



— 70 years —
1950-2020

Integrating national and European battery initiatives – lessons learned in Norway

Fride Vullum-Bruer

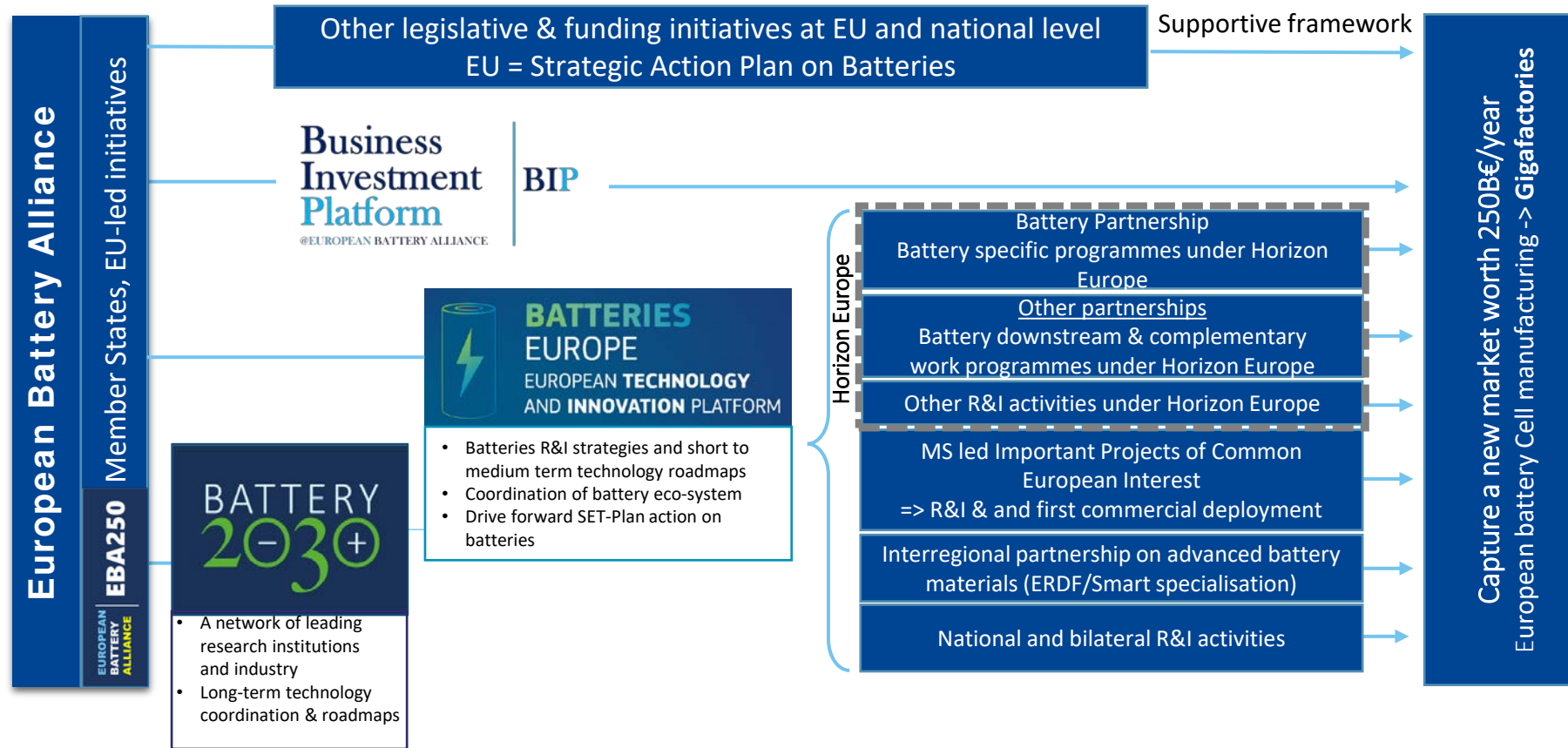
SINTEF Energy Research

Swiss Battery Days – 17.02.2021

Outline

- Involvement in EU initiatives, projects and networks
- Market situation and evolution in Norway
- Norwegian projects, fora and networks
 - BEACON
 - Battery Norway
 - FME MoZEES
 - Grønn Plattform (Green Platform) and infrastructure
- Lessons learned and challenges

European Battery Networks Landscape



SINTEF's strategic roles in the European arena

SINTEF has been involved in EERA ES for many years. Edel Sheridan lead SP 1, Atle Harby leads SP4 + several other participants.



