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70 years
1950-2020

Integrating national and European battery initiatives – lessons learned in Norway

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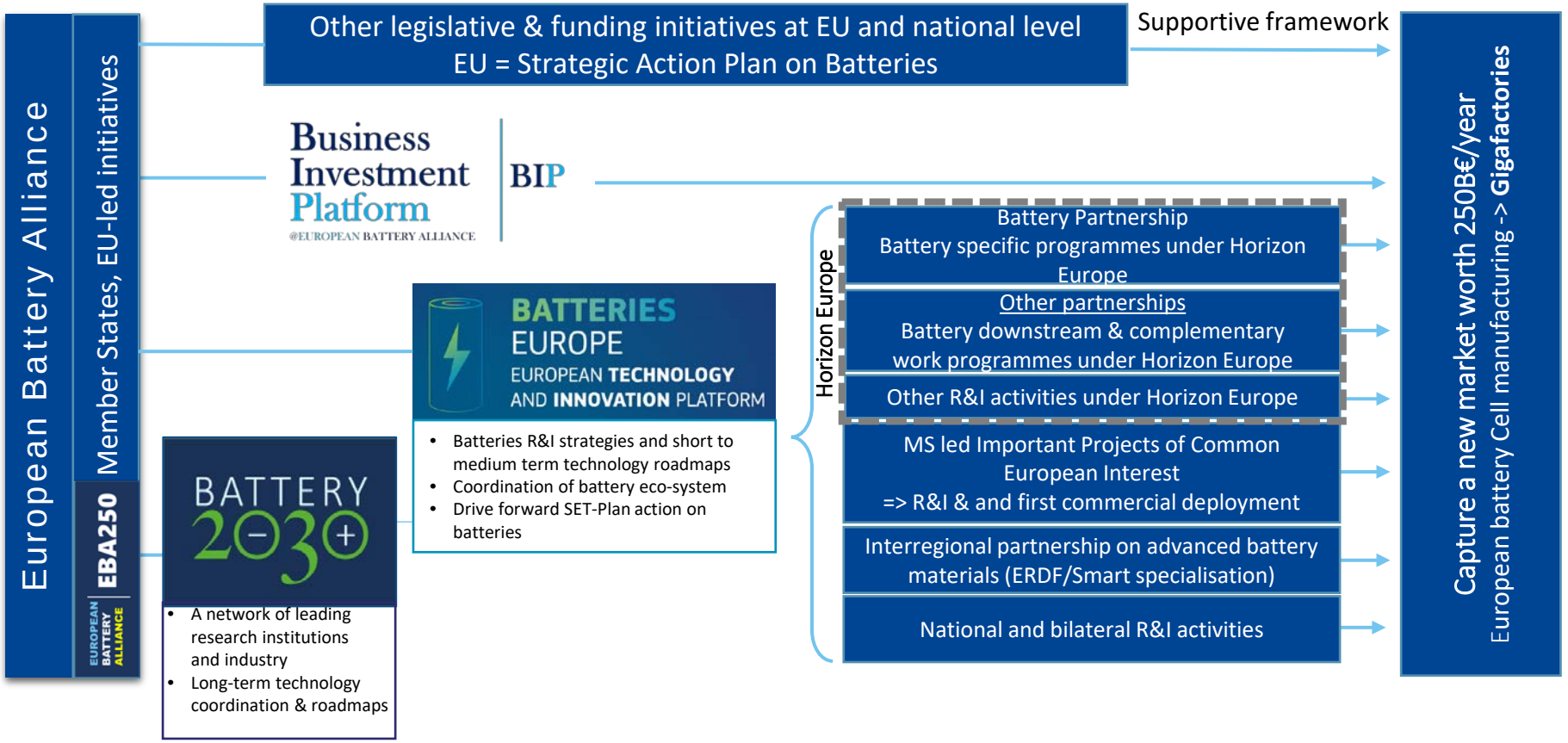
SINTEF Energy Research

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



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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

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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

