STORY

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Deliverable 9.7
STORY Deployment Oriented Reports

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Project STORY - H2020-LCE-2014-3

STORY

Table of contents

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Project STORY - H2020-LCE-2014-3

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Project STORY - H2020-LCE-2014-3

Executive summary

This document presents the STORY project's work towards the Specific Deployment Oriented Reports. These deployment-oriented reports are meant to cover topics emerging from the interactions with the stakeholders.

In this document, STORY's approach to the creation of impact through interactions with stakeholders is described, together with the main outcomes. These outcomes cover the results of reviews and discussions on the experience accumulated through the STORY technology demonstrations of energy storage in a variety of settings (residential, industrial), both within the project consortium as well as with stakeholders and experts brought together as the STORY Advisory Board.

Furthermore, at several stages of the STORY project, reflections have been organised aiming to identify project outcomes that have the potential to become a marketable product or service. These so-called exploitable results were not restricted to the STORY technology demonstrations as such but have emerged from the wealth of experience accumulated by initiating and operating these technology demonstrations, as well as the creative interactions between project partners and Advisory Board members.

The focus is on the outcomes of reflections, organised at several stages of the STORY project, that were aimed at identifying project outcomes that have the potential to become a product or service than can be commercialised. These so-called exploitable results emerged from the wealth of experience accumulated by initiating and operating these technology demonstrations, as well as the creative interactions between project partners and Advisory Board members.

This document highlights the process put in place within the STORY project to help partners focusing and moving forward their key exploitable results. This document shows that starting from general ideas about what the key exploitable results from STORY could be moved towards concrete products and services ideas that will be, or already are on the market. The input of stakeholders through the Advisory Board meetings and final stakeholder workshop and closing event was instrumental and helping STORY partners thinking about the KERs and seeing the potential value of these KERs in potential markets.

This document covers the outcomes of these reflections, with a particular emphasis on four products and services that have been identified as "Key Exploitable Results".

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1 Introduction

This document is part of the deliverables of work package 9 of STORY. The focus of WP9 is on achieving impact on a common understanding of energy storage, its meaning and potential in the low and medium voltage grid as well as to ensure that the climate for deployment is created. More specifically, deployment is set up to increase the market uptake of storage as a solution for grid challenges. Reaching this objective is obviously not the outcome of one specific work package, but rather the integrated result of the project as a whole, as well as the cooperation with other projects, with EU grid operators, regulatory bodies and policymakers, etc.

In STORY, the deployment-oriented tasks aimed at:

- setting up a strong and relevant stakeholder group
- setting the stage for the Projects Council (coordinators of other LCE6-10 2014-2015 projects, later organised as BRIDGE co-operation), assuring the creation of a constructive collaboration
- assuring the relevance of project outcomes through yearly stakeholder workshops
- deriving common LCE6-10 deployment chapters for industry, policy and regulation and more generally oriented towards a broad spectrum of stakeholders.

Within the WP9 tasks that had been defined to reach these objectives, the focus of Task 9.9 was on “Creating long term impact”, with subtasks related to the organisation of:

- Advisory Board meetings (Subtask 9.9.1)
- European and national stakeholder workshops (Subtask 9.9.2)
- Projects Council meetings (Subtask 9.9.3)
- Final stakeholder workshop (Subtask 9.9.4)

Furthermore, the development of an overall replication plan is dealt with by Subtask 9.9.5.

A number of project deliverables link to these tasks and subtasks. One deliverable in particular relates to this document: Deliverable D9.7: Specific Deployment Oriented Reports. These deployment-oriented reports are meant to cover topics emerging from the interactions with the stakeholders.

The related task in WP9 were led by Prospex Institute who were supported by all STORY partners in the implementation of the activities described below. The practical organisation and design of the meetings was done by PI, while other STORY partners actively contributed content for the meetings as well as participated to these to exchange with stakeholders and present the material they contributed.

In this document, STORY's approach to the creation of impact through interactions with stakeholders is described, together with the main outcomes. In this statement, the terms “stakeholders” and “outcomes” need to be specified:

- the term “stakeholders” in general refers to parties that (can) have an impact or can/will be impacted by (the objectives of) the project. For the purpose of this document, the following distinction needs to be made:
  - the stakeholders of the respective STORY energy technology demonstrations

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- the specific group of stakeholders that have been brought together as the Advisory Board
- additional stakeholders that might be identified through the reflections on the STORY technology demonstrations, broader project outcomes, or relevant to the energy storage as a general matter

the term “outcomes” refers to the learnings and achievements of the STORY technology demonstrations, but also to the exploitable results that have been identified during the course of the project.

After this introductory chapter, this document is structured as follows:

In Chapter 2, the approach to the deployment of outcomes of STORY is presented.

Chapter 3 covers a number of opportunities and challenges that have emerged from the interactions with the stakeholders.

In Chapter 4, the approach that led to the identification and further elaboration of STORY’s Key Exploitable Results is explained.

The remaining chapters 5 to 8 focus on one particular Key Exploitable Result and constitute specific deployment-oriented reports, for each of these Key Exploitable Results.

2 Approach to the deployment of STORY outcomes

2.1 Introduction

In this chapter, the approach taken to create (lasting) impact based on the outcomes of STORY is laid out. The outcomes presented in the subsequent chapters have been achieved through the processes and with the structures presented in this chapter.

Note that the focus is not on matters and project outcomes covered by other project work packages and associated deliverables. In fact, for a comprehensive overview of the various aspects related to creating impact - at the technology level, the regulatory level, newly developed insights with regards to business models, etc. - it is recommended to consult the deliverables and reports that address these specific areas.

Obviously, the creation of impact of STORY cannot be disconnected from the STORY technology demonstrations. Indeed, within the STORY project, 6 different demonstration cases for energy storage in different settings - covering industrial and residential environments - and with different local and small-scale storage concepts and technologies, have been initiated and operated. These cases are presented in Figure 2.1. For more information on the cases, the technologies applied as well as the obtained results, reference is made to other STORY reports and deliverables.

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Project STORY - H2020-LCE-2014-3

Figure 2.1. The 6 STORY cases to demonstrate energy storage technologies in different residential and industrial settings.