SINTEF, by Edel Sheridan, Deputy of the Secretariat of *Batteries Europe ETIP* with 560 active European stakeholders involved



SINTEF (Clark, Løvvik, Sheridan) co-authored the 10-year roadmap for battery R&I in Europe.



SINTEF is among the first R&I members to join the *European Battery Alliance*



SINTEF, by Edel Sheridan, member of the executive board for the new Battery European Partnership Association



Involvement in EU projects

HYDRA (SINTEF is coordinator)

- Hybrid power-energy electrodes for next generation lithium-ion batteries
- Total budget: 9.4 million Euro

BIG MAP (SINTEF is partner)

- Battery Interface Genome – Materials Acceleration Platform
- One of 6 projects constituting the Battery 2030+ initiative
- Total budget: 20 million Euro

CROCODILE (SINTEF is partner)

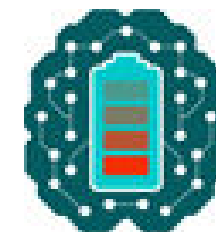
- First of a kind commercial compact system for the efficient recovery of cobalt designed with novel integrated leading technologies
- Total budget: 14.6 million Euro

SOLSTICE (SINTEF is partner)

- Sodium-Zinc molten salt batteries for low-cost stationary storage
- Total budget: 7.7 million Euro

SEABAT (SINTEF is partner)

- Solutions for large batteries for waterborn transport
- Total budget 9.5 million Euro



BIG-MAP



CRO Co DILE



Battery Industry Map in Norway

Industry Players

Research Organizations



Lithium-ion Battery @Mo I Rana

Battery System for Marine:

Siemens @Trondheim

SIEMENS

Zero Emission Marine @Oslo (Høvik)



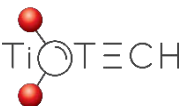
Kongsberg Maritime @Kongsberg



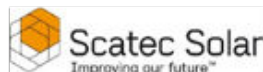
Corvus @Bergen

Corvus Energy

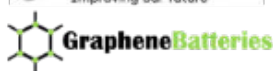
TiO Anode @ Bergen



ESS for PV @Oslo



Li-S battery @Oslo



Lithium-ion Capacitor @Stavanger

BEYONDER

Lithium-Sulfur Battery @Agder



Artificial Graphite & Si Anode @Kristiansand



Aluminium Battery Recycling @ Multi locations



Natural Graphite Mine Anode material @Skaland



SINTEF Helgeland @Mo I Rana
Energy/Process optimization



NTNU Sci. & Tech. Univ. @Trondheim
Battery materials, systems, production process



SINTEF @ Trondheim

SINTEF Energy: Large battery cell/pack testing

SINTEF Industry (Trondheim & Oslo): Battery materials, cell production, prototyping/testing, recycling

SINTEF Ocean: Battery integration – marine applications

SINTEF Community: Battery integration – buildings and infrastructure

SINTEF Digital: Battery integration – aviation. Automation, robotics

SINTEF Manufacturing @ Raufoss/Trondheim

Production processes, automation, digital twins, ...



