

Batteries: solution for electricity storage and e-mobility

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The role of batteries in reaching Hungary's decarbonisation goals

Dr. Péter Kaderják

Head of Zero Carbon Hub at the Budapest University of Technology and Economics
Managing Director, Hungarian Battery Association (HUBA)



Green Economic Development Agenda of Hungary



Electrification and electricity sector decarbonisation

Greening the transport sector

Developing the market for energy efficiency

Promoting renewable heat solutions (e.g. geothermal)

Developing the hydrogen economy

Developing the battery value chain

Carbon Capture, Use and Storage (CCS/CSU)

Digitalization and AI to promote decarbonisation

Greening the financial market (e.g. green bonds)

Agriculture and LULUCF reform

Circular economy

Promoting green jobs, R+D+I and local supply chain



Decarbonisation of the electricity sector: No1 flagship project



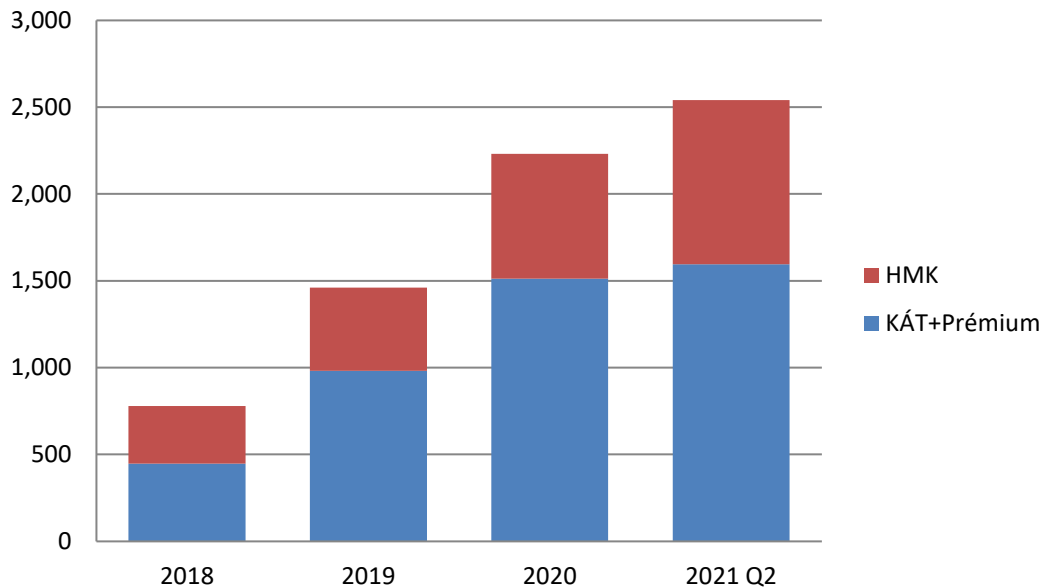
- ✓ **Decarbonising the power sector**
90% in 2030 vs 60% in 2020
- ✓ **Nuclear capacity renewal**
- ✓ **Lignite phase out**
- ✓ **Solar-heavy RES-E portfolio build-up**
6.6 GW by 2030; 12 GW by 2040
- ✓ **Gas based generation as primary backup**
- ✓ **Grid upgrade and re-regulation**
- ✓ **Flexibility market**
- ✓ **1 million smart meters**
- ✓ **Import ratio: 20% in 2040**



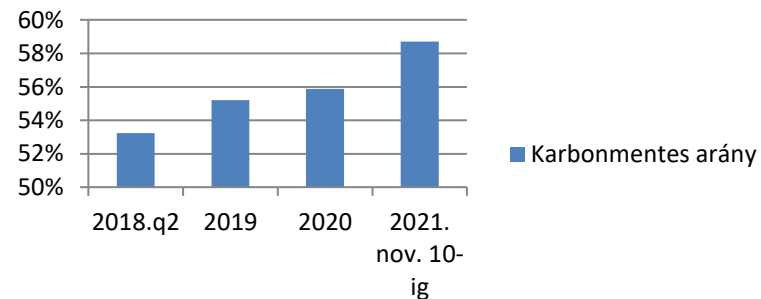
PV investment boom is happening in Hungary...



