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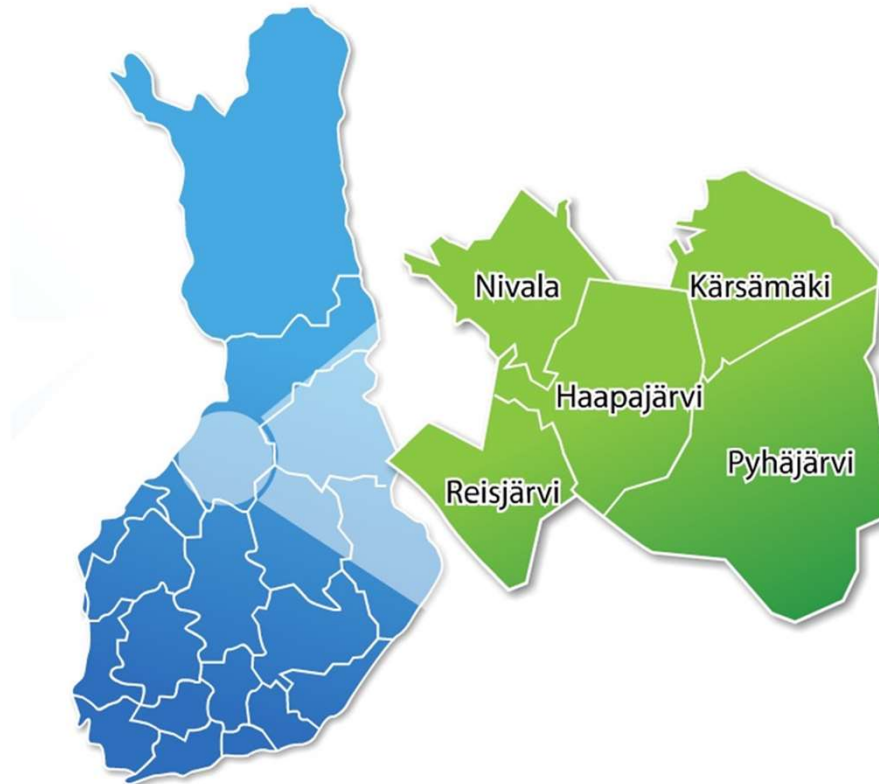
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**5.4.2018 Pyhäjärvi Energy Storage in Mine Event**

**Toni Krankkala – CEO, NIHAK**

- NIHAK is a development organization which offers **business services** for the local companies and **regional development services**.
- NIHAK is owned by 5 municipalities



