European Battery Alliance

Deliverable:

EU battery value chain approach initiatives

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☐ In Progress. Please explain:	☐ Iterative Process – This year's results have been 100% achieved. ☐ Delay – This year's results were not fully achieved.

Tracking Changes

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☒ EIT and InnoEnergy
☐ Public

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Executive Summary

This document contains the official information regarding the Battery value chain approach initiatives within the European Battery Alliance (EBA).

In this document, there will be specific focus on the general activities analyzed on a high level to show the progress throughout the year 2020.

In this report four examples of initiatives of distinctly varying character that have been done in the context of the Battery value chain approach.

The studied initiatives are:

- Development of regional battery strategies in Sweden and Hungary
- The local initiative to strengthen and develop the cluster around the battery cell manufacturing plant in Skellefteå, Sweden
- Developing Lithium refining capacity in Portugal
- The initiative to develop a Cell manufacturing company in France

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Abbreviations and Acronyms

Table 0-1 Acronyms

ASIDI	Average System Interruption Duration Index
BAU	Business as usual
CAPEX	Capital expenditures
CBA	Cost Benefit Analysis
DER	Distributed Energy Resources
DMS	Distribution Management System
DSO	Distribution System Operator
EC	European Commission
EEGI	European Electricity Grid Initiative
EU	European Union
FD	Fault Detection / fault detector
EBA	European Battery Alliance
EIT	European Institute of Innovation and Technology
EV	Electric Vehicle
COVID	Corona Virus Disease

1 Introduction

The European Battery Alliance (EBA) officially launched by Vice-President Maroš Šefčovič in charge of the Energy Union on October 11th 2017, intends to act as a call addressed to the European industry to seize the opportunity of a technology, namely Battery, that will be at the core of the energy transition. The main goal of the EBA is indeed to create the necessary momentum to support the European Industry in the field of safe and sustainable batteries which is estimated to an amount to 250 b€ of an annual European market by 2025 (that covers the needs all along the value chain: power, transport and industry), and make European champions emerge as a credible alternative to North American and Asian players and to eventually avoid the risk for Europe to become fully dependent of foreign batteries.

This project report focuses on the high-level progress of some of the Battery value chain approach initiatives that have been created in the context of the European Battery Alliance.
These examples of projects that have been initiated are in line with the general goals and objectives as specific originally when defining the EBA back in 2017 – further information on the objectives can be found on the EBA website.

1.1 Background

Following-up the political launching of the EBA, Vice-President Šefčovič gave mandate to EIT InnoEnergy to mobilize and steer the industry towards the delivery of first recommendations on enabling framework conditions to create a pan-European and cross-sectoral batteries ecosystem, capable of converting a technological leadership into competitive products and services. These recommendations formulated by the so-called EBA250, the industrial workstream of the EBA led by EIT InnoEnergy, notably contributed to the Strategic Action Plan on Batteries issued by the European Commission in May 2018. In practice, this process thus gave birth to a reinforcing and growing industrial ecosystem of stakeholders coming from the entire battery value chain and driven by the shared ambition of making Europe one major stakeholders in the Batteries sector in the coming years (see Figure 1-1).