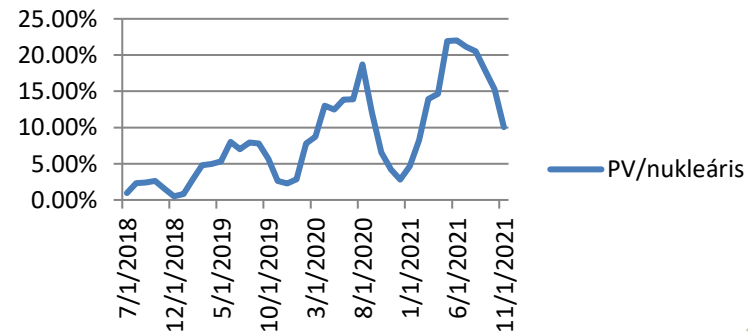
Installed PV capacity in Hungary, MW



Ratio of carbon free electricity generation (wo HSG)



PV/nuclear production (wo HSG)



116,298 Household size generation units, end of Q2 2021

...and the outlook is attractive as well

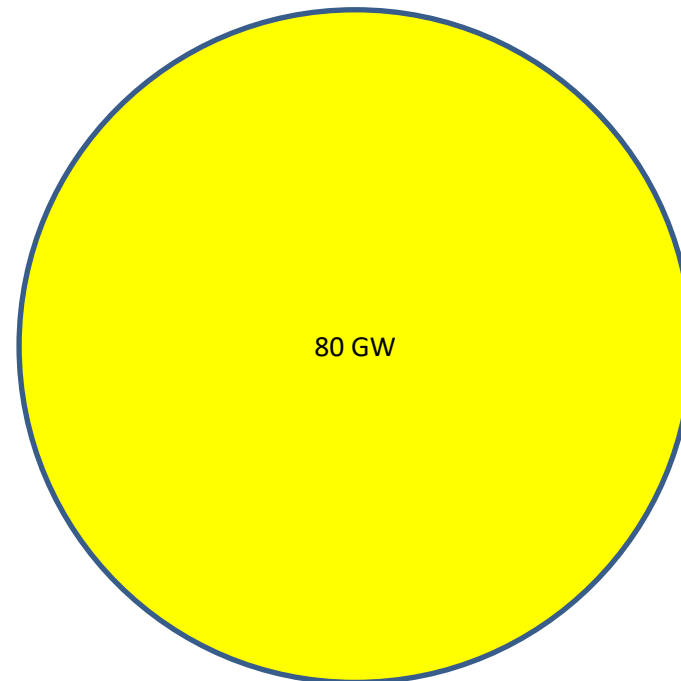
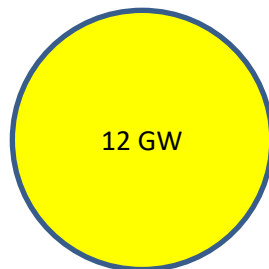