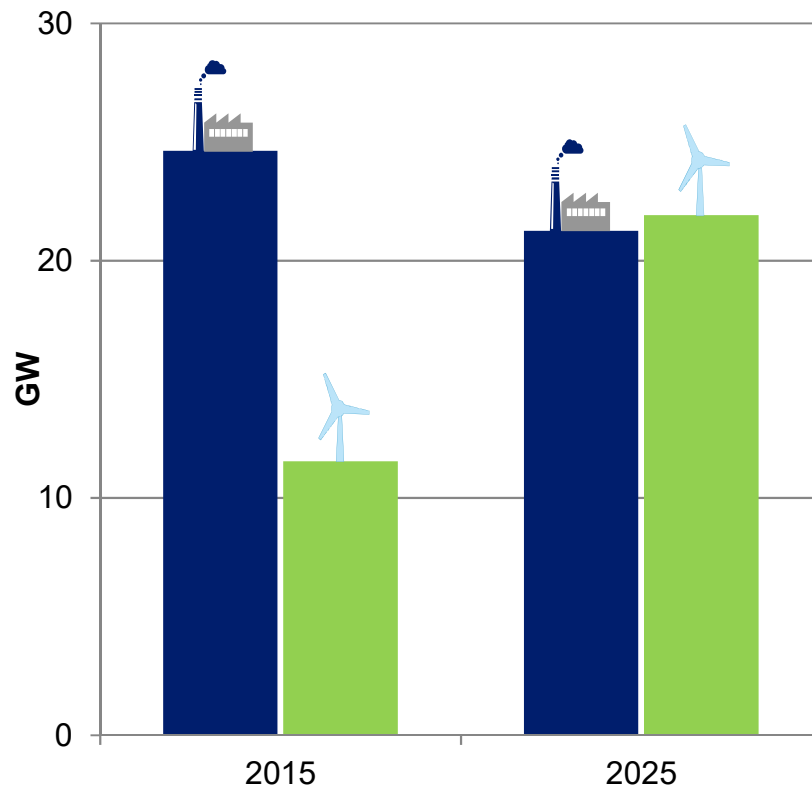
# Change in the global energy market

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- Increasing use of renewable energy

# Expected development in Nordic countries



Lähde: Pöyry

- The share of balancing power in the energy market will decrease all the time

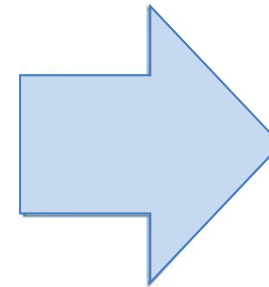
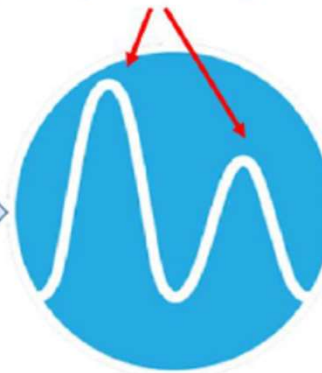