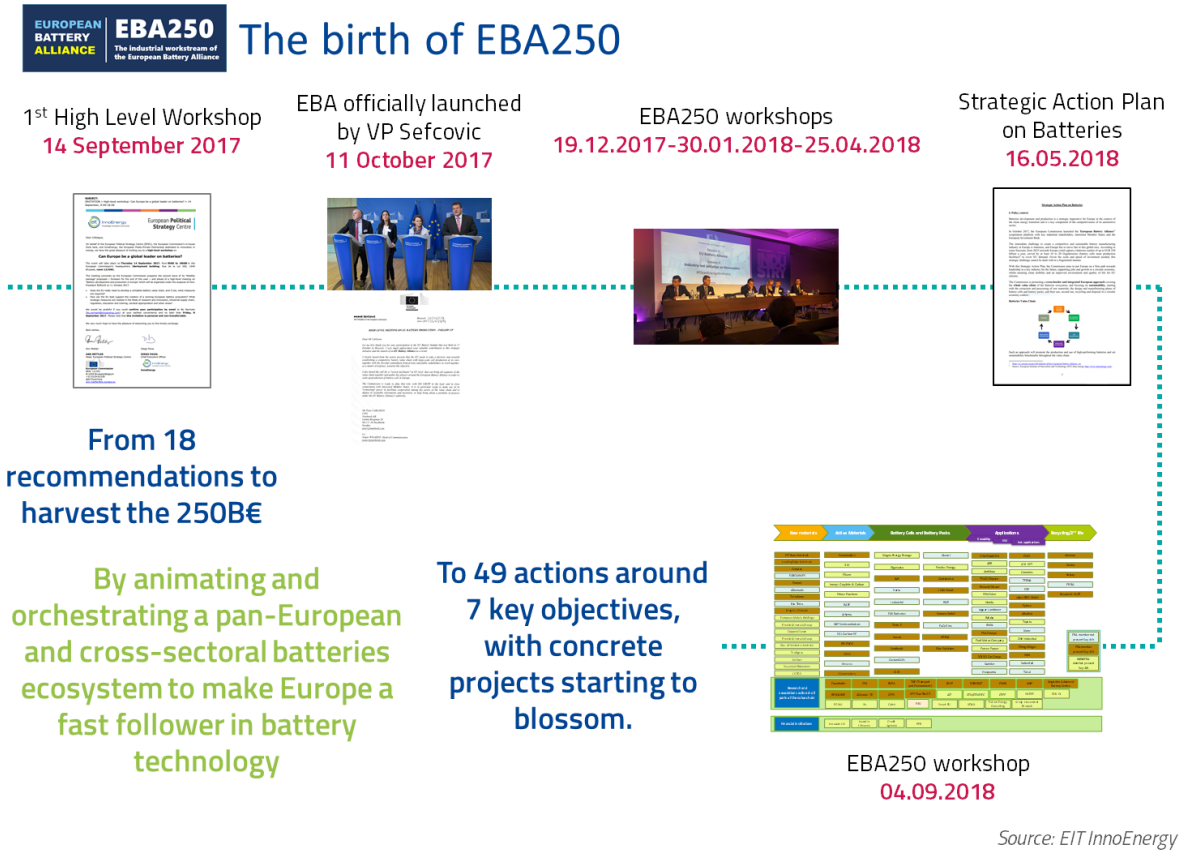

Figure 1. The birth of EBA250

The main idea behind development of EBA is to provide a framework that includes secure access to raw materials, support for technological innovation and consistent rules on battery production. The immediate objective is to create a competitive manufacturing value chain in Europe with sustainable battery cells at its core. To prevent a technological dependence on our competitors and capitalize on the job, growth and investment potential of batteries, Europe has to move fast in the global race. According to some forecasts, Europe could capture a battery market of up to €250 billion a year from 2025 onwards. Covering the EU demand alone requires at least 10 to 20 'gigafactories' (large-scale battery cell production facilities), that is the reason why there is a requirement of a combined effort to address this industrial challenge.

In Figure 1-1, one can see the different key players for each step of the value chain when it comes to the production of batteries.

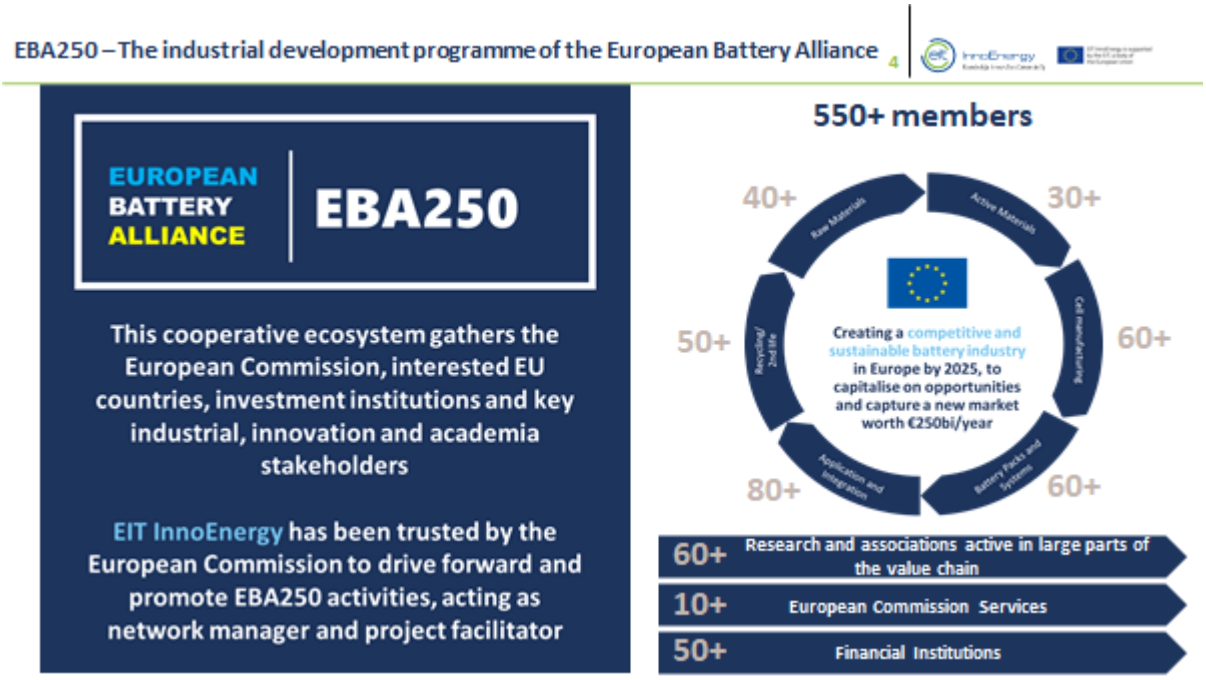

Figure 2. EBA250 and the number of members distributed over the European Battery Industry value chain

Within the strategic action plan for batteries defined by the European Commission, a comprehensive set of concrete measures were adopted to develop an innovative, sustainable and competitive battery "ecosystem" in Europe. The plan aims to:

- Secure access to raw materials for batteries from resource-rich countries outside the EU and facilitate access to European sources of raw materials, as well as access secondary raw materials by recycling in a circular economy of batteries
- Support scaled European battery cell manufacturing and a full competitive value chain in Europe. the Alliance is bringing key industry players and national authorities together and work in partnership with EU countries and the EIB to support integrated (cross-border) manufacturing projects at scale
- Strengthen industrial leadership through accelerated research and innovation support to advanced (e.g. Lithium-ion) and disruptive (e.g. solid state) technologies
- Develop and strengthen a highly skilled workforce along the whole value chain to close the skills gap. This includes providing adequate training at EU and country level, re-skilling and upskilling, and making Europe attractive for world-class experts in the field
- Support the sustainability of EU battery cell manufacturing industry with the lowest environmental footprint possible. This entails setting requirements for safe and sustainable battery production in Europe
- Ensure consistency with the broader EU regulatory and enabling framework (Clean Energy Strategy and Mobility Packages, trade policy, etc.)