2022

2030

2040

2050

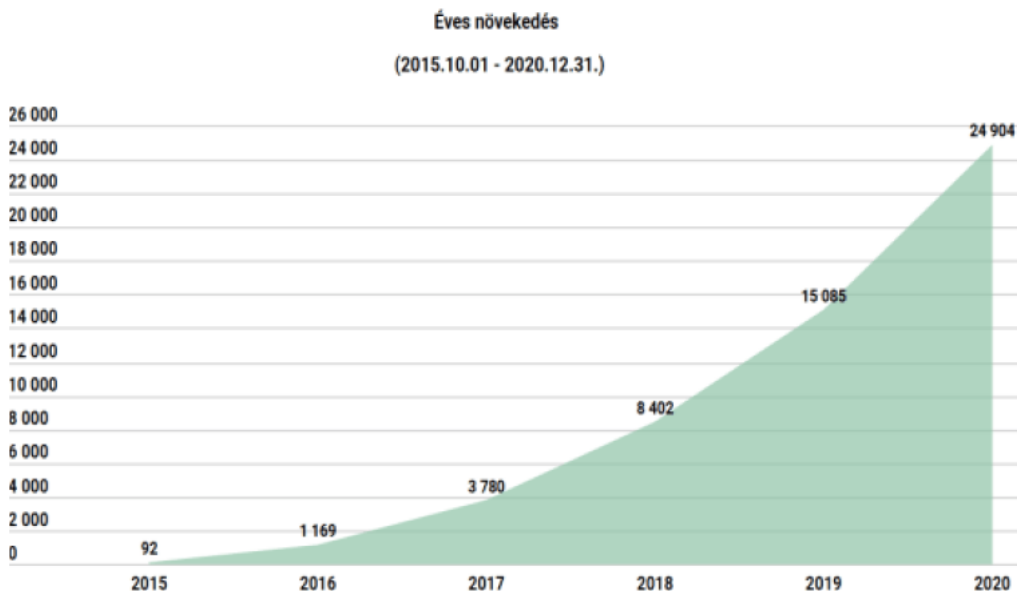


Seasonal storage?

E-mobility, solar based heating?

Hungarian innovation and value added?

E-mobility penetration trend is also promising



Source: Interior Ministry, MAGE, ACEA, JÁK

Y-on-y change in the car market, 2019-2020

Category	Car unit	Change
New BEV sales	3046	+66,2%
New PHEV sales	2996	+170,9%
New EV sales	6042	+105,6%
Used EV import	3777	0%