In this document, the focus is on the outcomes of reflections, organised at several stages of the STORY project, that were aimed at identifying project outcomes that have the potential to become a product or service than can be commercialised. These so-called exploitable results were not restricted to the STORY technology demonstrations introduced above but have emerged from the wealth of experience accumulated by initiating and operating these technology demonstrations, as well as the creative interactions between project partners and Advisory Board members.

In this chapter, more information is given on:

- the STORY Advisory Board
- the learning cycle leading to the identification and evaluation of exploitable results
- within this cycle, the associated process that resulted in the identification of key exploitable results
- as well as the role of the Advisory Board at various stages, and more specifically in the evaluation of these key exploitable results

2.2 The STORY Advisory Board

In addition to the generic internal project governance structures and bodies typically created for the management of large projects (project management team, steering committee, work package team meetings), STORY has created an additional project body consisting of members that are external to the project (hence no consortium members). This body, the Advisory Board, comprises experts and

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stakeholders in the field of energy storage, more specifically from the perspective of the implementation and larger roll-out of energy storage technologies.

The purpose of the Advisory Board is to act as a sounding board for STORY as a project, and more specifically for the STORY energy technology demonstrations, by providing feedback and direction, in order to increase the (industrial) relevance of project activities and outcomes, and by contributing to identifying and evaluating exploitable results (see Figure 2.2).

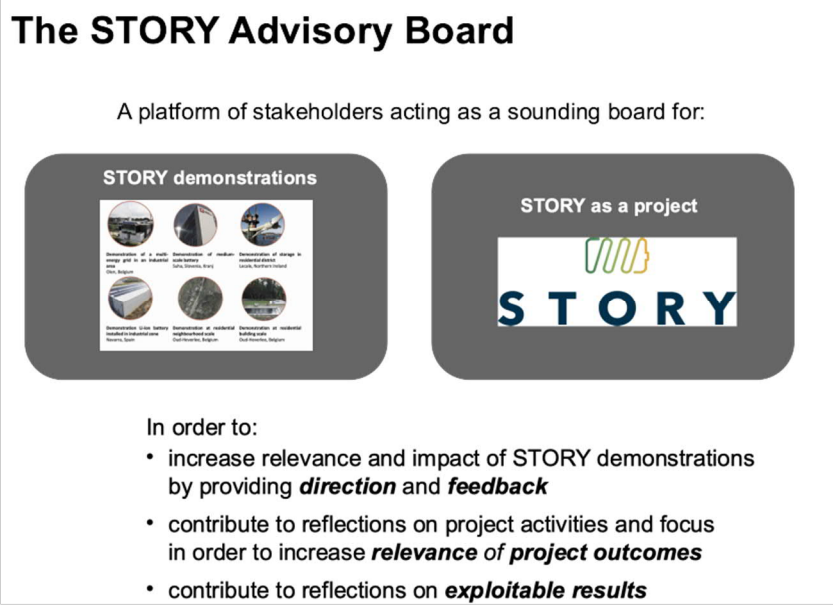

Figure 2.2. The STORY Advisory Board.

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It should be noted that the composition of the STORY Advisory Board was defined and managed (to the extent possible) as to have a balanced representation from a variety of stakeholders (industry, research, civil society, public institutions, etc.). Furthermore, efforts were spent on avoiding over- or under-representation with respect to the position in the energy value chain, the geographic representation across Europe, as well as gender. Finally, the composition was not fixed for the duration of the project but was optimised as a function of the objectives of the meeting at hand as well as the project phase - see Figure 2.3.

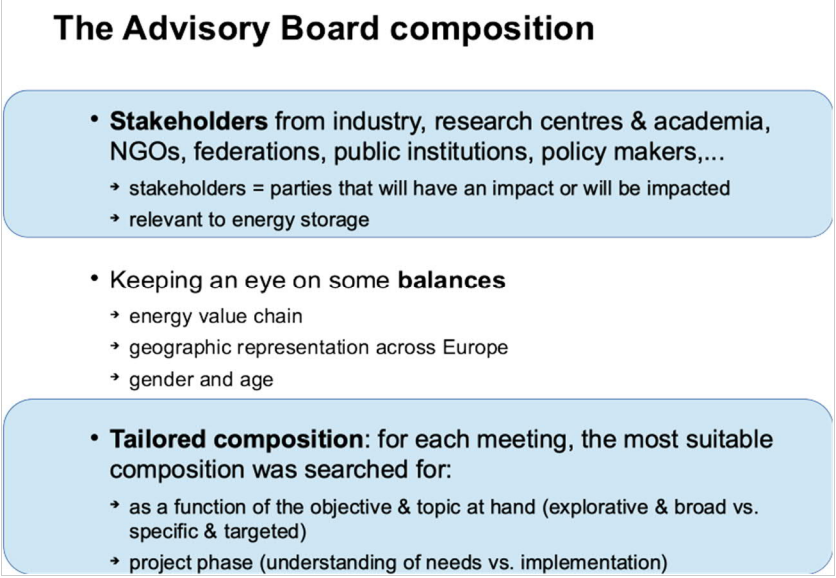

Figure 2.3. The composition of the STORY Advisory Board.

In Table 2.1, an overview of the Advisory Board meetings is given.

Table 2.1. Overview of the STORY Advisory Board meetings.

Meeting	Date	Location	Focus
Advisory Board Meeting #1	June 2016	Espoo (Finland)	Identifying and exploration of needs, opportunities and challenges for energy storage. Exploring the STORY project design and the STORY technology demonstrations.
Advisory Board Meeting #2	April 2017	Leuven (Belgium)	Review on the STORY technology demonstrations Business preconditions and network tariff design

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Meeting	Date	Location	Focus
Advisory Board Meeting #3	April 2018	Ljubljana (Slovenia)	Review and feedback on the STORY technology demonstrations. Identification of opportunities, applications and markets for the STORY technology demonstrations. Exploration of value blueprints and business model canvas of selected applications of the STORY technology demonstrations.
Advisory Board Meeting #4	August-September 2020	online	A range of online sessions, each focussing on one specific key exploitable result. Objective: discussing and hypothesis testing of the key exploitable results.
Advisory Board Meeting #5	October 2020	online	The last Advisory Board meeting was organised as part of the Final Stakeholder Workshop and Closing Event of STORY. This event looked at various critical issues for the roll-out of local energy storage in the future and also served as a platform for STORY partners to showcase products and services they developed or fine-tuned as part of the STORY project.