See also figure below for the goals and objectives of the strategic action plan on Batteries:

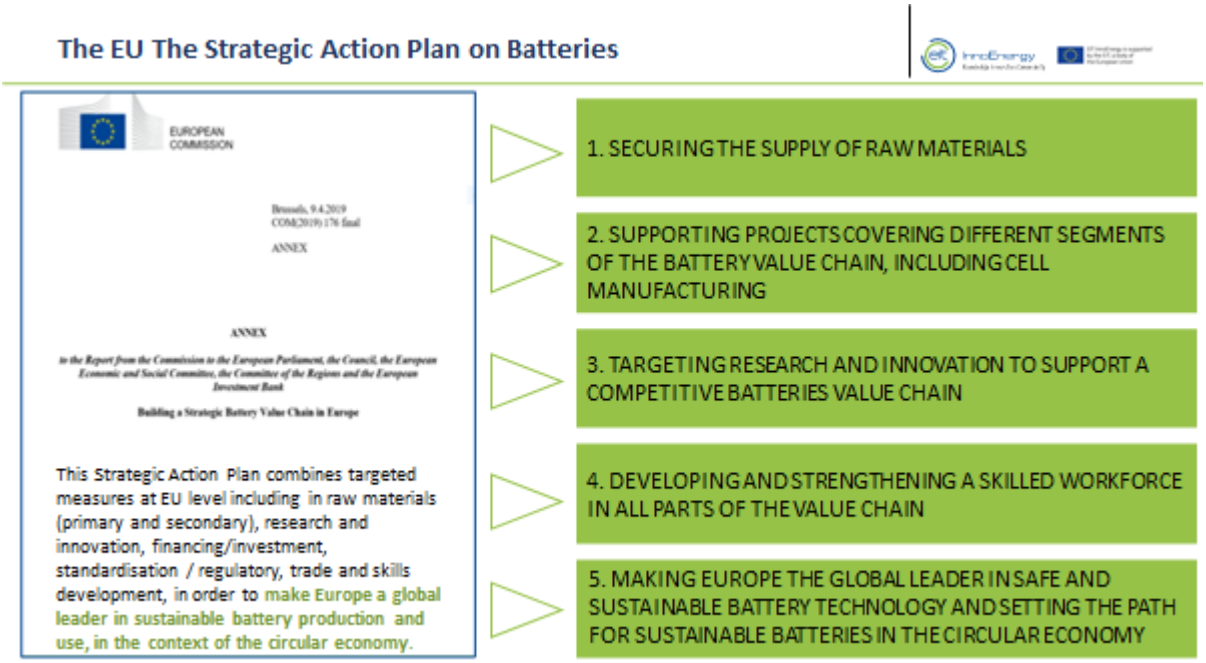

Figure 3. EU Strategic Action Plan on Batteries

1.2 Scope of the document

The main aim of this deliverable is to document the is to highlight some examples of the specific initiatives that have sprung from the general goals and objectives described above.

1.3 Structure of the document

The document comprises the following main sections:

- Creation of Regional Battery Strategies
- Strengthening of Local Value chain clusters
- Creation of raw material refining capacity
- Creation of national cell manufacturing plant

2 Battery value chain approach initiatives

In the context of the Battery value chain approach several initiatives have been initialized.
The goals/objectives/actions that were defined from the start in 2017 have been briefly described above in chapter 1.
In addition to these, more specific projects have also been initiated and four of these are detailed below.

2.1 Creation of Regional Battery Strategies

In the context of building a strong European battery value chain in Europe, the need for a support on a regional level has been arising during the last years. For that reason, several initiatives have been assessed and the conclusion of implementing regional strategies was taken.
Such strategies would include insights on joint efforts to get a workforce with the right skills, to get common infrastructure, get common awareness for the industry, get common assistance from authorities and so on, all within the region.

A good example of a Regional Battery project is the work done by EIT InnoEnergy to create the Swedish regional Battery Strategy:

The work was contracted by the Swedish Government office to Fossilfritt Sverige (Fossil (fuel) free Sweden – a Swedish state initiative to make Sweden the first fossil fuel neutral state. See more here: https://fossilfrittsverige.se/en/about-us) to develop a national strategy for sustainable industrial manufacturing and use of batteries in Sweden.
The organization Fossilfritt Sverige in turn contracted EIT InnoEnergy to lead the work to establish a national Swedish battery strategy. The reason for choosing EIT InnoEnergy for this work is due to the fact that the industrial part of the European Battery Alliance, EBA 250, resides within EIT InnoEnergy and the making of the Swedish battery plan has been for the most part been based on the essence of the thoughts within EBA.