Energy Institute @Oslo (Kjeller)
Si anode research, Cell prototyping/testing

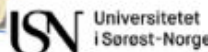


Defence Research @Oslo (Kjeller)
Battery safety testing



Univ. Oslo @Oslo

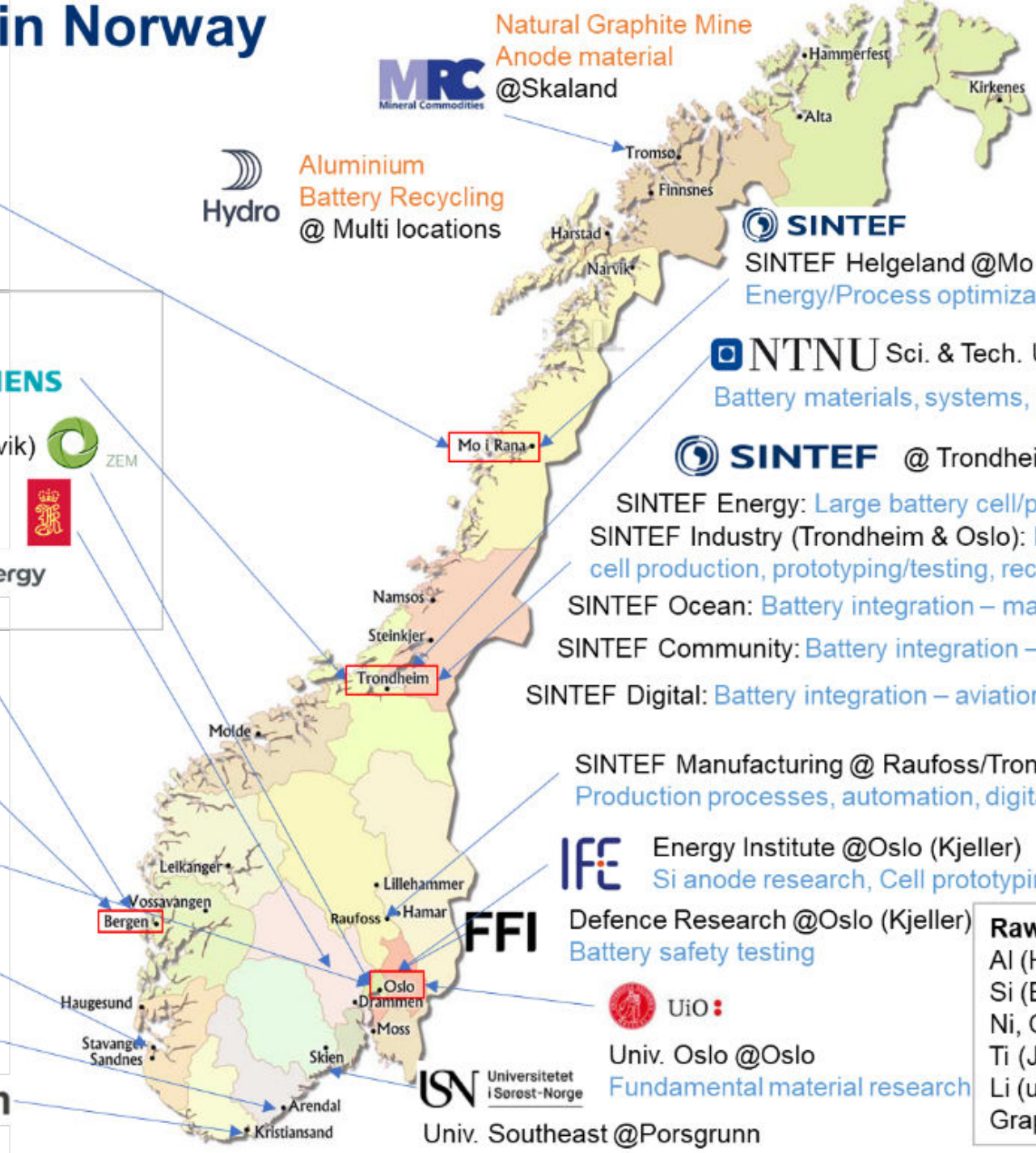
Fundamental material research



Univ. Southeast @Porsgrunn