# Change in the global energy market



variable  
output of wind  
& solar energy

*stronger variations in electricity production / prices  
→ need for balancing*

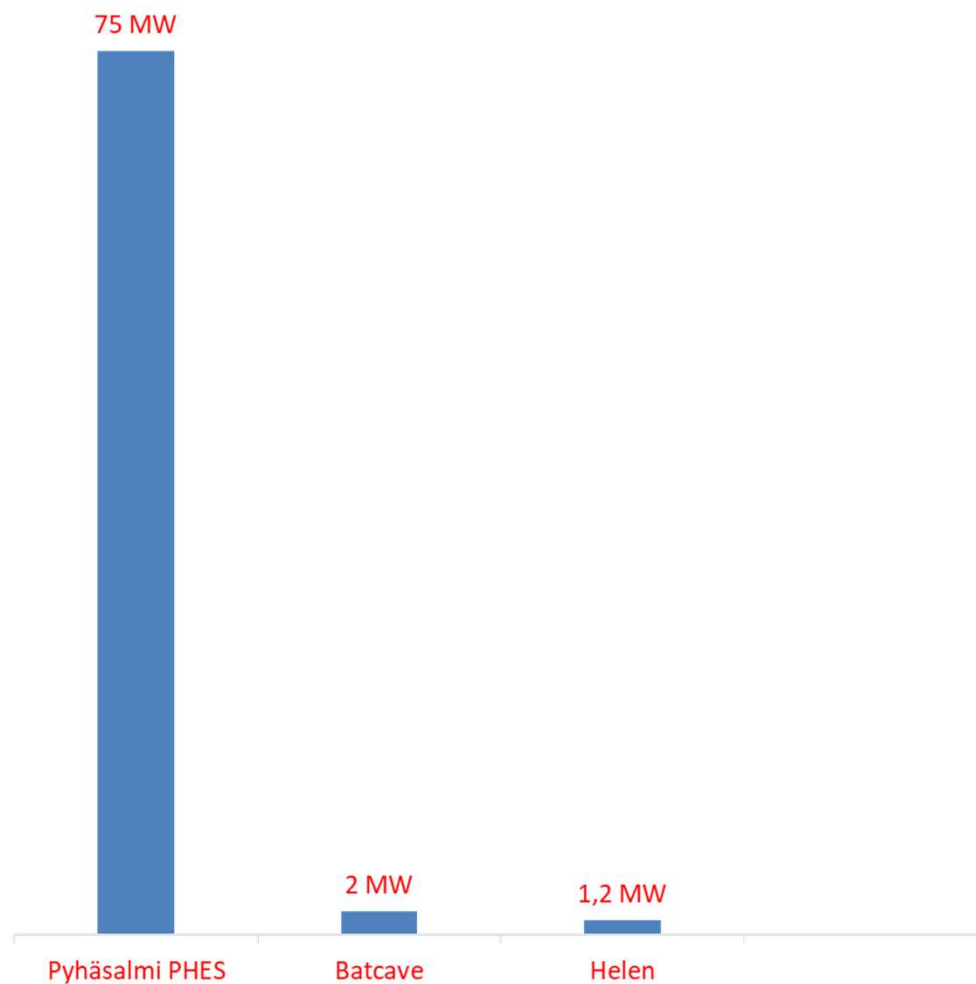


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# First large scale energy storage project in Finland?

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**75 MW (+75 MW)**

**530 MWh**

**7h**



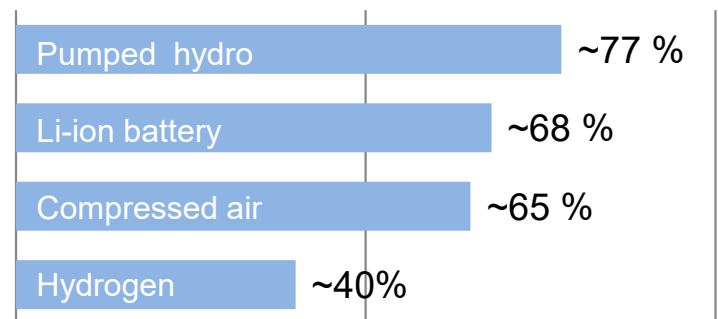
# Key advantages of Pumped Hydro Energy Storage in Mine



## Long lifetime

<b>Pumped hydro</b>	vs.	<b>Batteries</b>
over <b>50 years</b>		<b>11 – 15 years</b>

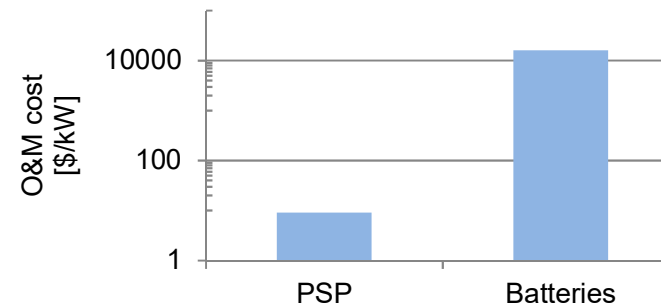
## High efficiency



## Bigger capacity

<b>Pyhäsalmi PHEs</b>	vs.	<b>Helen Suvilahti battery</b>
<b>7 h</b>		<b>0.5 h</b>

## Smaller operating costs



# Key advantages of Pumped Hydro Energy Storage in Mine

## Change in the energy markets



- Flexible capacity needed

## Existing infrastructure



- Existing mine infrastructure with no impact to environment
  - 1 445 m high hydraulic head
  - close to grid
  - existing water reservoir
  - well known rock (geological conditions)

## Reliable technology



- Solution is widely used and based on reliable and robust technology with lifetime of over 50 years
- Closed water circulation, existing mine infrastructure with no impact to environment

