



ZERO TERRAIN

STORAGE IS A MUST, NOT AN OPTION

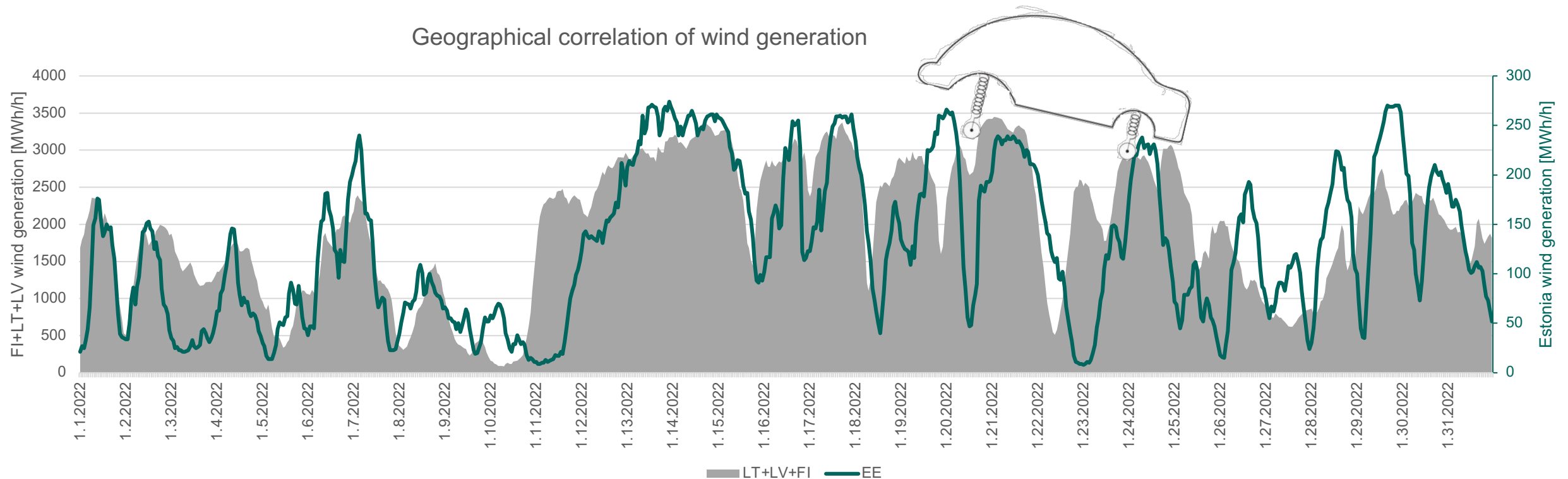
Mario Vee

Energiasalv | Zero Terrain

12.12.2023 | Nordic-Baltic Energy Conference 2023

WEATHER-DEPENDENT GENERATION REQUIRES FLEXIBILITY

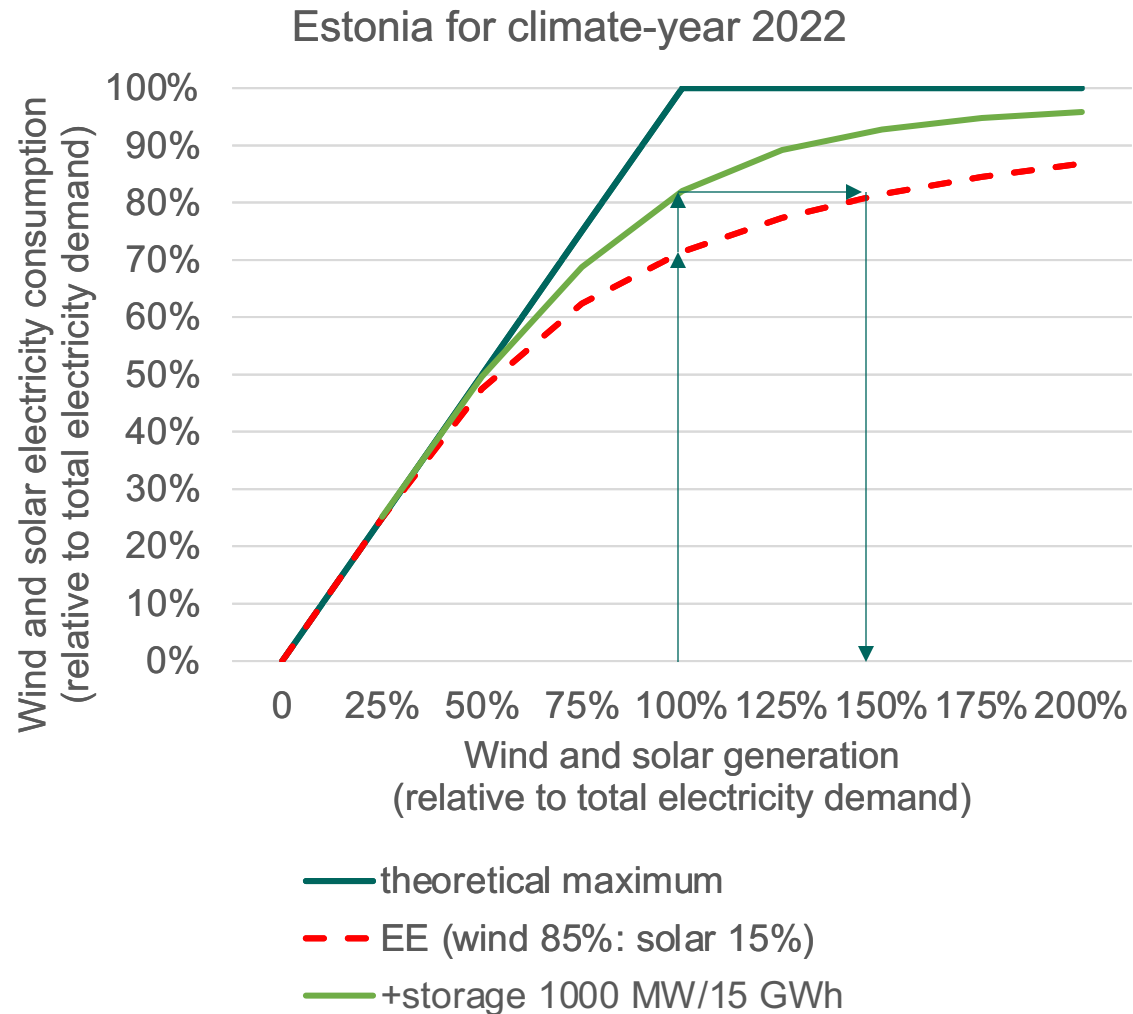
1. Geographical correlation makes it hard to export the problem or import the solution.



2. Wind can create “bumpy roads” that require special “suspension systems” (ramping)

- 62% → 3% → 82% /06.10.2023, Lithuania
11h 10h ← close to “full cycle” within 21 hours;

IS THE AMBITION TO BE 70% CLIMATE NEUTRAL?



30%

... of weather dependent generation “misses the target”