New passenger car sales	131 757	-19%
Used car import	126 721	-16%
Total passenger car fleet	3 812 013	3 920 799

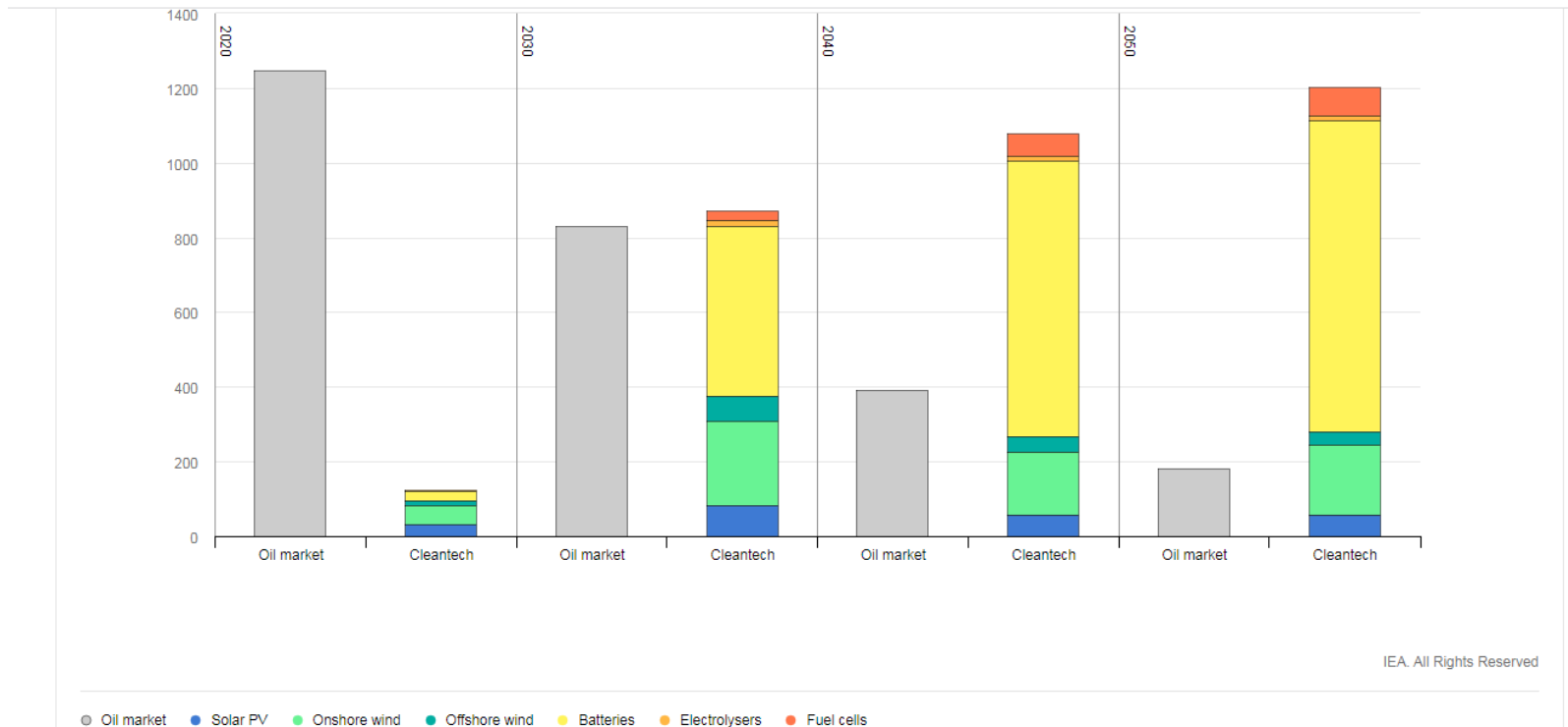
- 2020 market share of newly registered EVs: 4.6%
- 2020 Q4 market share: 6.6%
- EV fleet will surpass 30,000 by the end of 2021 Q2
- Expected EV fleet in 2025: 80,000 (based on the 2016 NPF)
- Expectes EV fleet in 2030: 200,000 (based on the 2016 NPF)