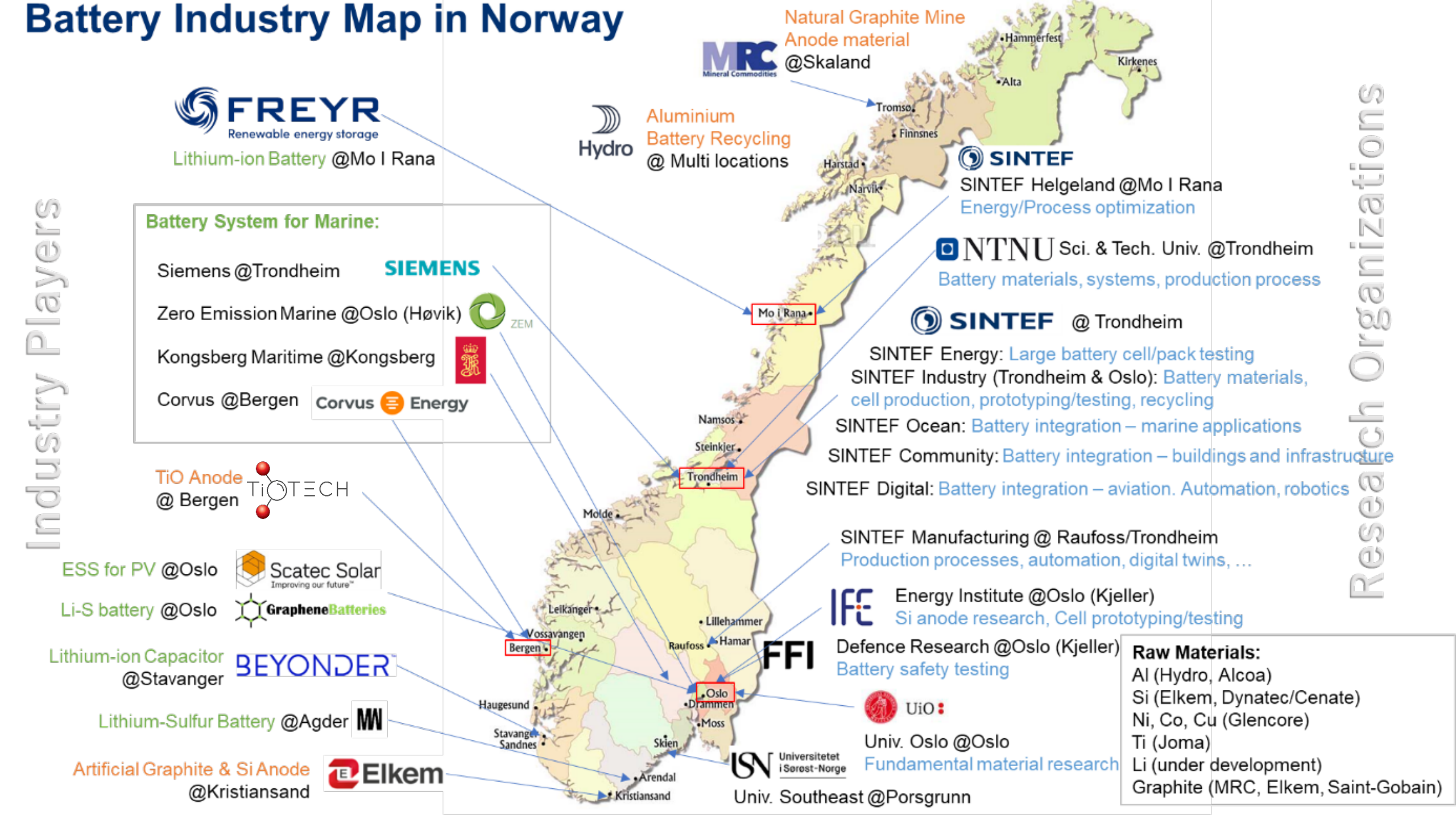
SOLSTICE (SINTEF is partner)