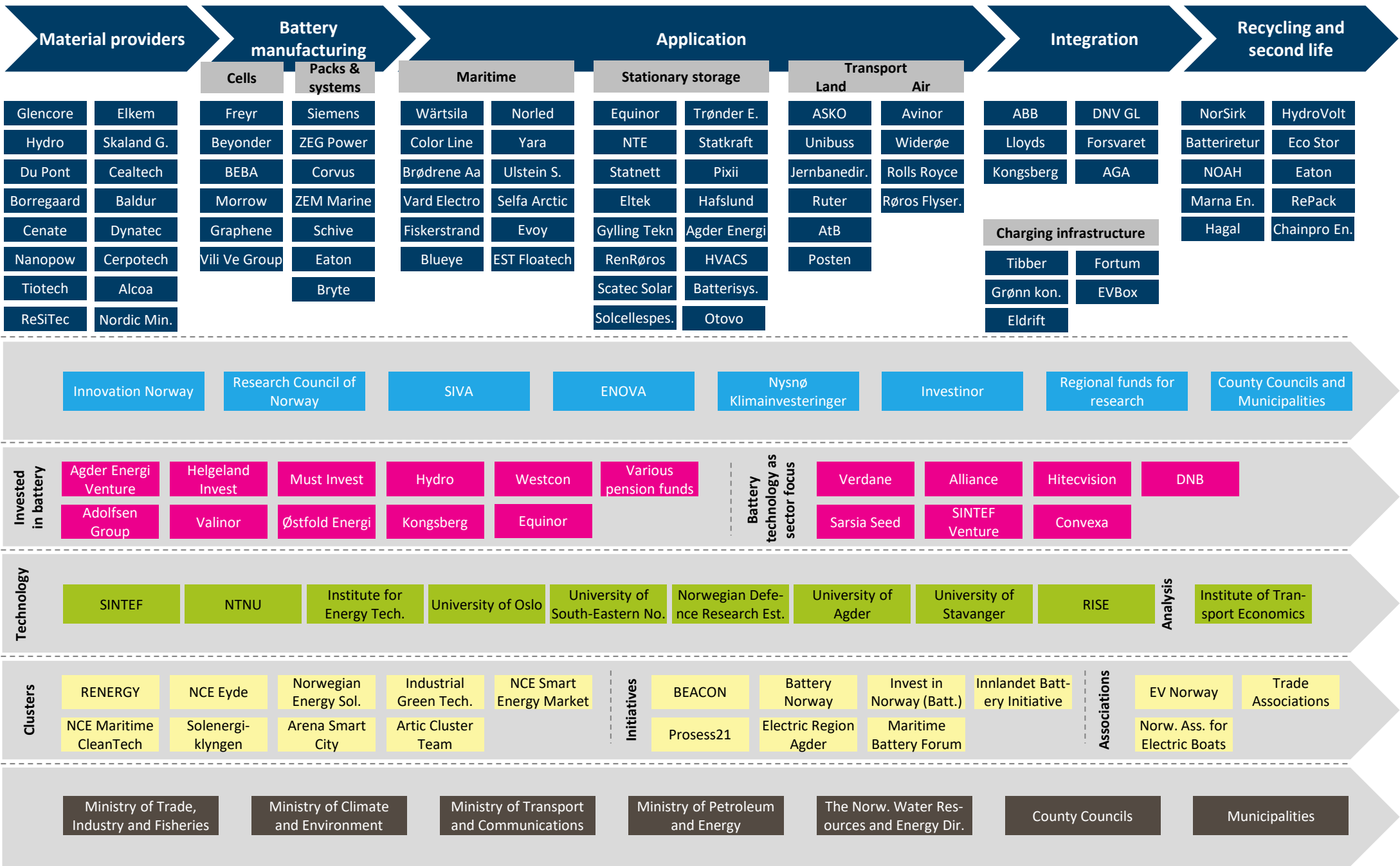
Raw Materials:

Al (Hydro, Alcoa)
Si (Elkem, Dynatec/Cenate)
Ni, Co, Cu (Glencore)
Ti (Joma)
Li (under development)
Graphite (MRC, Elkem, Saint-Gobain)





Stakeholders in the Norwegian battery value chain



What is BEACON and who is it for?