## Local support



- Local economy needs to have "locomotive" project for re-use of mine

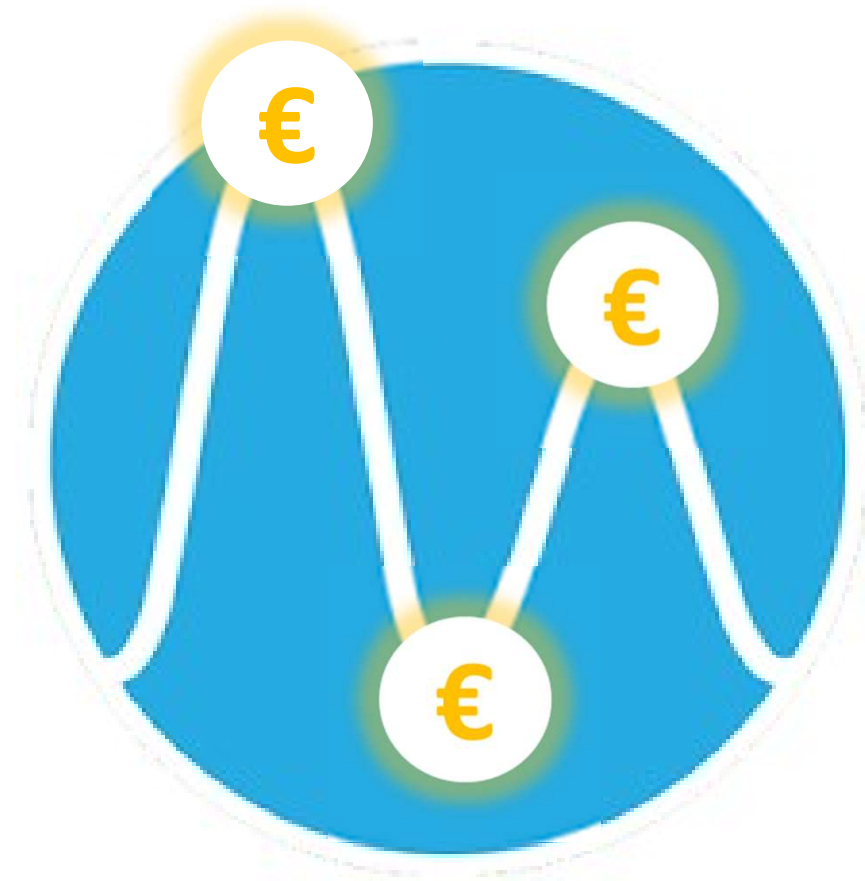


# Investment

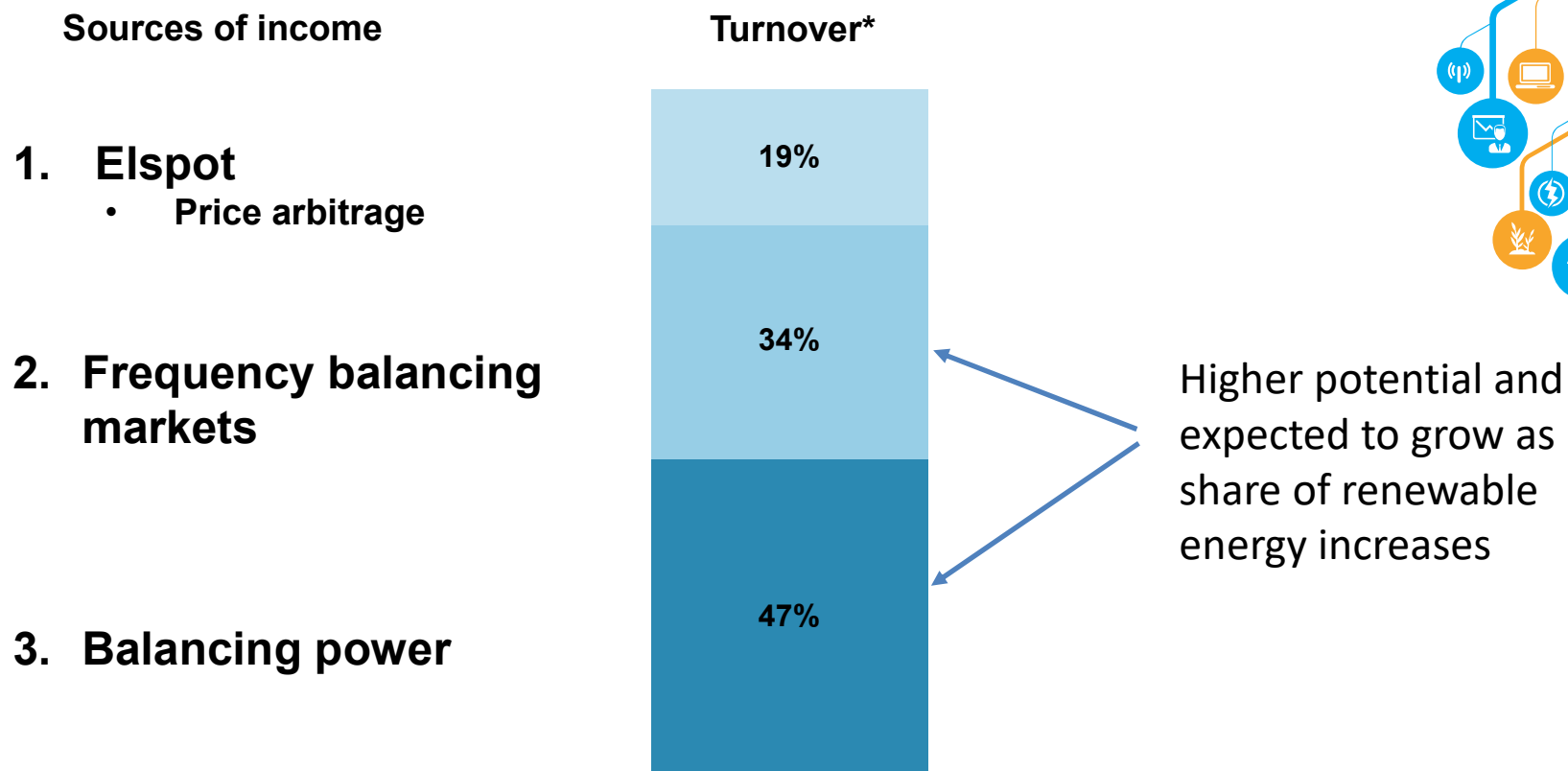
- Total investment 103 M€
- 530 MWh  $\rightarrow$  194 €/kWh  
(vs. Li-Ion battery storages 1 600 - 3 333 €/kwh).