More detailed information on the composition of the Advisory Board meetings is provided in the respective reports. The Advisory Board meetings were designed and facilitated by Prospex Institute

2.3 The learning cycle leading to the identification and evaluation of exploitable results

During the STORY project, the information continuously accumulated through the design, initiation and operation of the 6 STORY technology demonstrations was treated as a valuable source of experience and knowledge, which was exchanged and discussed within the project consortium as well as the Advisory Board.

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This interplay between the teams working on the technology demonstrations, the project consortium and the Advisory Board, created a learning cycle, as depicted in Figure 2.4.

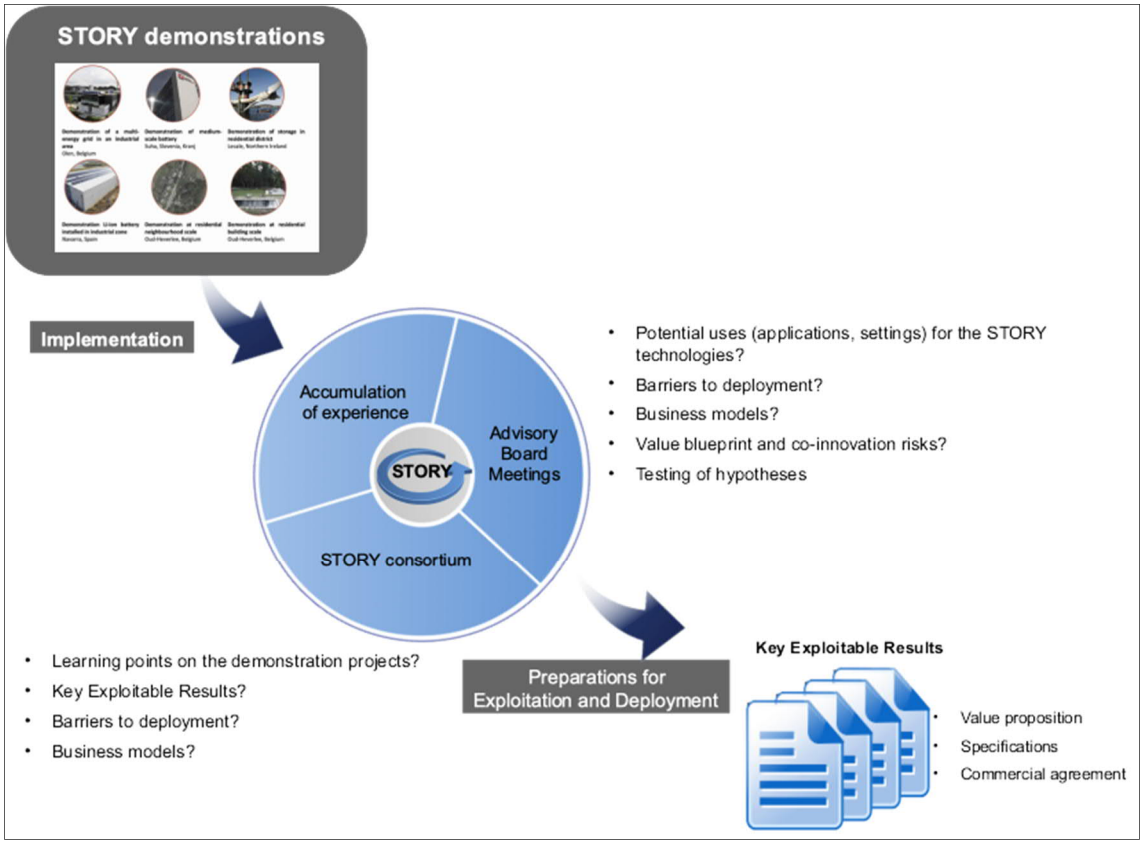

Figure 2.4. Graphic representation of the learning cycle leading to the identification and evaluation of STORY Key Exploitable Results.

As the project progressed towards completion, the nature of the discussions within the consortium and the Advisory Board shifted - from an initial focus on exploration and problem solving to a focus on identifying and evaluating applications, markets and (key) exploitable results in the final stages.

2.4 Reflections on key exploitable results within the STORY project consortium

Reflections on how to create impact based on the outcomes of STORY have been part of the discussions within the consortium, basically at each stage of the project. However, on two specific instances, the STORY consortium went through a brainstorming session (organised internally) in order to identify:

- products or services associated to the STORY technology demonstrations, that showed promising potential to be commercialised (and for which the STORY experience would constitute a considerable lever)

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- in a broader sense: knowledge accumulated during the STORY project that could potentially be transformed and valorised as commercial products or services - even if these products or services would not be associated to the STORY technology demonstrations strictly speaking.

In Table 2.2, an overview of these meetings is presented.

Table 2.2. Overview of the STORY internal meetings on KERs.

Meeting specifics	Date	Location	Focus
STORY consortium meeting, session facilitated by Prospex Institute	October 2017	Graz (Austria)	Exploring STORY outcomes in order to identify knowledge and experience that has the potential to become exploited.
STORY consortium meeting, session facilitated by META, as part of the Support Services for Exploitation of Research Results (SSERR)	October 2019	Belfast (Northern Ireland)	Identification of key exploitable results Exploration of selected key exploitable results, in terms of problem-customer, product-market, business model, pitch

These two sessions were instrumental to the identification and subsequent elaboration (in 2020) of the key exploitable results that are presented in chapters 5 to 8 of this document.

2.5 The role of the Advisory Board in the review of the key exploitable results

As shown in Table 2.1, each Advisory Board meeting served to exchange experiences and review STORY outcomes, with a particular eye on the (large-scale) implementation of energy storage technologies.