- 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

Battery Industry Map in Norway



Stakeholders in the Norwegian battery value chain

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	Material providers	Battery manufacturing		Application				Integration		Recycling and second life	
		Cells	Packs & systems	Maritime		Stationary storage		Transport Land	Transport Air		
Industry players	Glencore	Freyr	Siemens	Wärtsila	Norled	Equinor	Trønder E.	ASKO	Avinor	ABB	DNV GL	NorSirk	HydroVolt
	Hydro	Beyonder	ZEG Power	Color Line	Yara	NTE	Statkraft	Unibuss	Widerøe	Lloyds	Forsvaret	Batteriretur	Eco Stor
	Du Pont	BEBA	Corvus	Brødrene Aa	Ulstein S.	Statnett	Pixii	Jernbanedir.	Rolls Royce	Kongsberg	AGA	NOAH	Eaton
	Borregaard	Morrow	ZEM Marine	Vard Electro	Selfa Arctic	Eltek	Hafslund	Ruter	Røros Flyser.			Marna En.	RePack
	Cenate	Graphene	Schive	Fiskerstrand	Evoy	Gylling Tekn	Agder Energi	AtB		Charging infrastructure		Hagal	Chainpro En.
	Nanopow	Vili Ve Group	Eaton	Blueye	EST Floatech	RenRøros	HVACS	Posten		Tibber	Fortum		
	Tiotech		Bryte			Scatec Solar	Batterisys.			Grønn kon.	EVBox		
	ReSiTec					Solcellespes.	Otovo			Eldrift			
	Elkem												
	Skaland G.												
	Cealtech												
	Baldur												
	Dynatec												
	Cerpotech												
	Alcoa												
	Nordic Min.												

Public policy instruments	Innovation Norway	Research Council of Norway	SIVA	ENOVA	Nysnø Klimainvesteringer	Investinor	Regional funds for research	County Councils and Municipalities

Private investors	Invested in battery	Agder Energi Venture	Helgeland Invest	Must Invest	Hydro	Westcon	Various pension funds	Battery technology as sector focus	Verdane	Alliance	Hitecvision	DNB
		Adolfsen Group	Valinor	Østfold Energi	Kongsberg	Equinor			Sarsia Seed	SINTEF Venture	Convexa	

Research actors	Technology	SINTEF	NTNU	Institute for Energy Tech.	University of Oslo	University of South-Eastern No.	Norwegian Defe-nce Research Est.	University of Agder	University of Stavanger	RISE	Analysis	Institute of Tran-sport Economics

Clusters, initiatives and associations	Clusters	RENERGY	NCE Eyde	Norwegian Energy Sol.	Industrial Green Tech.	NCE Smart Energy Market	Initiatives	BEACON	Battery Norway	Invest in Norway (Batt.)	Innlandet Batt-ery Initiative	Associations	EV Norway	Trade Associations
		NCE Maritime CleanTech	Solenergi-klyngen	Arena Smart City	Artic Cluster Team			Prosess21	Electric Region Agder	Maritime Battery Forum			Norw. Ass. for Electric Boats	

Public authorities	Ministry of Trade, Industry and Fisheries	Ministry of Climate and Environment	Ministry of Transport and Communications	Ministry of Petroleum and Energy	The Norw. Water Res-ources and Energy Dir.	County Councils	Municipalities