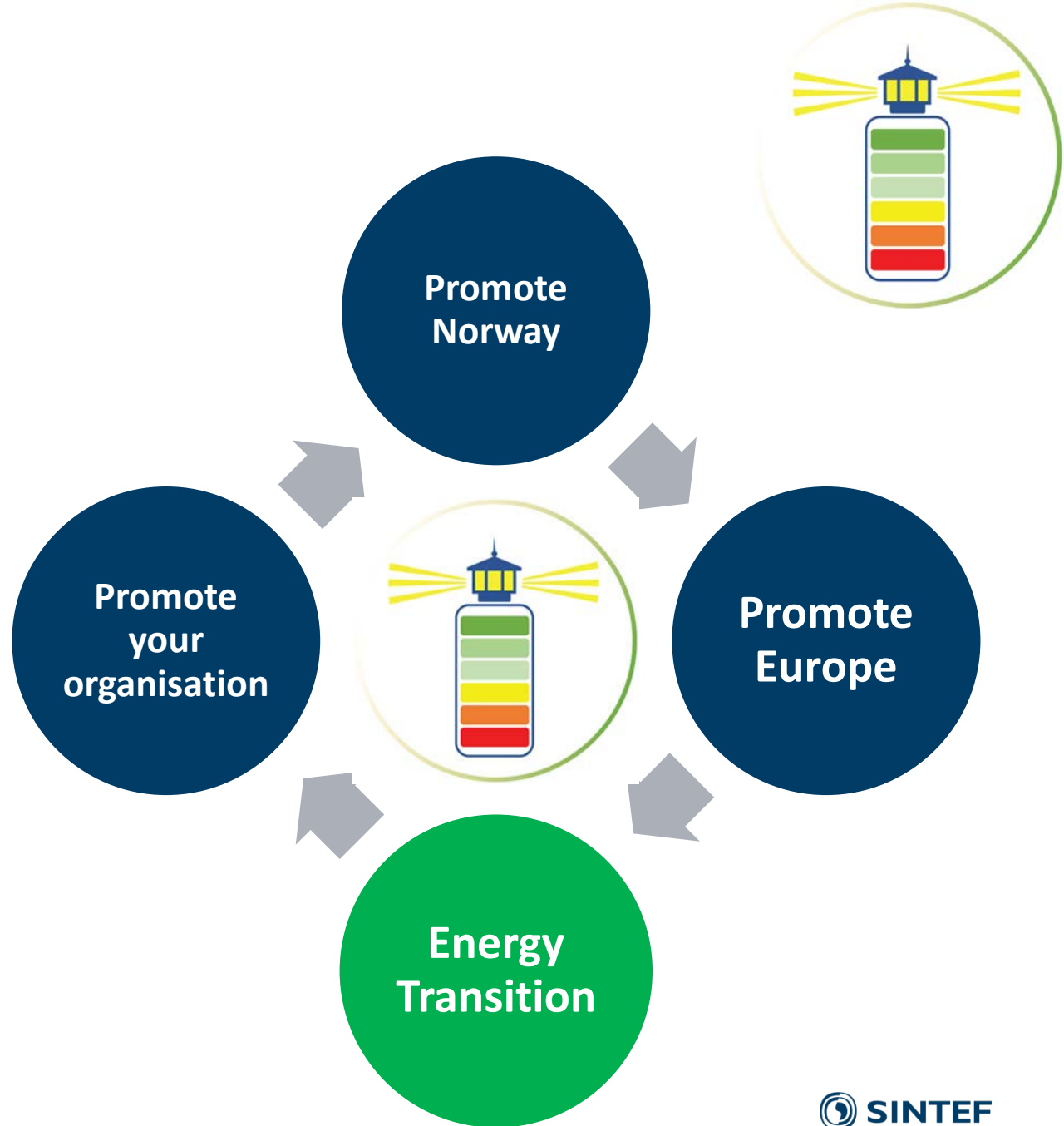
Battery Ecosystem Accelerator of Norway - a national network of battery stakeholders aiming to:

- Create synergies by connecting different parts of the supply chain
- A forum to identify research and development needs of the industry
- Provide stronger links for Norwegian stakeholders to European initiatives
- Provide Norwegian stakeholders with a common voice to ensure this industry is prioritised and its growth facilitated.
- Create a sustainable battery industry with global impact



How BEACON operates

- Open organisation
- Core group: SINTEF, NTNU, IFE, NORSK HYDRO, ELKEM, SIEMENS, HAFSLUND NETT, RCN
- Affordable and accessible to small start-ups
- Focus on cross-sectoral and interdisciplinary collaboration to build strong consortia, accelerate innovation and develop our home market.



Ba tte ry No rw a y




Ind ustria l c o lla b o ra tio n p la tfo rm

ste p he n@b a tte ry no rw a y.no
w w w.b a tte ry no rw a y.no

Battery Norway is a national industrial collaboration platform

Battery Norway will contribute to

- development of a national Norwegian battery strategy that facilitates sustainable growth - Framework conditions, a “Voice of industry”.
- efficient and streamlined reception of international expertise for the construction and operation of industrial plants.
- building of relevant longer-term industrial competence (operator, engineer) and infrastructure.
- fast tracking of permitting processes via exchange of experience and guidance.