Three specific Advisory Board meetings should be singled out, when considering the exploitation of STORY outcomes (see Table 2.1):

- the meeting held in Ljubljana, April 2018, during which a brainstorming session was held to identify, discuss and explore applications and markets for the technologies used in the 6 STORY technology demonstration cases
- the round of online Advisory Board meetings, organised in August-September 2020, in which the Advisory Board members acted as a sounding board to review the key exploitable results presented by STORY partners.

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- The final stakeholder workshop and closing event (5th Advisory board) which served as a platform for STORY partners to showcase their products and services developed or fine-tuned as part of the STORY project.

While the first of these meetings was explorative in nature, the second was firmly aimed at testing hypotheses and collecting specific feedback, on a market offering that was elaborated by the STORY partner while the 3rd one was meant as an opportunity for partners to showcase their products and services to a wide audience.

3 Opportunities and challenges emerging from interactions with stakeholders

3.1 Opportunities and challenges for energy storage

During the first STORY Advisory Board meeting, held in Espoo (Finland) in June 2016 (see Table 2.1), a brainstorming session was organised with the purpose to identify:

- needs and opportunities for energy storage technologies, as seen from the market place in which they are active and have experience and area of work of the Advisory Board members
- obstacles and challenges that prevent energy storage technologies from realising these opportunities, again as seen from the experience of the Advisory Board members.

This brainstorming session was held when the project was in its initial stages, and before the Advisory Board members were informed on the STORY technology demonstrations.

The answers were subsequently clustered in themes, or issues. In Table 3.1, an overview of the clusters is presented, together with the underlying opportunities and challenges. Furthermore, the colour coding indicates if a cluster theme is covered by the STORY project (green colour), not covered (red colour) or that further consideration was needed at that stage (blue colour).

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Table 3.1. Overview of the main issues related to energy storage technologies as identified by the Advisory Board members. The issues have been identified as themes for clusters of opportunities and challenges. (extract from the report on the first Advisory Board meeting)

Market Design	*Opportunities* • Connecting market areas • Aggregators • Capacity markets • Market structure(s) + regulatory framework for operating storage *Challenges* • Operational requirements • Lack of market model • Liquid markets • Acknowledge additional value (responsiveness • Focus on profitable cases (Noxx) • Lack of level playing field • Fair market design • No market pull (end user) • Missing economics without subsidizing • Heat markets are undefined and do not favor distributed assets • Business models (where's the money) • Subsidies / incentives • Market structures do not fit with new technologies (e.g. definitions for balancing markets • No market design for trading with local storage to optimize grids. Storage is not an allowed component in grid investment
Network Management	*Opportunities* • Neighbourhood energy balancing • TSO Network balancing • Voltage support on distribution net • Load following • Frequency regulation • DSO small scale reserve • Provision of reactive power • (Office) buildings demand response • Super markets (solar local) + demand side • A part of LVDC solutions *Obstacles* • OPEX vs CAPEX for DSOs => no incentive to reduce costs • Legacy infrastructure • Legacy IT systems • IT security • No standard for information exchange to operate distributed storage • Control (comms) tech & cost • System complexity & control • Lack of standards / interoperability • Integration of technologies • Storage connection costs are high

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Project STORY - H2020-LCE-2014-3

Network Cost	*Opportunities* • Cut transformer peak loads • Option to reinforce distribution grid • Contribution to flexibility in energy system • Reducing grid investments => flexibility • Remote location grid access enabling • Reducing peak demand (offset high cost)
Regulatory	5 sub clusters: 1. *EU Level Playing field* *Opportunities* • Differentiated per country – ability + needs • Creating EU level playing in regulatory framework 2. *Barriers in taxation / tariffs* *Obstacles* • Lack of fair grid tariffs for storage
	• Double taxation • Net metering kills business case • Regulatory obstacles (e.g. taxes + surcharges) 3. *Agility (partially being addressed – partially to be considered)* *Opportunities* • Asia-Europe speed! *Obstacles* • Regulatory jungle leading to small scale • Network regulation to be updated • From vision to strategy formulated? • Regulatory risk / synchronize with local / EU regulation / fast market • Regulatory slowness • Regulation as enabler? 4. *Division of roles* *Opportunities* • Need clear role for storage in regulatory framework • Need clear role for DSO related to storage in regulatory framework *Obstacles* • Meeting commercial interests of individual stakeholders 5. *Boundary of roles* *Obstacles* • Protectionism • DSO unbundling is incomplete – risk of market distortion • Sharing of storage in a community is not allowed • DNO liability • DSO needs are local – what if market won't provide • Competition by grid operators • DSOs: allow to own, use, operate storage • DSOs possibility to own and operate storage facilities • DSOs should NOT be allowed to own + operate storage • Kickstart role DSOs

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Project STORY - H2020-LCE-2014-3

Change	*Obstacles* • Raising awareness – education • Resistance to change – "never change a winning system'
Longterm – shortterm mismatch	*Obstacles* • Consumer solutions vs professional solutions • Warranties (suppliers) • Long guarantees (15 years) in DSO / TSO systems
Innovation / Business Models	*Opportunities* • Need medium / large scale demos of new technologies • Minimizing societal cost of energy transition • Reliability (insurance) • More economics => supports storage • Reduce costs of technology • Africa / Asia • Locality (industry as energy production) • Interim product management in industrial processes *Obstacles* • Storage solutions are designed for 1st world problems • Cost sharing models for multi-use storage do not exist • Reducing cost per kWh / kJh • Storage technologies have high unit costs • Cost of storage technologies outweighs market benefit • Yet to become (mostly) economic • Industry / regulator forget end-customer • Additional transaction cost vs lower cost to end-user • High cost of technology • Cost of storage (economies of scale)
Legacy Business Models	*Obstacles* • Legacy business models • Fear of devaluing storage capacity of vehicles • Lobbyists? Stakeholders? Winners / losers?
Access to funding / capital	*Obstacles* • Lack of funding for small entities (SMEs) • Investor appetite for risk • Investment stability • Derisking investment • Payback expectations (investors) • Investor understanding (risk)
CO2 Targets	*Opportunities* • Renewable energy production • Buffering solar / wind • Optimise PV • Wind & renewables • Reaching climate targets (helping deployment of RES) • Match demand & production • Heat network balancing with residual heat • Intermodal energy conversion