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

https://www.sintef.no/projectweb/beacon/

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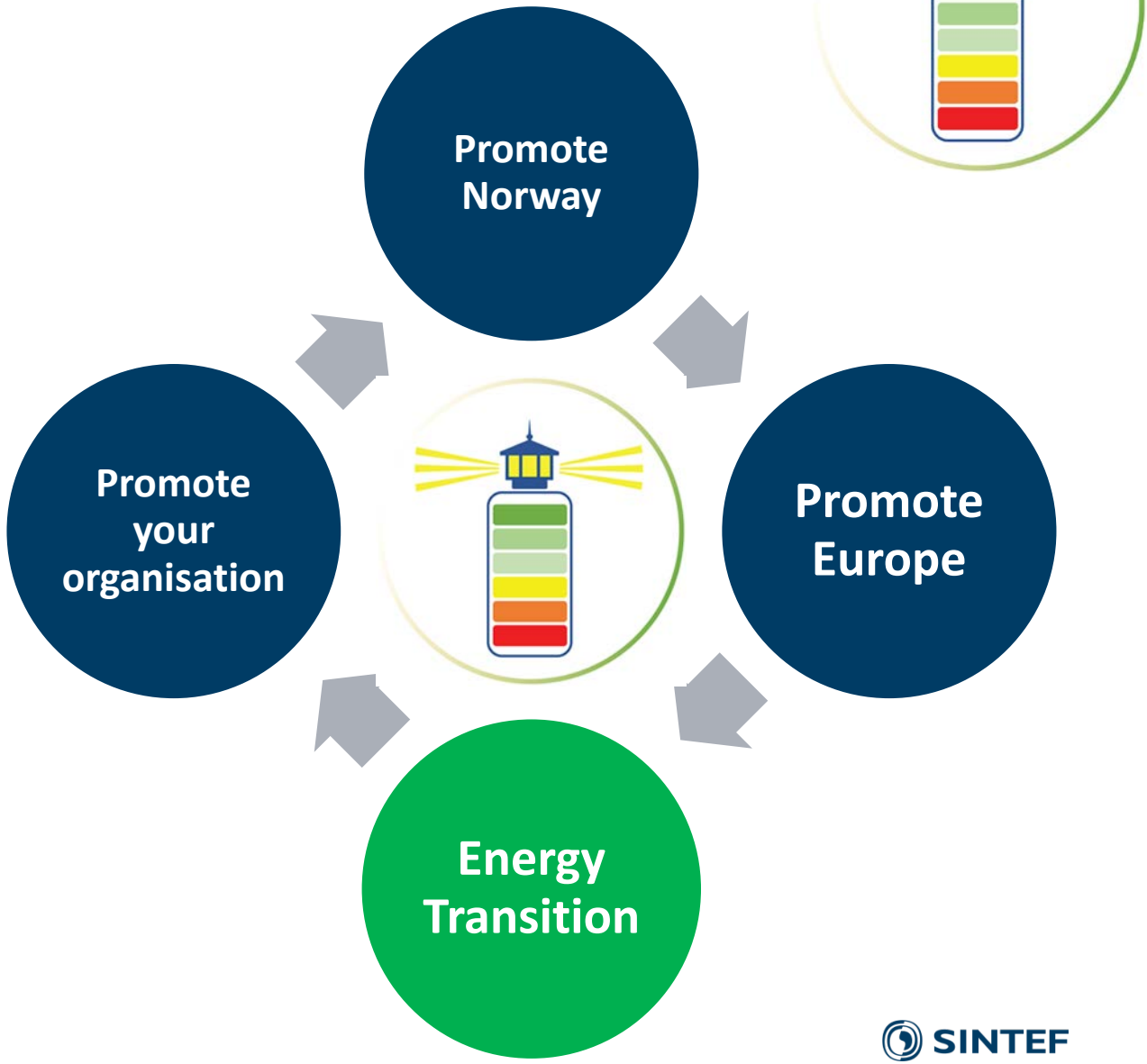
How BEACON operates

- 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.



Battery Norway

FREYR Renewable energy storage

NIKKELVERK A GLENCORE COMPANY

Elkem

MORROW

BEYONDER

Industrial collaboration platform

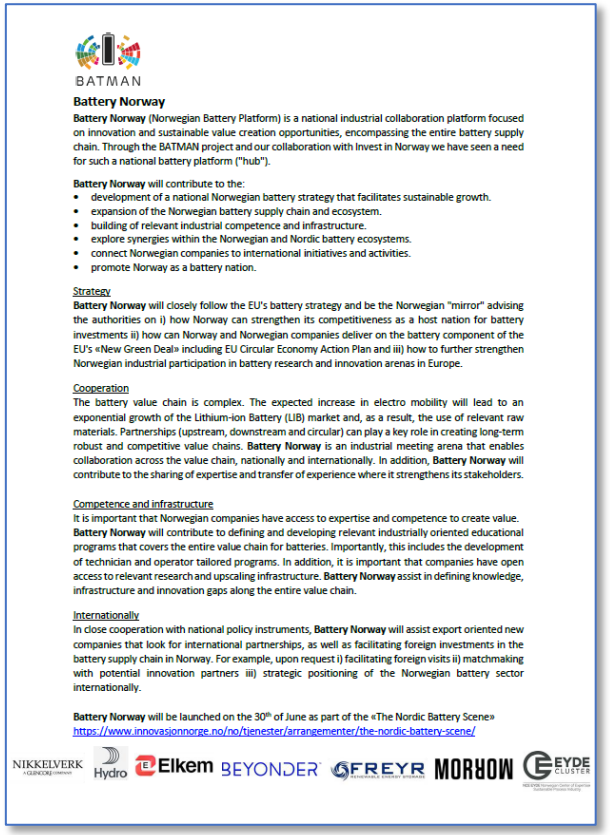
stephen@batterynorway.no
www.batterynorway.no

EYDE CLUSTER
NCE EYDE Norwegian Center of Expertise Sustainable Process Industry

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.