The work of completing the plan has been done and was presented to the Swedish Government Office on second of December 2020 after a thorough work to assemble the plan during most of 2020.
The plan is now in implementation phase and Fossilfritt Sverige has the mandate to coordinate this with the assistance of EIT InnoEnergy.

As the European Battery industry is built up at European level, it was important to find Sweden's comparative advantages and have a strategy for how and in which parts Sweden and the Nordic region could contribute best. Sweden already has advantages from fossil-free electricity and an early battery manufacturer that has already begun to establish itself, which are two important strengths to build on.

In the work, the strategy was developed to develop Sweden's newly established position as one of Europe's leading countries in battery manufacturing. The entire value chain for battery manufacturing was included; from raw materials via cell manufacturing to use and recycling. The focus was on how Sweden, together with our Nordic neighbors, fits into the European Battery Alliance. The work was supported by a reference group. A first interim report was finalized in August, which also served as an input to the Government's budget work. The final results of the work were finalized by November 2020.

The work to develop the strategy and plan was based on the experience EIT InnoEnergy have gained from the work on the European Strategy developed within the European Battery Alliance (EBA) and thus the same people will be involved working in the EBA. Concrete deliveries for the project were:

- Anchoring the strategy in a reference group from industry, academia and society
- Plan and conduct relevant workshops and meetings
- Develop a strategy paper
- Produce written documentation
- Produce presentation material
- Participate in presentations of the strategy

The above work was done in close collaboration with Fossil-free Sweden.

Essentially, the work was done in the following phases:

1. Establishment of a reference group with representatives from industrial and from authorities
2. Initial recommendation based on the overall goals and objectives from EBA (see above)
3. Identification of Swedish strengths to build on challenges to improve in order for Sweden to contribute to the previous step
4. Individual workshops on
    - R&D and Education
    - Battery production and Applications
    - Raw materials /mining and refining
5. Formulation of Sweden specific recommendations and actions
6. Review of final report
7. Presentation and delivery

The slides below (partially in Swedish, translation to English of Swedish parts below) gives a summary of the most important findings, recommendations and actions of the Swedish Battery Strategy plan:

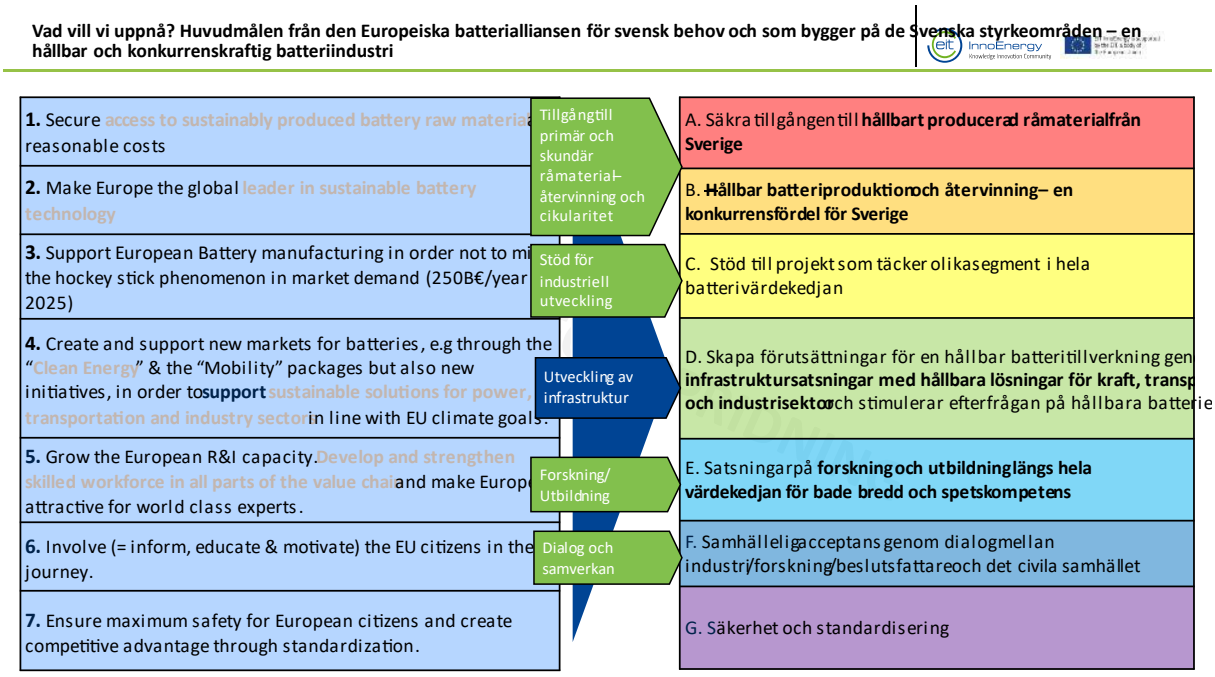

Figure 4. Summary Swedish Battery Strategy plan – part 1

The English translation to Figure 4 can be found here:

Access to primary and secondary raw materials recycling and circularity
A. Ensure access to sustainably produced raw materials from Sweden
B. Sustainable battery production and recycling competitive advantage for Sweden

Support for industrial development
C. Support for projects covering different segments throughout the battery value chain

Development of infrastructure
D. Create conditions for sustainable battery production through infrastructure investments with sustainable solutions for the power, transport and industrial sectors and stimulates demand for sustainable batteries