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Project STORY - H2020-LCE-2014-3

	• Maximise efficiency in renewable energy *Obstacles* • Dimension of electricity storage • Environmental concerns • Lack of large scale seasonal storage • Sub-optimisation with self-consumption & grid dependence
Definition	*Obstacles* • 'Double' charging (network charges + levies) • Lack of license category • Definition ⇔ ownership • Quantify value across system • Regulatory uncertainty • Lack of understanding about the systemic value of storage in community • If technology – which? • Storage is the same as or different from production? (Double tax) • Technology or LCE market driven?
Safety	*Obstacles* • Safety: end user, DSO, IT, etc. • Standards + lifetime safety
Transport	*Opportunities* • Vehicle Charging Station boosting • Environmentally friendly transport / ships • Mobility / vehicles • Electric vehicles => CO2 reduction • Vehicle 2 Grid (V2G) *Obstacles* • Vehicles are not interconnected • Charging stations to no have V2G capabilities built in • The rail network is disconnected from the overall network • Railways face transmission losses if participating in other grids
Grid – Security of Supply	*Opportunities* • Network Quality • European perspective in grids • Increase quality of supply & security • Balancing generation asset output • Infrastructure security / reliability • Grid stability => primary responses • Grid level • Manage interruptions
	• Peaker units => increase generation cost • For DSOs to ensure security of supply and grid stability • Security of supply • Energy security (no need for Gazprom) • Africa (large grid) • Buffering small scale hydro generation
Unclustered	*Obstacle* • Uncertain technology landscape

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Project STORY - H2020-LCE-2014-3

The following three themes were considered of major relevance to the STORY project:

- Market design
- Network management & network costs
- Regulatory aspects.

Subsequently, each of these three clusters were analysed by the Advisory Board members in terms of:

- What is the cluster about - main opportunities and challenges?
- How can STORY contribute to address these opportunities and challenges?

In Figure 3.1, an impression of the type of outcome (partial results) that was created is presented.

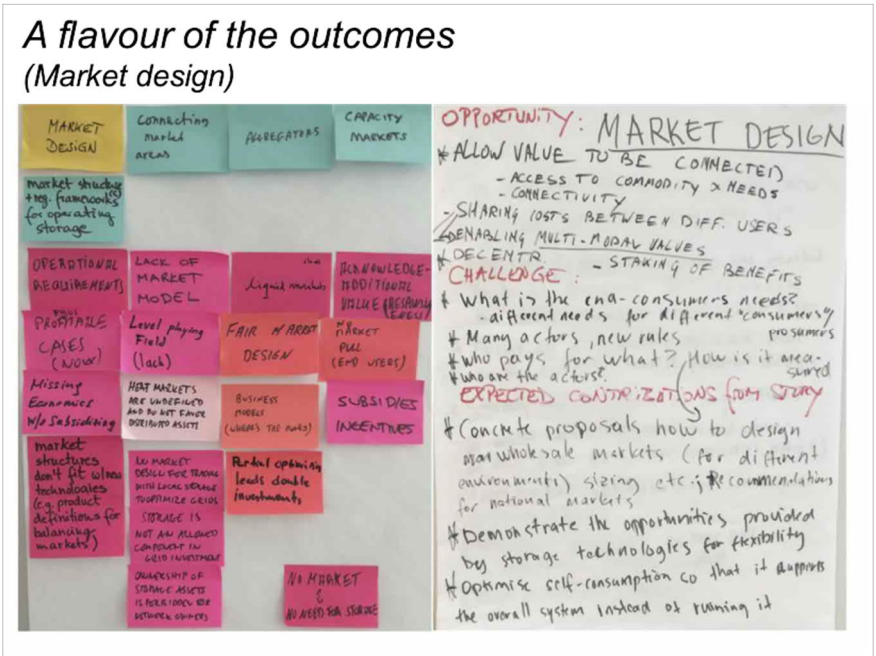

Figure 3.1. Impression of the analysis of the cluster theme "Market Design" (partial outcome).

3.2 Potential applications and markets for the STORY Technology Demonstrations

During the third STORY Advisory Board meeting, organised in Ljubljana (Slovenia) in April 2018 (see Table 2.1), a brainstorming session was organised with the purpose to identify applications and markets for the STORY technology demonstrations.

Impressions of the type of outcomes are presented in Figure 3.2 (applications and markets).

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Project STORY - H2020-LCE-2014-3