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# Energy storage revenues



\* Arvio perustuu Pöyryn analyysiin, säätösähkön suhteellinen osuus kasvaa laitoksen toiminnan aikana. Esimerkki vuodelta 2025..

## Combination with other renewable energy projects

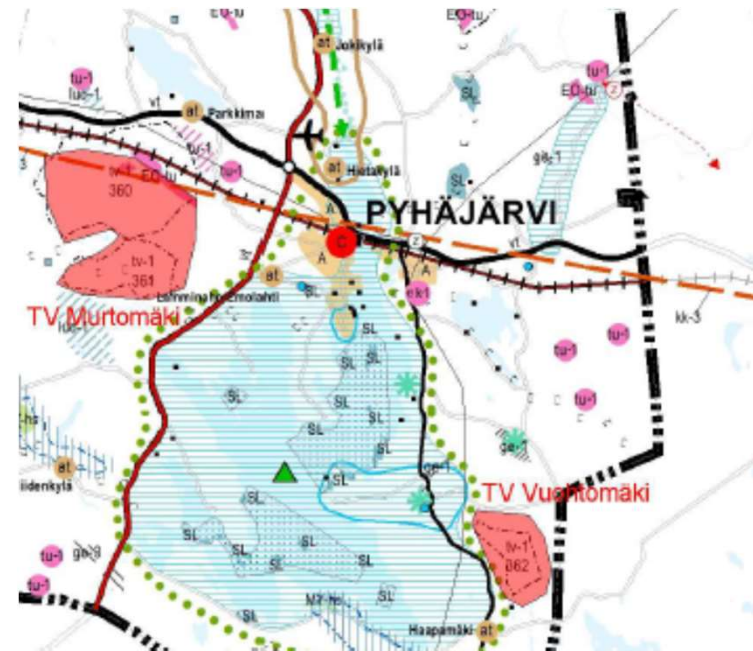
- Energy storage could be combined with local renewable energy projects  
➔ synergy would increase the profitability



## Wind parks near by

1. Murtomäki tuulipuisto
2. Vuohtomäki tuulipuisto
3. Välikankaan tuulipuisto
4. Ristiniitty tuulipuisto
5. Sauviinmäki tuulipuisto

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# Kiitos!

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