BATMAN

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.innovasjonnorge.no/no/tjenester/arrangementer/the-nordic-battery-scene/

NIKKELVERK Hydro Elkem BEYONDER FREYR MORROW EYDE CLUSTER

Other Relevant Fora

Maritime Battery Forum

https://www.maritimebatteryforum.com/

ELECTRIC REGION AGDER

electricregionagder.com

RENERGY Renewable Energy Cluster

https://renergycluster.no/

PROSESS21

https://www.prosess21.no/

INVEST IN NORWAY

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

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Roadmap for future industry 2019-2021
Knowledge base provided by SINTEF

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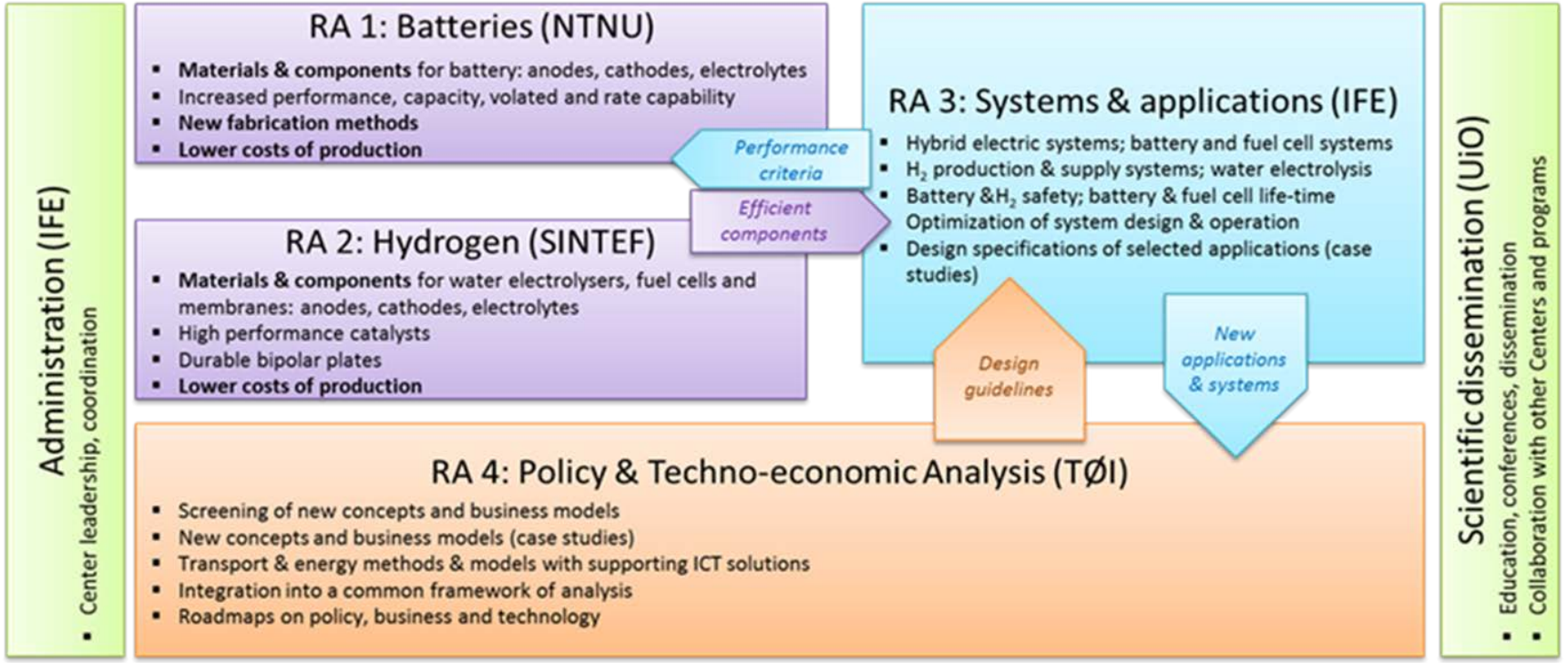
FME MoZEES – Mobility Zero Emission Energy Systems

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€)

NABLA
Norwegian Advanced Battery Laboratory Infrastructure

UiO : NTNU UiA

IFE FFI Forsvarets forskningsinstitutt SINTEF

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

<u>Challenges</u>

- 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

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70 år

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Teknologi for et bedre samfunn