Source: Jedlik Ányos Cluster, 2021

Batteries: the new oil?



Estimated market sizes of oil and selected clean energy technology equipment in the Net Zero Scenario, 2020-2050 (USD billion, 2020)



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With a worldwide rank Nr. 12, Hungary has a good starting point

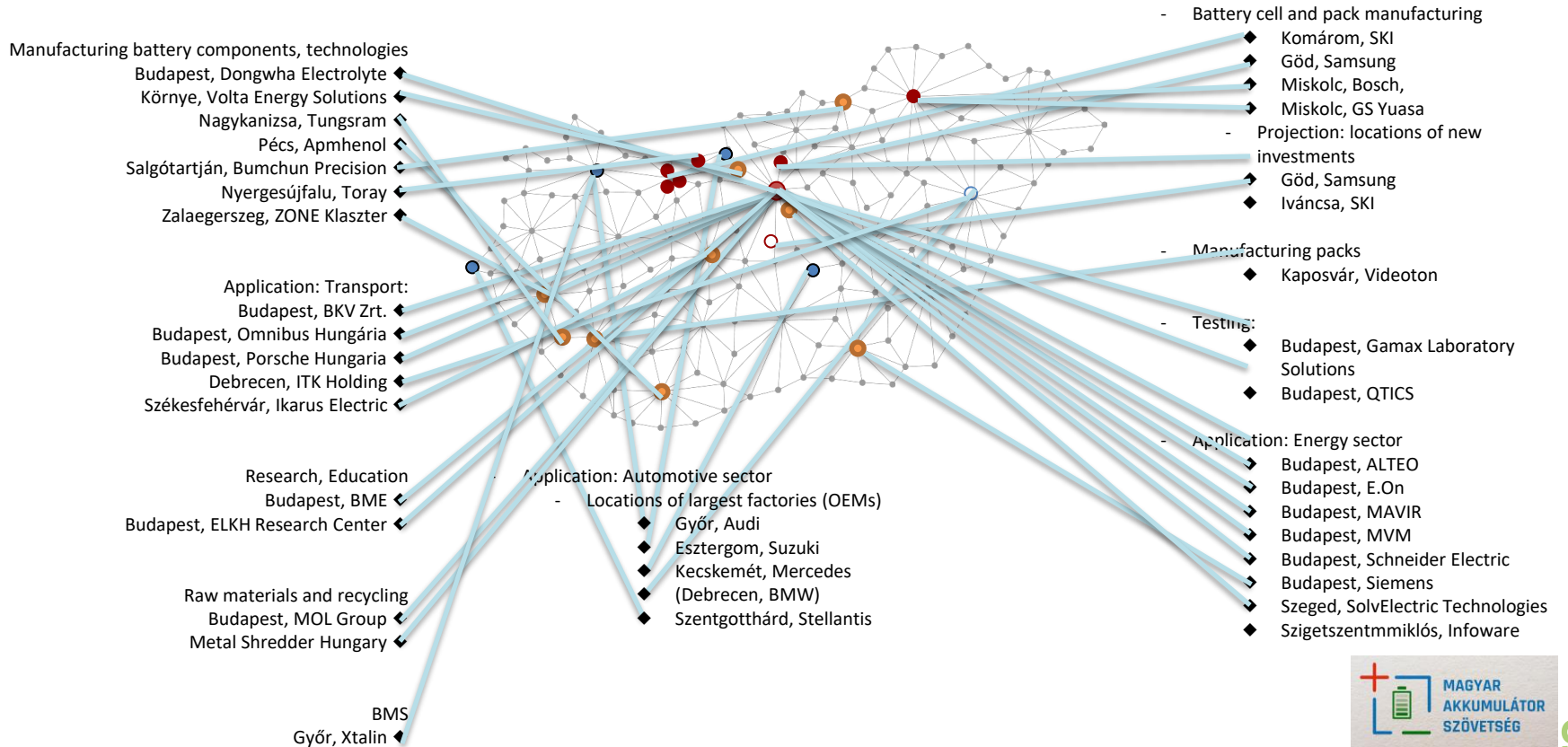


Lithium-ion battery supply chain rankings in 2020 and expected in 2025

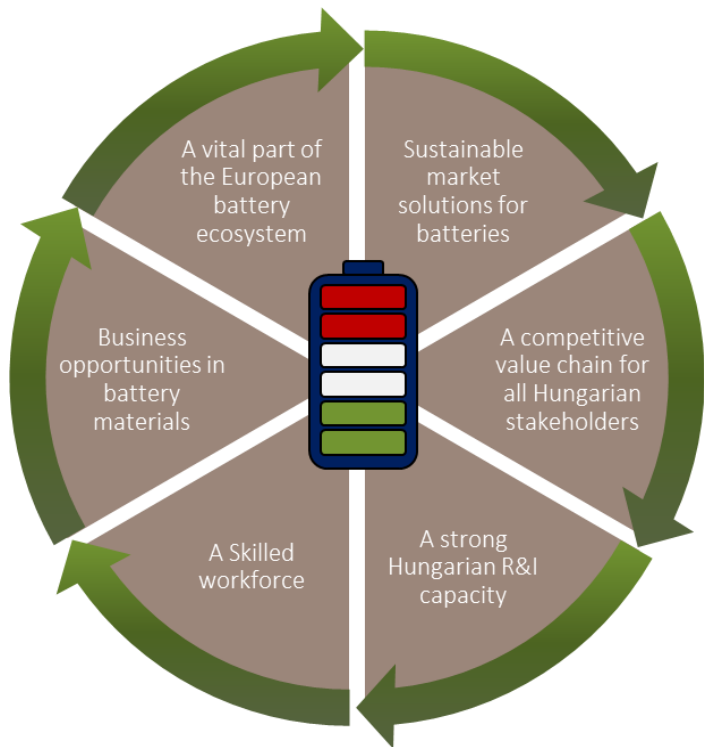
Country	2020 rank	Raw material	Cell & component	Environ.	RIL	Demand	2025 rank	Raw material	Cell & component	Environ.	RIL	Demand
China	1	1	1	16	11	1	1	1	1	15(▲1)	11	1
Japan	2	12	2	6	7	6	2	8(▲4)	3(▼1)	7(▼1)	7	8(▼2)
S. Korea	3	17	2	9	5	2	8(▼5)	16(▲1)	2	13(▼4)	5	9(▼7)
Canada	4	4	10	4	10	11	5(▼1)	3(▲1)	12(▼2)	4	10	6(▲5)
Germany	4	17	6	12	2	2	6(▼2)	22(▼5)	6	9(▲3)	2	3(▼1)
U.S.	6	15	4	13	6	2	3(▲3)	13(▲2)	3(▲1)	7(▲6)	6	2
U.K.	7	17	6	9	4	6	8(▼1)	17	8(▼2)	10(▼1)	4	4(▲2)
Finland	8	11	13	5	3	13	7(▲1)	10(▲1)	8(▲5)	6(▼1)	3	17(▼4)
France	8	17	13	1	9	5	10(▼2)	17	12(▲1)	1	9	5
Sweden	10	22	13	3	1	8	4(▲6)	17(▲5)	7(▲6)	3	1	7(▲1)
Australia	11	2	13	21	12	8	11	2	12(▲1)	19(▲2)	12	11(▼3)
Brazil	12	3	13	2	24	23	12	7(▼4)	18(▼5)	2	24	15(▲8)
Poland	12	22	6	11	13	14	13(▼1)	22	6	12(▼1)	13	19(▼5)
Hungary	12	22	6	8	14	15	15(▼3)	22	8(▼2)	11(▼3)	14	18(▼3)
Czech Rep.	13	17	10	17	8	17	16(▼1)	17	13(▼3)	17	8	21(▼4)
India	16	9	13	19	18	11	16	13(▼4)	18(▼5)	21(▼2)	18	10(▲1)
Chile	17	6	13	18	16	20	14(▲3)	4(▲2)	12(▲1)	15(▲3)	16	23(▼3)
Vietnam	18	16	6	22	20	10	23(▼5)	17(▼1)	12(▼6)	23(▼1)	20	12(▼2)
S. Africa	19	5	13	23	17	19	20(▼1)	4(▲1)	18(▼5)	19(▲4)	17	22(▼2)