Storage vs +50%

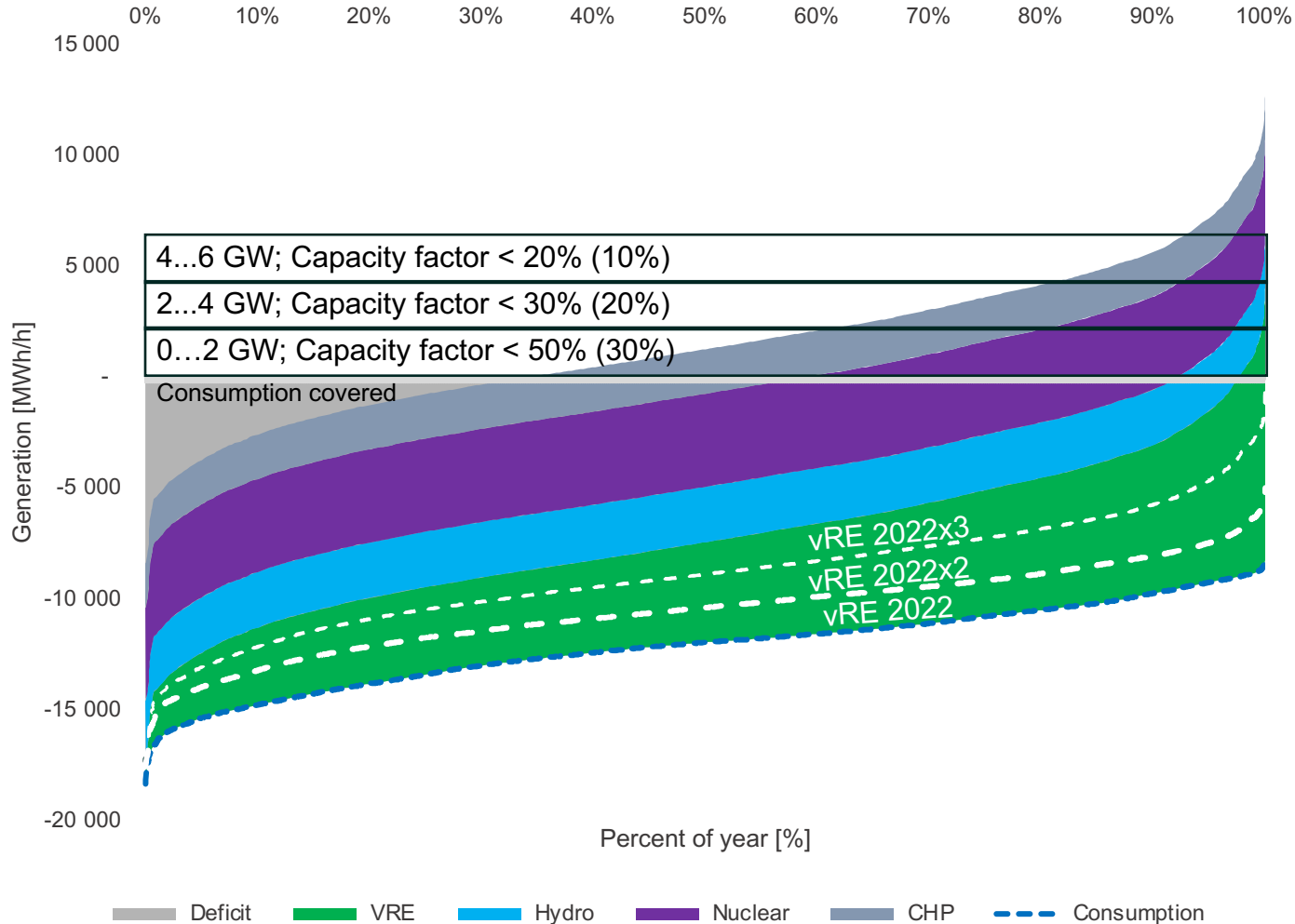
storage makes the same effect at

3x

... less CAPEX

IN GOD WE TRUST ALL OTHERS MUST BRING DATA

Finland+Baltics, VRE 3x2022; price-maker hours



Is there enough power for X?

- Expensive equipment needs utilisation
 - 6000h (ca 70%)
- Considering *additionality*;
- Is over-generated energy from vRE + nuclear enough;
 - CHP for P2X? (heat pumps)
 - Expected electricity price [€/MWh]?
 - What is a penetration of vRE required;
- P2X would benefit from storage as well!**