Research / Education
E. Investments in research and education throughout value chain for both breadth and excellence

Dialogue and collaboration
F. Social acceptance through dialogue between
industry research decision makers and civil society

G. Security and standardization

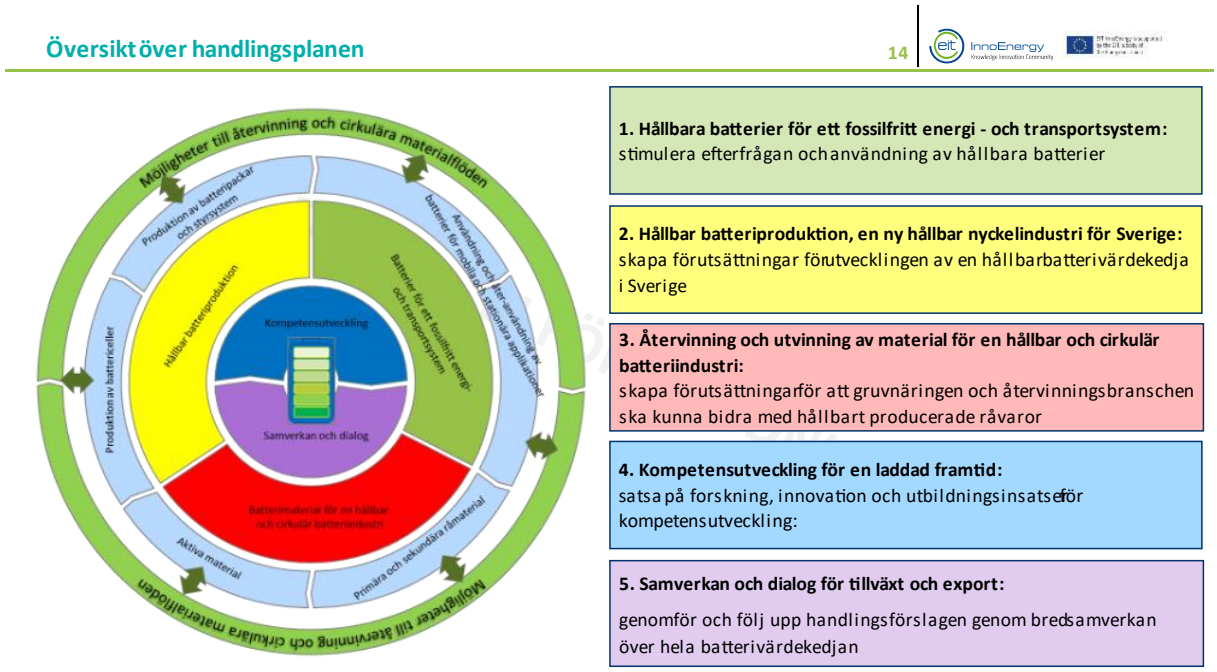

Figure 5. Summary Swedish Battery Strategy – part 2

Translation to English of figure 5:

1. Sustainable batteries for a fossil-free energy and transport system:
   stimulate demand and the use of sustainable batteries
2. Sustainable battery production, a new sustainable key industry for Sweden:
   create conditions for the development of a sustainable battery value chain in Sweden
3. Recycling and extraction of materials for a sustainable and circular battery industry:
   create conditions to the mining and recycling industrymust be able to contribute with sustainably produced raw materials
4. Skills development for a charged future:
   focus on research, innovation and educational initiatives for skills development:
5. Collaboration and dialogue for growth and exports:
   implement and follow up the action proposals broadly cooperation across the entire battery value chain

2.2 Strengthening of Local Value chain clusters

Whereas the initiative above described is a regional initiative, in this chapter, we will focus much more on a local level-set of initiatives.
A good example for this is the initiative that was possible to set in motion due to the battery cell manufacturing plant that is being built in the town of Skellefteå, in northern Sweden.

For a large Battery Cell manufacturing plant to be built and for it operate, a large number of related suppliers and supporting companies are needed. Especially when the Battery cell manufacturing plant is rather large compared to the already existing industry.

Hence there was a clear need to strengthen the local value chain in order for it to support and supply the needed resources to the large battery cell manufacturing plant. Furthermore, due to the impact it had, it served as a driver that demanded an innovative cluster around it.

As Skellefteå is the home to Northvolt's battery production plant – the largest single site investment in Europe – and investing in a multi-billion-euro development programme for smart and sustainable infrastructure-, Skellefteå is quickly becoming an innovation hub for renewable energy. This makes the city an attractive launch pad for energy start-ups.

For this reason, EIT InnoEnergy and Skellefteå Kraft launched an accelerator programme to drive energy innovation in Northern Sweden.

EIT InnoEnergy signed a partnership with Skellefteå municipality last year to support its plans and is already involved in several projects across the city, including the smart and sustainable development of local infrastructure.