Argentina	20	12	13	6	22	24	16(▲4)	8(▲4)	18(▼5)	5(▲1)	22	25(▼1)
Indonesia	21	7	13	25	21	15	20(▲1)	4(▲3)	18(▼5)	24(▲1)	21	13(▲2)
Mexico	22	12	13	15	19	22	16(▲6)	12	18(▼5)	13(▲2)	19	16(▲6)
Thailand	23	22	10	19	15	17	22(▲1)	22	8(▲2)	21(▼2)	15	20(▼3)
D.R.C.	24	8	13	14	25	24	25(▼1)	10(▼2)	18(▼5)	18(▼4)	25	24
Philippines	25	9	13	24	23	20	24(▲1)	13(▼4)	18(▼5)	25(▼1)	23	14(▲6)

- Currently Hungary has the largest battery cell production capacity in Europe
- Since 2016 FDI in battery production reached EUR 5,3 Billion and created 14 thousand new jobs in the country
- Current cell production is up to cc. 26 GWh/y in Hungary
- Samsung SDI and SK Innovation dominates production
- Forecasted EU cell production capacity is up to 500 GWh by 2025!

Overview of battery sector in Hungary - HUBA



Objectives and intervention logic of the strategy



Government decision 1766/2021 (X.29)

The Strategy builds on earlier achievements to help Hungary grow into the centre of the European battery value chain

1) by creating an environmentally and socially sustainable battery value chain:

- ✓ the environmental footprint of manufacturing processes can be reduced
- ✓ recycling capacities can be built

2) by developing a competitive national industry:

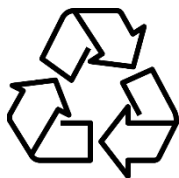
- ✓ shift from products “made in Hungary” to products “developed in Hungary”
- ✓ an organic value chain needs to be established with the participation of companies involved in working capital investments and domestic SMEs and research organisations
- ✓ domestic lithium-rich geothermal deposits need to be involved in the production of quality raw materials for battery production