PHS “TICKS THE BOXES” BUT REQUIRES INTELLIGENCE

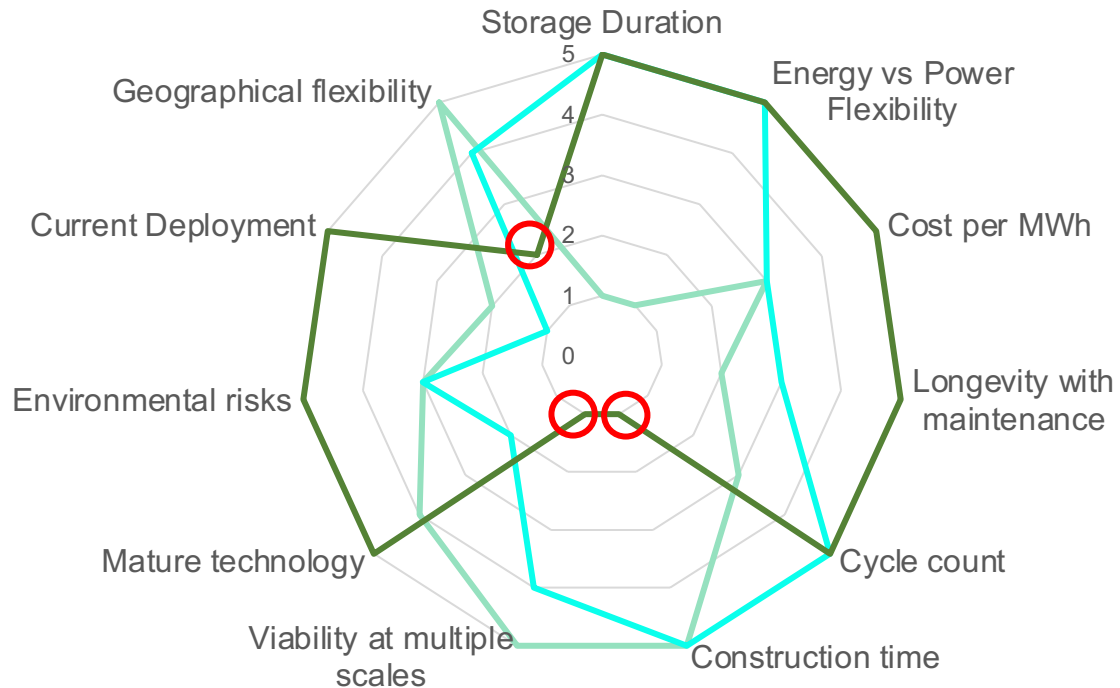
Oxford University Press, “Monetizing energy storage” based on 30 studies modelling storage requirements for European wind-dominated power systems.

- *>0,2% of annual consumption → Estonia >20 GWh*
- *50% of peak demand → Estonia ca 800 MWh*
- *20+ hours required*

Grid storage assessment

Source: M. Barnard "The future is electric"

— Li-Ion — Redox flow — PHS



PHS is the most affordable, robust, long-lasting, and proven technology

But it requires long-term system planning:

- Construction time (5...7 years)
- Suitable only at grid scale (≥ 500 MW)

Climate ambition and goals define the need.

We still have time (goals for 2030)

If only there were suitable locations...