The objectives of this initiative were defined as follows:

- Create Innovative Ecosystem
- Professional learning and Training
- Smart city

In the following figure, the objectives of such initiative can be found:

Figure 6. Objectives to drive sustainable energy innovation in Skellefteå

The initial stakeholders identified for this task were the following:

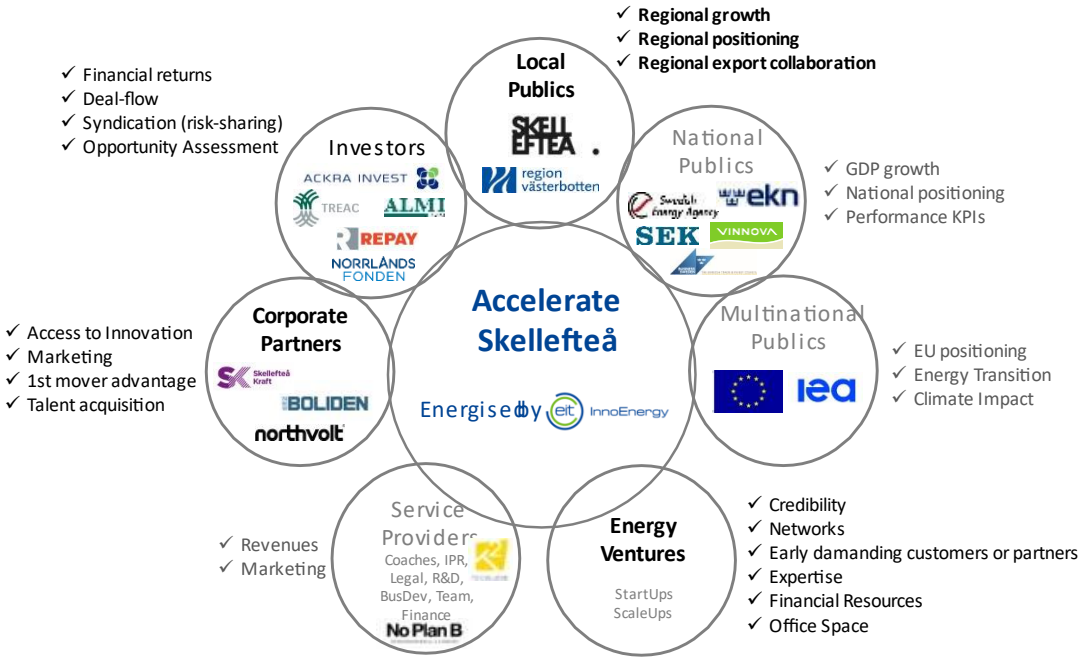

Figure 7. Stakeholders initially identified

EIT InnoEnergy partnered with Skellefteå Kraft, municipality-owned power company in Skellefeå, Sweden, to launch the Accelerate Skellefteå Project. The call for this start-up project offered applicants from across Europe the opportunity to grow their sustainable energy businesses in Sweden, as part of a green economic recovery post-COVID-19.

The call for applications for innovation start-ups across the entire energy value chain closed on 23 August. Successful applicants were part of a three-month tailored programme offering access to a broad range of services, such as supply chain development, business validation, revenue and pricing models, and technology and industrialization support. The successful start-ups also had the opportunity to collaborate closely with EIT InnoEnergy and Skellefteå Kraft to support the city's, and the entire region's energy transition.
All in all, five projects were selected which are now three remaining and ongoing startup projects.

Other parts of the initiative like on skills/training and smart city are still in starting phase and will be reported next year. These parts have been delayed and affected by the logistic difficulties imposed by the COVID situation.

2.3 Creation of raw material refining capacity

The European battery value chain being build is a lot centered around the lithium-ion Battery and the demand is picking up very fast. Hence, it is no surprise that the need for raw materials to make these batteries is increasing at a very rapid pace. The curve below shows an indication of the need for lithium and on a regular basis this curve is adjusted upwards due to the increasing need.