Priority projects support the implementation of the Strategy

Lithium extraction from domestic thermal water resources

Starting the exploitation of non-conventional lithium resources to meet the exponentially growing demand for lithium in battery production, and establishing a low GHG-emission, responsible lithium mining industry based on domestic lithium assets

Recycling of batteries



- development of battery analytics technologies
- development of digital technologies for sharing battery data (“battery passport”)
- development of battery design to facilitate disassembly and automated module replacement
- exploration of recycling opportunities, development of innovative recycling technologies
- development of technologies to recover raw materials from spent batteries
- development of practices for the drop-off, collection and logistics of used batteries

Participation of batteries in electricity grid-balancing

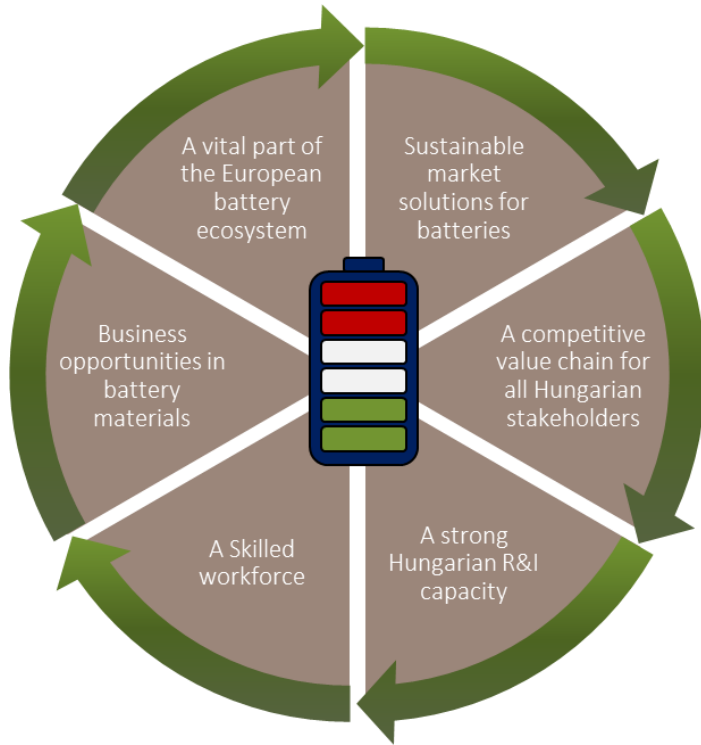
- inclusion of grid-connected batteries deployed at weather-dependent renewable electricity producer and large consumer sites in grid-balancing
- investigating systems based on the co-operation of batteries of various technologies and other solutions for energy storage (e.g., supercapacitors)
- increasing the efficiency of cross-border electricity trade, preparing aggregation projects

Battery development in the domain of electromobility

Increasing capabilities in the production and control of batteries for vehicles with electric drive, including: exploiting the potential of sharing-based electromobility (batteries specifically developed for electric fleets) and developing V1G (smart charging) and V2G (grid balancing) technologies



- 45 founders
- 4.000 Bn HUF net revenue in 2020
- Professional operation from March 1, 2022
- Main objectives
 - Industry representation
 - Value chain development (EU relevant)
 - Supporting Strategy implementation



- Priority projects should support value chain development
- Creation of competence centers by main market segments (mobility, electricity storage, < 2kWh)
- Support integration into multinational value chains
- Focus on supporting Hungarian SMEs
- Projects should represent real technological and business development

- Competence centers establishment – HUF 3.4 Bn
- Horizontal programs – education, testing, health&safety, competitiveness – HUF 2 Bn
- Lithium from geothermal water – HUF 2 Bn
- Battery reuse and recycling – HUF 4.5 Bn
- Batteries in electricity sector regulation – HUF 67 – 320 Bn
- Batteries development for e-mobility solutions – HUF 1.5 Bn

Thank you for your attention!

zerocarbonhub.hu
kaderjak.peter@bme.hu



ZKK – knowledge centre for the
development of the Hungarian green
economy