BATTERY NORWAY

Battery Norway (Norwegian Battery Platform) is a national industrial collaboration platform focused on innovation and sustainable value creation opportunities, encompassing the entire battery supply chain. Through the BATMAN project and our collaboration with Invest in Norway we have seen a need for such a national battery platform ("hub").

Battery Norway will contribute to the:

- development of a national Norwegian battery strategy that facilitates sustainable growth.
- expansion of the Norwegian battery supply chain and ecosystem.
- building of relevant industrial competence and infrastructure.
- explore synergies within the Norwegian and Nordic battery ecosystems.
- connect Norwegian companies to international initiatives and activities.
- promote Norway as a battery nation.

Strategy

Battery Norway will closely follow the EU's battery strategy and be the Norwegian "mirror" advising the authorities on i) how Norway can strengthen its competitiveness as a host nation for battery investments ii) how can Norway and Norwegian companies deliver on the battery component of the EU's «New Green Deal» including EU Circular Economy Action Plan and iii) how to further strengthen Norwegian industrial participation in battery research and innovation arenas in Europe.

Cooperation

The battery value chain is complex. The expected increase in electro mobility will lead to an exponential growth of the Lithium-ion Battery (LIB) market and, as a result, the use of relevant raw materials. Partnerships (upstream, downstream and circular) can play a key role in creating long-term robust and competitive value chains. **Battery Norway** is an industrial meeting arena that enables collaboration across the value chain, nationally and internationally. In addition, **Battery Norway** will contribute to the sharing of expertise and transfer of experience where it strengthens its stakeholders.

Competence and infrastructure

It is important that Norwegian companies have access to expertise and competence to create value. **Battery Norway** will contribute to defining and developing relevant industrially oriented educational programs that covers the entire value chain for batteries. Importantly, this includes the development of technician and operator tailored programs. In addition, it is important that companies have open access to relevant research and upscaling infrastructure. **Battery Norway** assist in defining knowledge, infrastructure and innovation gaps along the entire value chain.

Internationally

In close cooperation with national policy instruments, **Battery Norway** will assist export oriented new companies that look for international partnerships, as well as facilitating foreign investments in the battery supply chain in Norway. For example, upon request i) facilitating foreign visits ii) matchmaking with potential innovation partners iii) strategic positioning of the Norwegian battery sector internationally.

Battery Norway will be launched on the 30th of June as part of the «The Nordic Battery Scene»
<https://www.innovationnorge.no/no/tienester/arrangementer/the-nordic-battery-scene/>