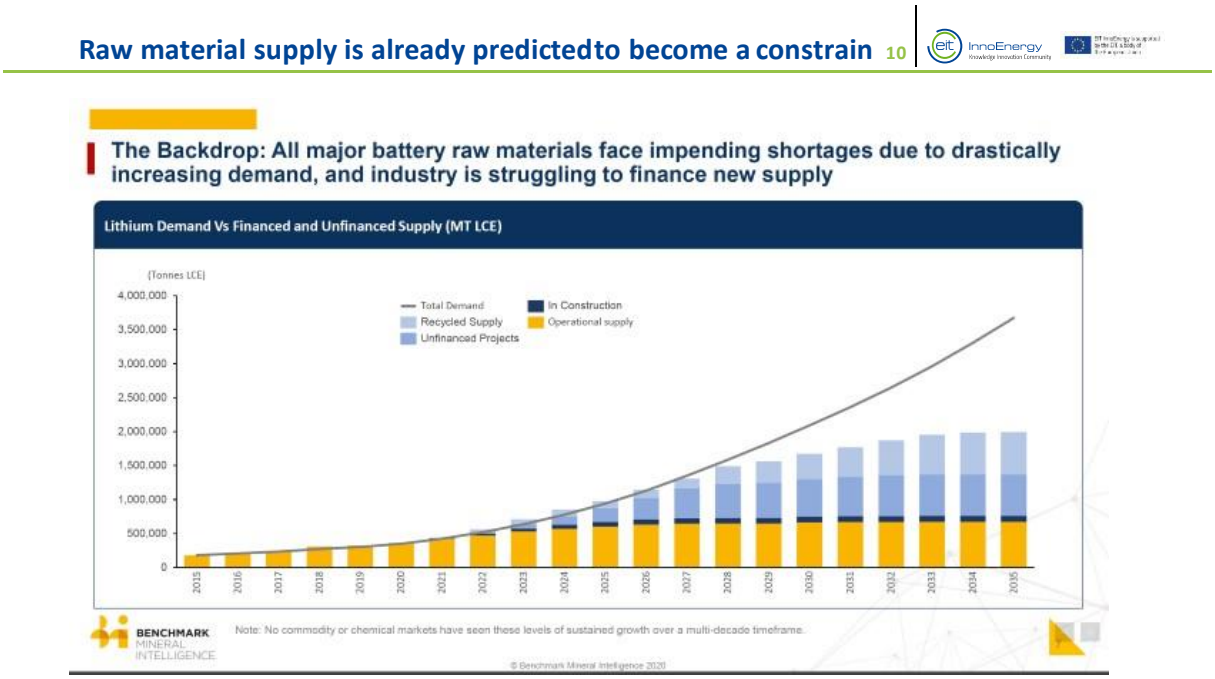

Figure 8. Supply vs demand forecast of lithium

This projection of ever-increasing demand and also the key EBA objective described above in chapter 1 to secure the access to raw materials makes it highly important to do so in a resilient way, i.e. in a way so that the supply chain is resilient and is not likely to be disturbed by geopolitics, or pandemics which has recently been the case.
This makes it more and more interesting to ensure a supply chain of, for example lithium, that is within the control of the European market i.e. inside the EU.

For this reason, large European cell manufacturers have initiated the work to secure precisely this- a European lithium supply chain.
There are several lithium mines however these are relatively small in relation to outside EU suppliers.
In comparison, the refining plant needed in order to produce the battery grade lithium from the lithium concentrate produced by the mines is relatively expensive unless combined for more than one source of lithium concentrate.

EIT InnoEnergy has engaged with one of these cell manufacturing companies in order to study the possibility to make a refining plant that serves more than one mine.

At this point in time, the work is concentrated in optimizing the costs of energy, transport logistics, availability of type of lithium concentrate and choice of refining technology to find the optimum refining plant solution and its location.

So far, a couple of working hypotheses have crystallized and even lead to visits to potential plant sites in Europe. However, more work is needed in order to finally decide on the best solution

The conclusions on the ongoing work are likely to be revealed in the next 6 months.

2.4 Creation of national cell manufacturing plant

In response to the dramatically increasing need for batteries to support the transformation of the European Automotive industry, EIT InnoEnergy has taken the initiative to found a new startup company in Battery Cell Production. The company, VERKOR, has now been officially launched and EIT InnoEnergy has currently two members in the Advisory Board.

The strategy to build VERKOR has significant similarities with Northvolt and therefore sharing these experiences on a regular basis is important for VERKOR. Some of the lessons learned from Northvolt and FREYR have resulted in:

- Close and trustful cooperation between VERKOR management and EIT InnoEnergy
- Competence hiring from day one
- Strong industrial partner established early
- Strong advisory board established early
- Political support established early
- Off-takers established early
- Initial contacts with potential partners in the battery industry

Verkor was established during 2020, is based in France and has secured the core team of staff with the right drive and experience to during 2021 take key steps on their roadmap to building a Lithium Ion battery Gigafactory at a optimal location in France.

The vision of Verkor is shown in the picture below. For further information, please refer to Annex I.

3

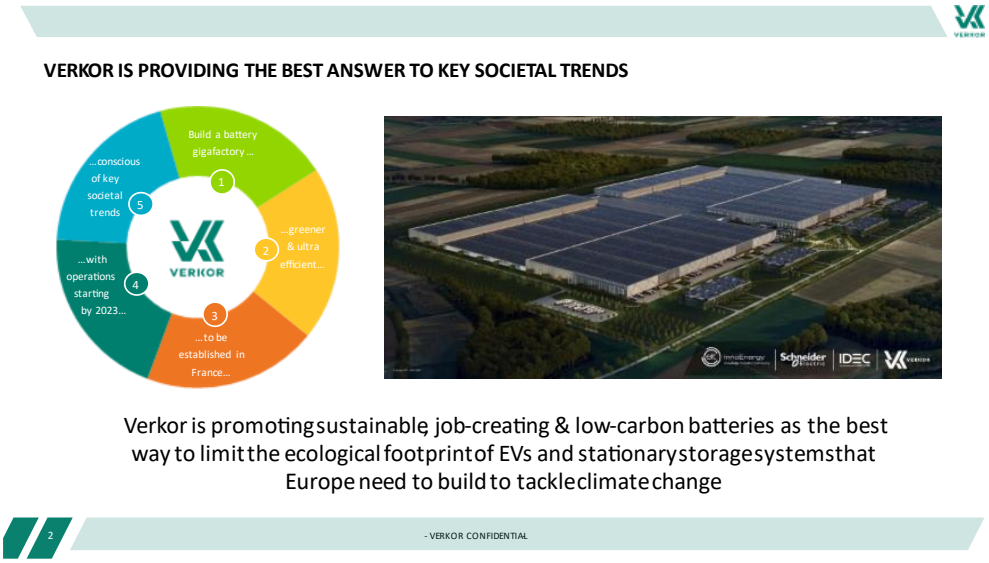

Figure 9. Vision of Verkor – Cell manufacturing plant in France

3 Conclusions

In October 2017, EIT InnoEnergy got the mandate from the Vice-president Maroš Šefčovič of the European Commission to lead the implementation of the EBA. The objective of the EBA is to capture the annual 250B€ new business across the battery value chain – from mining to recycling – in Europe by 2025.