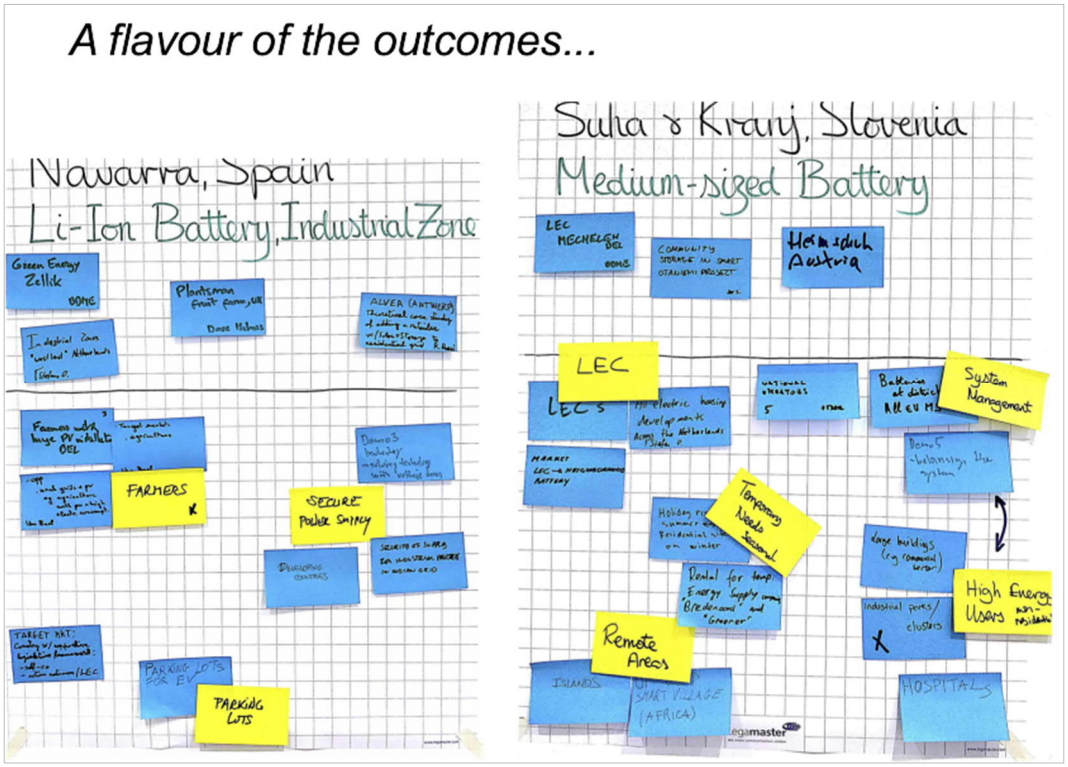

Figure 3.2. Impression of the brainstorming on opportunities and potential markets and applications of the STORY Technology Demonstrations.

The list of potential markets and applications that have been identified is presented in Table 3.2.

Table 3.2. Overview of the potential markets and applications identified for each of the 6 STORY Technology Demonstrations during the third Advisory Board Meeting.

STORY Technology Demonstration	Potential markets and applications
Demo 1 & 2 - Residential building (Oud-Heverlee, Belgium)	• Local Energy Communities, with application of a variety of energy storage technologies
Demo 3 - Li-ion battery in an industry zone (Nevarra, Spain)	• Farmers • Parking lots • Secure power supply
Demo 4 - Compressed air (Lecale, Northern Ireland)	• Remote communities • Former mining areas (existing infrastructure) • Hydraulic wind turbines + CAES (avoids electric losses) • CAES for decreasing RES variability

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STORY Technology Demonstration	Potential markets and applications
Demo 5 - Medium-sized Battery (Suha & Kranj, Slovenia)	• Local Energy Communities (LEC) • Temporary / seasonal needs • Remote areas • System management • High energy users (non-residential)
Demo 6 - Wood fired Boiler, coupled to ORC (Olen, Belgium)	• Other waste streams (instead of waste wood) as fuel • Food manufacturing industry • Olive oil production (agricultural waste) • Cattle farms (in combination with biogas digester)

For some of these applications, a further brainstorming was organised, more specifically to:

- map and analyse the ecosystem of actors that would need to be aligned for that specific application. To this extent, the concepts of Ron Adner[1] with respect to the value blueprint, with co-innovation and adoption chain risks, have been used
- develop a preliminary business model for that application or market. For the analysis of the business model, the Business Model Canvas, as proposed by Alex Osterwalder[2] has been used.

Impressions of these are presented in Figure 3.3 (value blueprint with indication of risks, for the application of Local Energy Communities), and Figure 3.4 (business model canvas for the case of Renewable Energy Supply for cattle farms).

1 The Wide Lens, a new strategy for innovation, Ron Adner
2 Business Model Generation, Alex Osterwalder and Yves Pigneur, Wiley (2010)

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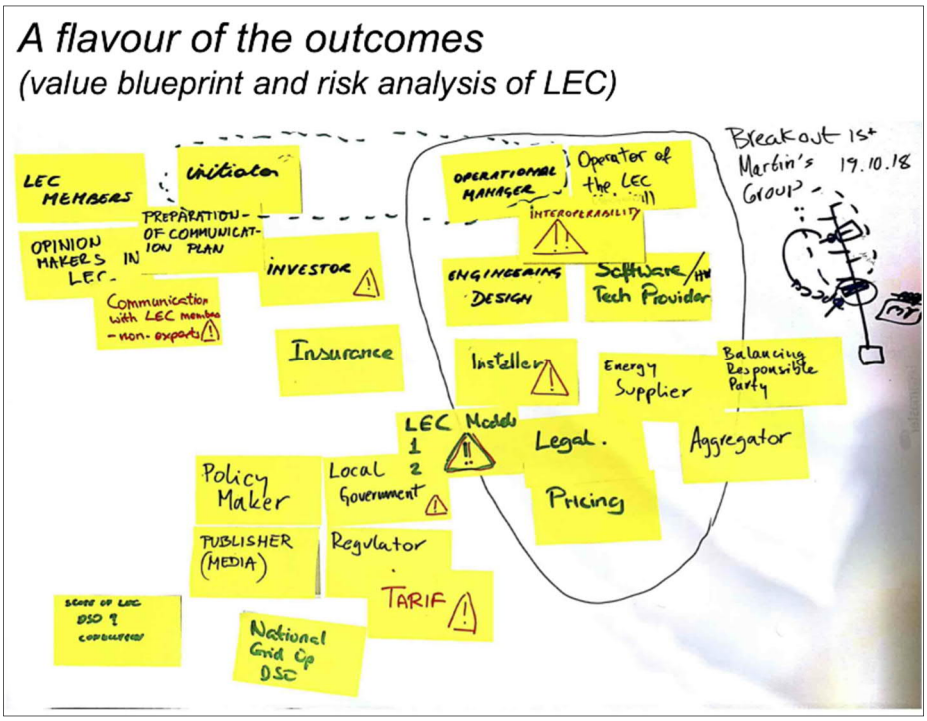

Figure 3.3. Outcome of the exercise on the value blueprint, for Local Energy Communities (third Advisory Board Meeting).

