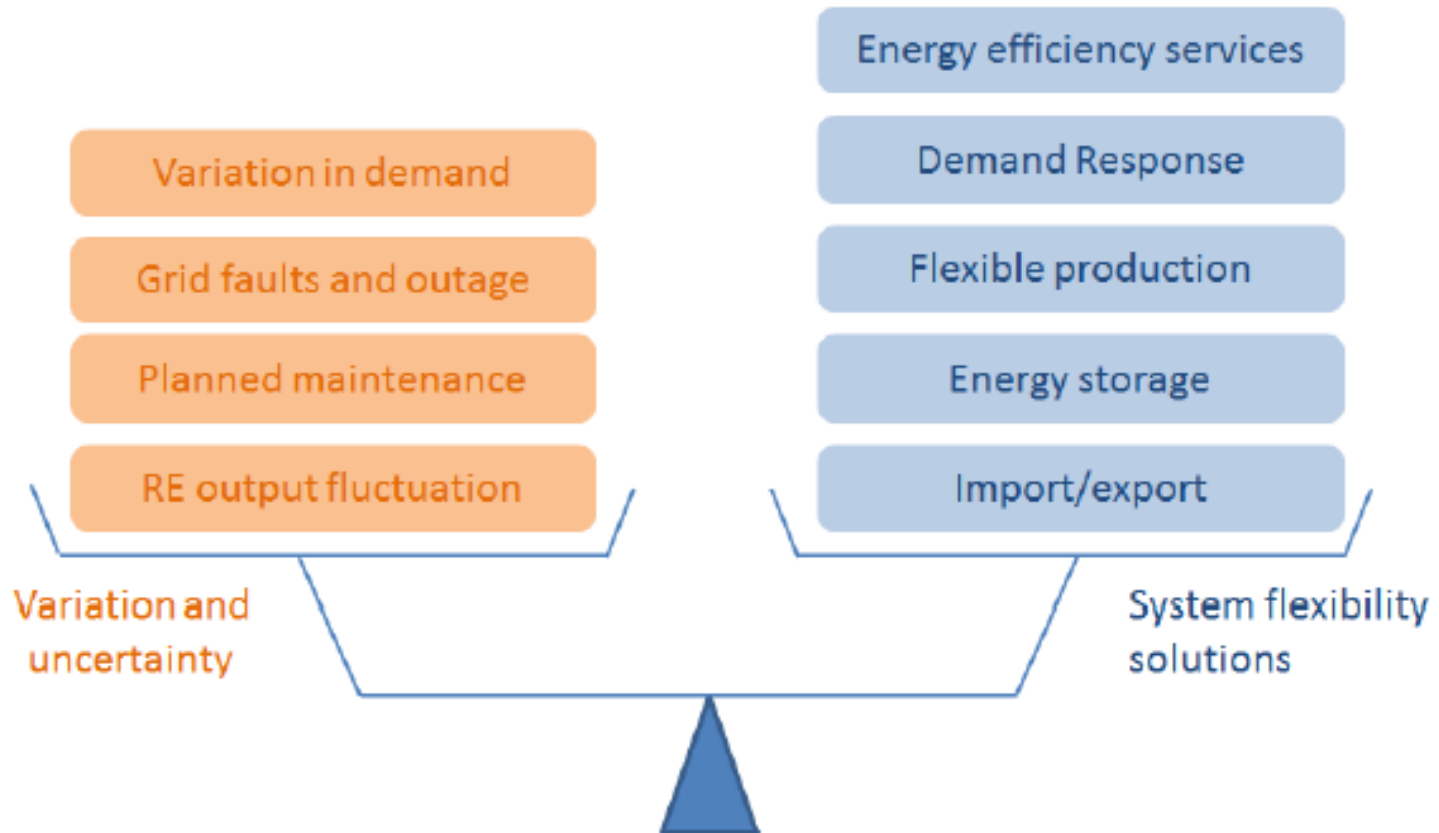
Disturbing Question: *Should the Wind Farm exit from the Electricity Market ?*



CHP BATTERY MACROECONOMIC IMPACT



Balancing, Flexibility & Efficiency of the Power *& Heat System*



5. CONCLUSIONS

(Tulcea case: **“first EU city heated by wind energy ?”**)

- District Heating of Constanta, Navodari, Mangalia, Braila, Galati, etc., provide the highest levels of “sink energy” for balancing purposes, due to high penetration level of wind energy in Dobrogea;
- **EXCESS WIND ENERGY SHOULD NOT BE TAXED IF “SUNK” IN DISTRICT HEATING**
- In the future, probably the wind farm planners may consider the **heat supply options and not only electricity**, for improving the operation efficiency and economics;
- **WE CAN HEAT ALL ROMANIAN CITIES WITH WIND ENERGY !**

HOW “STORAGE” SHOULD BE TREATED ?

(quotes from EU principles)

- Grid Fee: plays a major role in deployment of energy storage
(Grid Fee should be scrapped for energy storage- it's part of the Grid !)
- Storage= electricity is used twice (?!):
 - first: supply to storage
 - second: supply from storage to the consumers
 - **BUT: storage it is neither generator, nor consumer of energy !**
- EURELECTRIC Position: *“Withdrawing electricity from the grid with the aim of electrical, chemical, mechanical or thermal storage and re-feeding it with delay into T&D systems, **are not final consumers** and **should be exempted from the obligation to pay grid charges** for final consumers” !*
- **Everything depends on each country Regulator !**

Thank you!

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