NIKKELVERK Hydro Elkem BEYONDER FREYR MORROW EYDE CLUSTER

Other Relevant Fora



electricregionagder.com



<https://www.prosess21.no/>

Maritime - ~~~~~ + Battery Forum

<https://www.maritimebatteryforum.com/>



RENERGY
Renewable Energy Cluster

<https://renergycluster.no/>



<https://invinor.no/industry-opportunities/battery/>

Roadmap for future industry 2019-2021

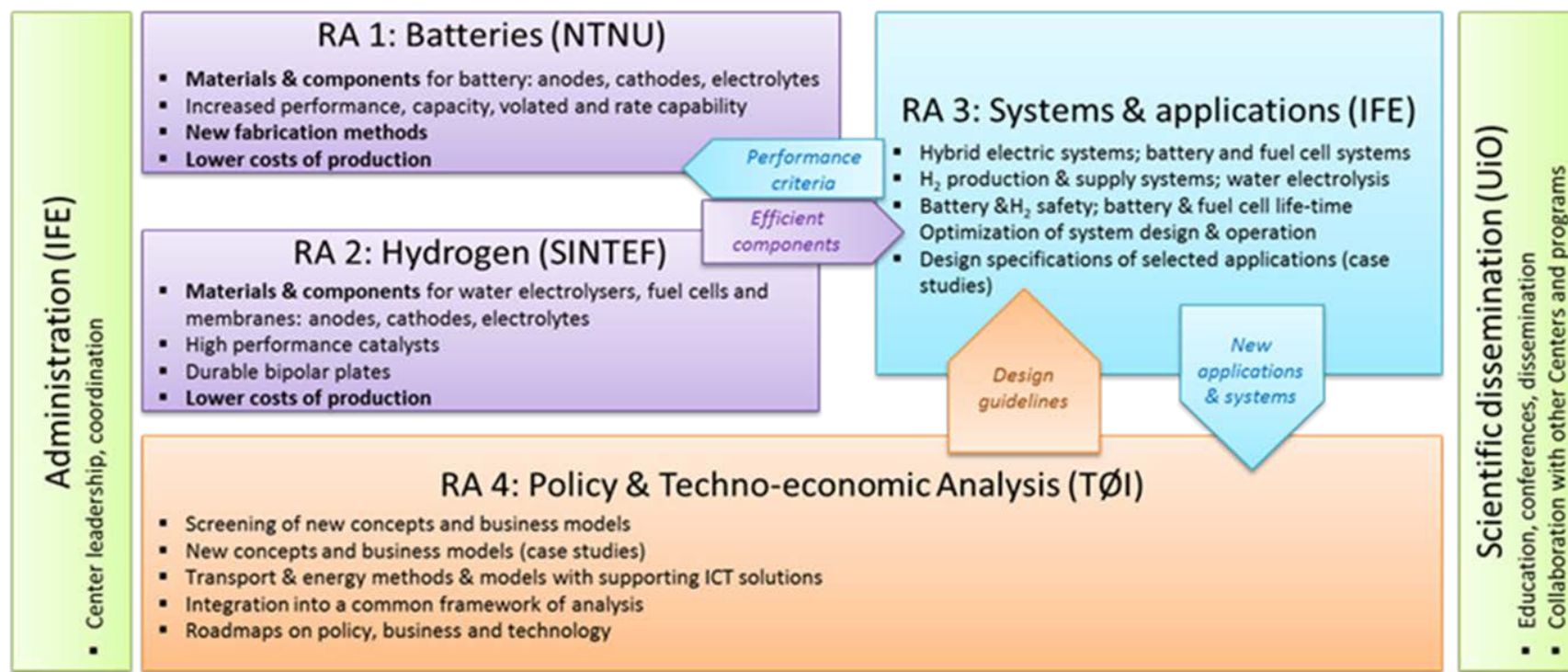
Knowledge base provided by SINTEF



FME MoZEES – Mobility Zero Emission Energy Systems

Main objective:

R&D for innovation on new battery and hydrogen materials, components, and technologies for existing and future transport applications on road, rail, and sea.



Total budget: **~26 M€**

Center Leader: **IFE**

Research Partners:

SINTEF, NTNU, UiO, USN, TØI and FFI

More than **30 other partners** from industry and public sector.

Grønn Plattform (Green Platform) and infrastructure

- The Green Platform Initiative provides funding for enterprises and research institutes engaged in green growth and restructuring driven by research and innovation
 - 3-year project
 - Up to 150 MNOK (~15 M€) per project
 - Make Norwegian companies and research institutions better equipped to exploit the opportunities provided by the EU's Green Deal initiative
- National infrastructure for battery research
 - Proposal submitted Nov. 18th 2020 for
 - Partners include 3 research institutes and 3 universities
 - Total budget: 168 MNOK (~16,8 M€)



Lessons learned and challenges

- It's time consuming and takes a lot of background work to establish networks and motivate industry, but once it starts it moves very quickly
- Know the industry in your own country
 - What are their specific challenges and needs?
 - How can researchers help?
- Important to support SMEs
- Norway is a small country and we must collaborate and pull the load together
 - Industry has collectively reached out to politicians and decision makers for greater impact
 - Rapid increase in activities and coordination between industries and research institutes
- Norway is early an mover in electrification due to incentives and general public acceptance. Provides opportunities wrt i.e. recycling and reuse at an early stage
- Good dialogue with funding mechanisms and authorities is of utmost importance
- Covid19 has been a curse and a blessing

Challenges

- Few funding mechanisms for research infrastructure, which is often built piece by piece
- Establishing funding to operate an open network such as BEACON and Battery Norway is challenging without charging high participation fees



—— 70 år ——
1950-2020

Teknologi for et bedre samfunn