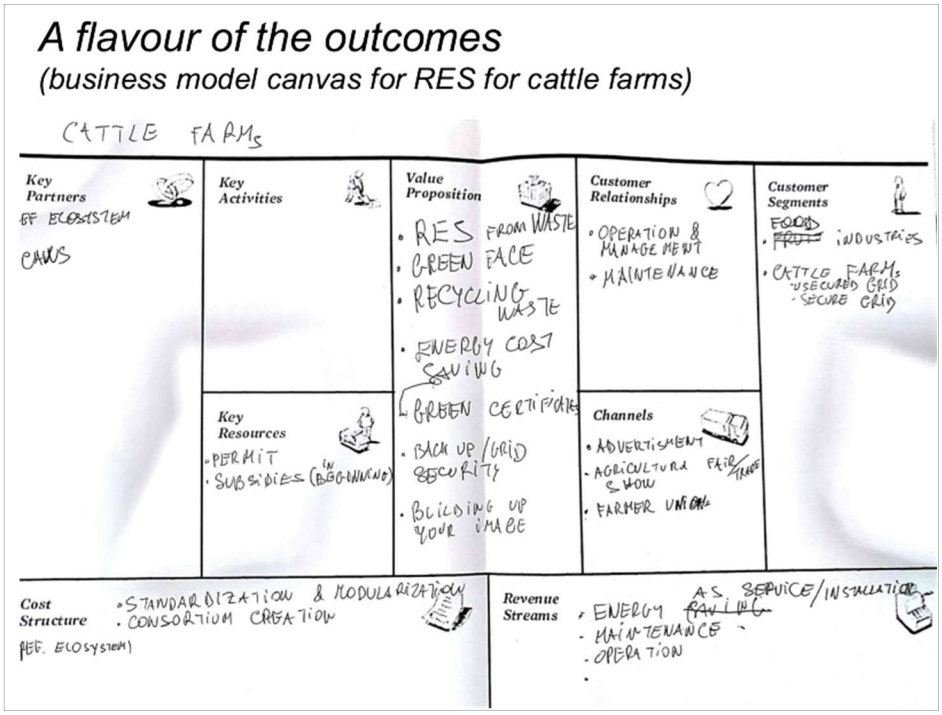

Figure 3.4. Outcome of the exercise on the Business Canvas Model for the application of energy storage in cattle farms (third Advisory Board Meeting).

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Project STORY - H2020-LCE-2014-3

These exercises contributed to a better understanding of the stakeholders associated to the adoption, deployment and exploitation of energy storage technologies, as it became clear that the list of stakeholders is much larger than a list of those identified from a narrow supplier-customer perspective. It indeed includes authorities and instances that have to deliver permits, insurance companies, investors, media, opinion makers, policy makers, installers, regulators etc.

Obviously, as these outcomes were the result of one brainstorming session, they cannot be considered exhaustive, nor complete or final. The main added value of the exercises was that they contributed to the identification of opportunities to deploy the STORY technology demonstrations, as well as to trigger the networking capacity of the Advisory Board members (when spotting existing opportunities).

For a more comprehensive overview of the arguments that have appeared during the discussions and the work sessions, reference is made to the report on the third Advisory Board meeting.

3.3 Issues identified during the work on the STORY Technology Demonstrations

The work carried out when initiating and operating the STORY technology demonstrations generated a wealth of experience, insights and learning outcomes. These have been reported in other reports and deliverables. In this section, some aspects have been singled out.

3.3.1 Residential applications

Many residential applications, such as (forms of) Local Energy Communities, require the support of the residents.

Often, these residents are open to the idea of energy storage as part of a picture that fits enhanced sustainability, renewable energy sources etc. Yet, the creation of a Local Energy Community goes beyond the technological aspects (the local grid, the monitoring devices, the local storage options, power generation and consumption, etc). It involves active work on the social dimension, the human side of the “community” in the Local Energy Community. This requires dedicated efforts and time.

This is certainly the case as long as interoperability issues and conflicts continue to exist. Households do not want to be bothered with technological issues regarding the provision of energy. Also, families have certain routines with regards to comfort and available energy and they have expectations to continue these routines.

This is especially the case when residents have a hassle-free alternative (e.g. the standard grid solution).

3.3.2 The need for energy technology integrators

In order to exploit the potential that can be achieved through energy storage, often different existing technologies have to be integrated. However, as suppliers of these energy technologies (understandably) reason from the perspective of their specific technology, its control logic, its

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Project STORY - H2020-LCE-2014-3

requirements and specifications, they are not always in the best position to understand what will happen when their system is coupled to another technology.

Control algorithms of different systems might interact when systems are connected, the required specifications as a stand-alone system might differ from those needed when coupled to other technologies, etc.

In fact, there is a need for parties that are able to liaise with a range of energy technology suppliers, and that have the competences to design an energy storage solution from an integrated perspective. Without these competences, the uptake of integrated energy storage solutions risks being hampered by investments that fail to deliver, resulting in negative experiences and a bad image.

4 Developing and testing Key Exploitable Results

4.1 Overview of the Key Exploitable Results

As explained in Chapter 2, a number of exploitable results have been identified, in successive and iterative stages. The most promising ones, the so-called key exploitable results, are listed in Table 4.1, together with the STORY partner that has taken the lead in the further elaboration of the idea.

Table 4.1. Overview of the STORY Key Exploitable Results.

Identifier	STORY lead partner	Key Exploitable Result
KER-1	BaseN	A platform for the Industrial Internet of Things
KER-2	VITO	Energy content of water storage tanks
KER-3	CENER	Energy management system
KER-4	B9	Excess electricity to green hydrogen

4.2 Development of the Key Exploitable Results

The 4 Key Exploitable Results have been further elaborated by developing a package containing the following elements:

- an introductory presentation to “pitch” the offering, depicting the problem being addressed, as well the offering including its benefits
- an analysis and description of the value proposition

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Project STORY - H2020-LCE-2014-3

- the list of specifications related to the offering
- indications on the proposed type of commercial agreement

When elaborating these packages, several of the learning points and models used and practiced during the meetings in Ljubljana, Graz and Belfast have been applied.

4.2.1 Pitching the offering

The introductory presentation used to “pitch” the offering depicts the problem being addressed, the target markets, how current/alternative solutions approach the problem and how the offering addresses the problem (in a better way).

4.2.2 The value proposition

In order to further elaborate the offering of the Key Exploitable Results, the Value Proposition canvas as proposed by Osterwalder[3] has been used. In essence, this model focusses on the central portion of Osterwalder's Business Model Canvas used during the third Advisory Board meeting (Ljubljana, 2018 - see Chapter 3).

In the Value Proposition Canvas, an analysis is made of the profile of the typical target customer (segment) for the offering, in terms of:

- the activities the customer is doing (relevant for the offering) (the so-called *customer jobs*)
- the difficulties or barriers the customer is experiencing when carrying out these activities (the so-called *customer pains*)
- the hopes and aspirations of the customer (the so-called *customer gains*).