THE WHOLE REGION CAN BENEFIT FROM ZERO TERRAIN

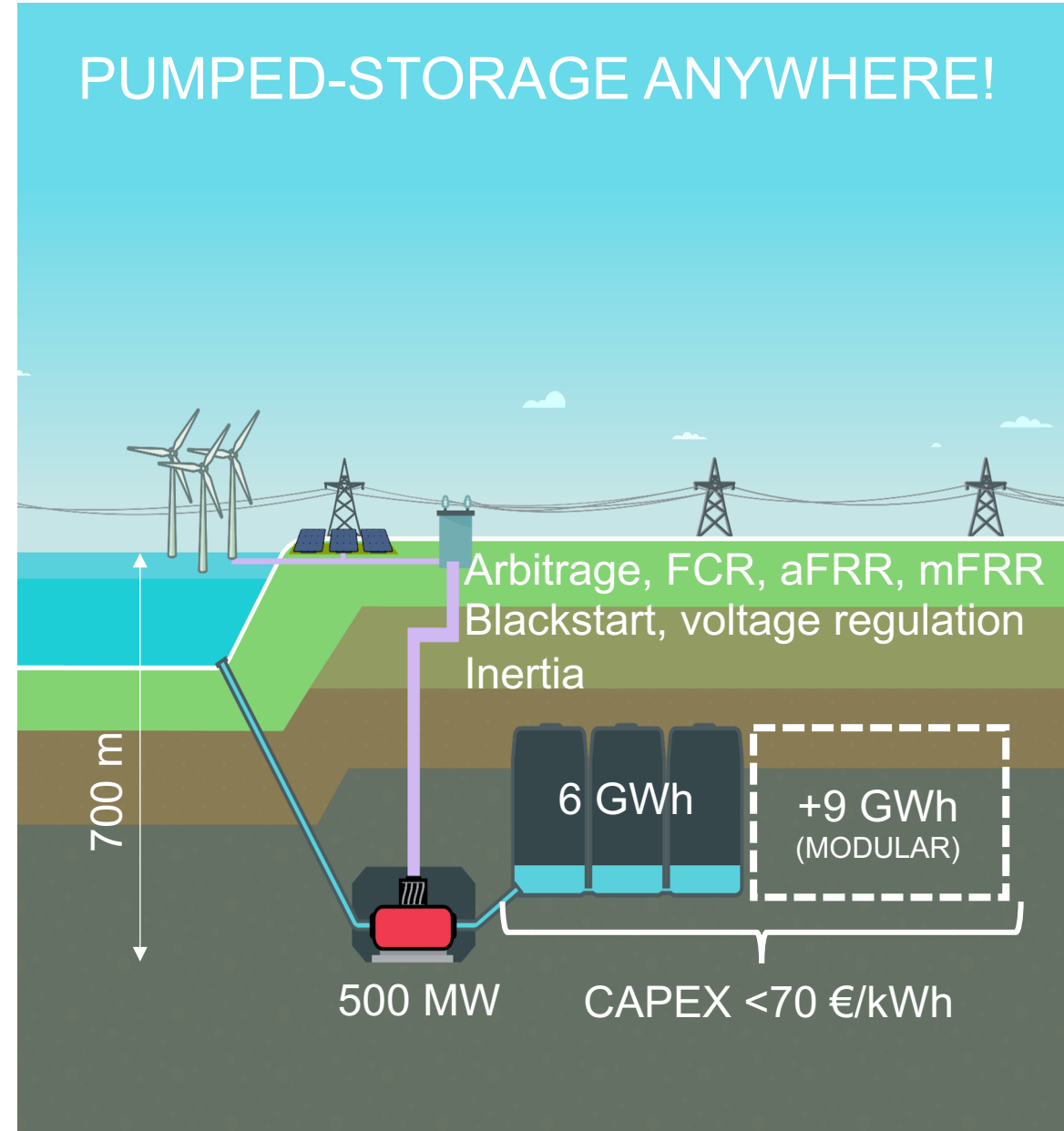
ZERO TERRAIN_Paldiski (Energiasalv)

- Demo project for Zero Terrain concept
- Ready to build (permitted)
 - FID 2024 → COD 2029_(3GWh)...2031_(6GWh)

EU PCI since 2013

PCI 6th Only Nordic-Baltic PCI storage project

- Reduces the need for dispatchable power
- Improves renewable balance
- Reduces DA electricity prices >100 M€ per annum



HOW TO GET FROM POWERPOINTS TO POWERPLANTS?

What would happen to a company that invented a “machine” that could generate all the electricity in the world at zero marginal cost?

- Energy-only market (EU REMIT): bankruptcy?
- Energy-only market is not designed for new investments

Financers are not too attracted to this outlook. They tend to ask for revenue certainty.

UK:

- is about to launch a mechanism to provide revenue visibility to attract finance

EU:

- is giving recommendations and putting hopes on member states
- member states are still hoping for each other; responsibility is vague
- The best candidate for *joint project obligation*: Zero Terrain Paldiski

We should not lose momentum in implementing the best technology available!

- Instead of exporting excess electricity, let's attract investments by showing cooperation capabilities resulting in a balanced energy trilemma!

T. Kangro “Thinking man”