The core objective is to build this competitive and sustainable European battery industry and to do that a complete value chain approach has been adopted from the start.
By following the overall goals as specified in the EBA action plan for batteries various initiatives are possible and fit into the context of EBA.

The four described in this report are all connected to the EBA overall goals of building this European Battery Industry. The four examples are not exclusive and can, with advantage, be adopted and applied to other parts of Europe or elsewhere.

In summary, all are cooperative and tend to find synergies and advantages for the good of the bigger industry.

By taking the complete value chain approach the resilience of the value chain and its individual parts are strengthened and builds up a bigger industry.

Annex I

EIT InnoEnergy, Schneider Electric and the IDEC Group invest in Verkor to accelerate the industrial momentum in battery-cell manufacturing in France and serve the European market (especially west and south of Europe).

Battery-cell manufacturing needed for the European market

The European Commission has accelerated the market roll-out of electric vehicles (EV) by the private sector, setting increasingly strict CO2/km standards and heavy and dissuasive penalties for failure to comply with these standards. The number of new electric models available on the market has since risen to 175 in 2020 compared to 50 in 2018, we are convinced that the battery electric vehicle (BEV) market is set to explode over the next few years. The reasons for this are simple. In addition to shifts in regulations, the economic advantage of vehicles over their thermal competitors will extend to more and more users (largely owed to more affordable batteries), and the adoption of these models will rise as more users share their experience (as was the case on the SUV market). It is impossible to predict what the market will look like in 2025 or 2030. As with renewables which already reach 50% in 2030, reality will consistently exceed expectations, and we know that as much as 25% of sales in the first quarter of 2020 for a model like the Peugeot 208 – the 2020 Car of the Year - were for its electric version, to the manufacturer's surprise.

Against this backdrop, projects to build battery-cell gigafactories are already numerous in Europe, and especially in northern and eastern Europe, with Germany making up most of the projects. For the southern European market (France, Italy and Spain), a conservative estimate of 1.4 million cars will need 85 to 100 GWh of battery cells by 2030. A more dynamic market assumption, based specifically on the gradual ban of petrol-car sales, puts the electric market share at 60% by 2030, representing 170 GWh for this region alone. Yet, only one project using disruptive technology has emerged in the sub-region at this stage. Therefore, there is room for other capacity-generating projects.

France has the ideal geographic position to address this need

France already has a robust battery-cell manufacturing ecosystem. It is home to sector heavyweights including Total, via its subsidiary Saft, Eramet, Arkema, Orano, Snam, Forsee Power, Renault and PSA. The French Alternative Energies and Atomic Energy Commission (CEA) has already developed a pilot line for its R&D. Numerous initiatives are in progress. Moreover, France has a major advantage over Italy and Spain: comparatively cheaper and carbon-free electricity. It is also centrally located in Europe, offers an attractive specialist job market, as well as a highly-qualified workforce that is drawn to industrial professions.
Like Sweden, France can manufacture its own batteries with a carbon footprint that is four times smaller than that of Poland and China. The cost of labour represents only 5 to 8% of total cell cost, and while it must be kept in check, it is in no way a deterrent. It will in fact be offset by the 4.0 optimisation of manufacturing processes (digital manufacturing, big data, IoT) to significantly improve margins and revenues while curbing production losses.

Verkor: a startup bringing together battery experts, and operating as a fast follower to strive for manufacturing excellence while optimising existing technology

Verkor is a team of professionals with rich and extensive experience in industry, the automotive sector, battery-cell manufacturing, financing and technological ecosystems.
Verkor was created for the express purpose of carrying out a detailed feasibility study in order to align the necessary conditions to launch the construction of a gigafactory from 2022. So far, the team has already:

- started recruiting seasoned experts on an international basis;
- begun drawing up the plans for the future factory;
- launched an open-innovation lab project to immediately implement the planned technical innovations;
- gathered strategic partners for supply, offtake agreements, and technology;
- started assessing land options.

Verkor: a bold vision to manufacture carbon-free batteries locally

Verkor will begin outlining the first French battery gigafactory for electric vehicles and storage.
The factory's capacity will be clearly defined before increasing in line with market dynamics: 16 GWh in the first phase with capacity to increase to up to 50 GWh, on 100-200 ha of land with a facility of 300 to 500,000m2. There will be between 2 and 3,000 direct jobs in the first tranche, and €1.6bn to €3bn in investment from 2022 at the latest.
To transform this vision into reality, in the short term Verkor needs to:

- hire the best people. By the end of 2020, Verkor will have 20 to 30 specialists from diverse fields on its payroll. In 2021, around 70 people will be required to bring the project together, and then 300 in 2022 to build the factory (not counting the high number of indirect jobs)
- select two or three pieces of land and carry out all the socio-technical-economic assessments before making a final decision over the course of 2021
- optimise the industrial parameters of the factory using the latest modelling methods.
- sign the trade agreements spanning the entire value chain (raw materials, energy, end products)
- Prepare the investment roundtable.

Verkor
Carbon-free. Digital. Circular. Inclusive.
An open, future-ready model to address the new needs of society.

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