Subsequently, the offering is elaborated in order to mirror the above three fields including:

- aspects/items that address the customer pains: *pain relievers*
- aspects/items that aim at delivering on the hopes and aspirations: *gain creators*
- the products and services that constitute the core of the offering as they address the customer jobs.

The resulting offer constitutes a more refined value proposition compared to a product or service that has been defined in a straight-forward manner, only considering the customer jobs. The Value Proposition Canvas is presented in Figure 4.1.

3 Value Proposition Design, Alex Osterwalder et al., Wiley (2014)

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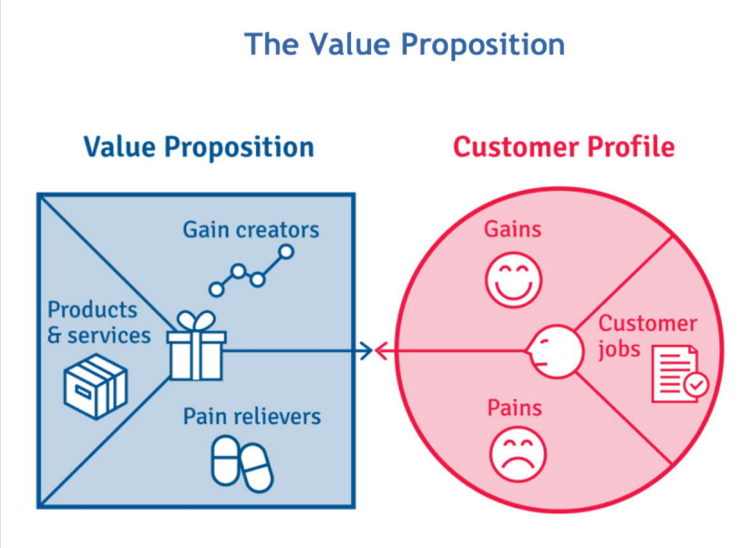

Figure 4.1. The Value Proposition Canvas used for the analysis of the offering of the Key Exploitable Results.

4.2.3 The list of specifications

The list of specification covers the market and technical specifications that are relevant for the proposed solution and the target market. These can include a.o. technical specifications (physical dimensions, performance, power, etc.), hardware requirements, compatibility or interoperability aspects, (data) protocols etc.

4.2.4 The commercial agreement

Indications on the commercial agreement cover:

- Type of transaction: sale, lease, licensing model, subscription model
- Commercial conditions: indications on financial terms and conditions
- Other items covered by the proposed agreement such as: warranty, insurance, updates, data protection, servicing/maintenance, etc.

4.3 Testing Hypotheses with the Advisory Board

4.3.1 Hypothesis testing for the Key Exploitable Results

In order to check the validity of the offerings of the different Key Exploitable Results, as elaborated by the respective STORY partners, it was decided to use the Advisory Board as a critical sounding board, aimed at testing and validating several hypotheses underpinning the offering, leading to questions such as:

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Project STORY - H2020-LCE-2014-3

- Are the target customers indeed experiencing the problems as perceived - today or in the future?
- Is the Value Proposition sufficiently attractive? Are the customer jobs, pains and gains indeed the ones that matter?
- Is the list of specifications complete?
- Is the proposed commercial agreement in tune with the market requirements?
- How does the STORY Key Exploitable Result compare to competing solutions?

The approach of hypothesis testing is in line with the concept of lean innovation, and the STORY Advisory Board constituted a perfect platform for this critical review of the offerings that had been formulated.

4.3.2 Overview of the Advisory Board meetings to test the Key Exploitable Results

During the summer of 2020, several online meetings were organised (STORY partners leading the Key Exploitable Results, together with Prospex Institute), to elaborate the Key Exploitable Results in terms of the Value Proposition Canvas, the list of specifications as well as the proposed type of commercial agreement for the offering.

For each of the Key Exploitable Results, a separate Advisory Board meeting was set up, with participants (Advisory Board members) selected specifically for their interest (including potential commercial interest) or relevant knowledge on the offering at hand.

In Table 4.2, an overview of the Advisory Board meetings is presented.

Table 4.2. Overview of the Advisory Board Meetings held to discuss the STORY Key Exploitable Results.

ID	Date Advisory Board Meeting	STORY lead partner	KER	Participants
KER-1	26 August 2020	BaseN	A platform for the Industrial Internet of Things	Industry players, DSOs and customer protection groups.
KER-2	2 September 2020	VITO	Energy content of water storage tanks	European associations, researcher, DSO network group.
KER-3	2 September 2020	CENER	Energy management system	Industry players, customer protection groups, researchers.
KER-4	28 October 2020 (TBC)	B9 Energy	Excess electricity to green hydrogen	N/A

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Project STORY - H2020-LCE-2014-3

5 KER-1: A platform for the Industrial Internet of Things (BaseN)

5.1 Participants in the Advisory Board Meeting

Offering: A platform to support the Industrial Internet of Things	
BaseN	**Participants**
• Jukka Paananen, SVP Sales • Topi Mikkola, Senior Software Engineer • Sonja Pöyry, Communications Officer	• Industry players, DSOs and customer protection groups.

5.2 Introduction to the offering

BaseN Platform is a full stack solution allowing to develop and run customers' entire operations on BaseN. It offers out of the box tools for real time collecting, storing and analysing data in massive scale. BaseN can either offer the entire full stack - from data collection devices and networking to visualization and analysis - or can integrate to existing systems in a GDPR compliant way. BaseN Platform offers a set of APIs and JavaScript/UI libraries to enable customers to create their own UI and analysis.

The system itself is scalable and built for very high reliability, as needed to monitor mission-critical customer systems. An on-call 24/7 engineering team is always available to guarantee uninterrupted services. Current customers range from big telecom operators to large enterprises.

BaseN also serves customers in the construction and smart energy business using the same system to monitor both customers' internal networks and services, while also providing end-user applications and services. More information is given in Figure 5.1, in which the introductory slides, used by BaseN to pitch their solution, are presented.

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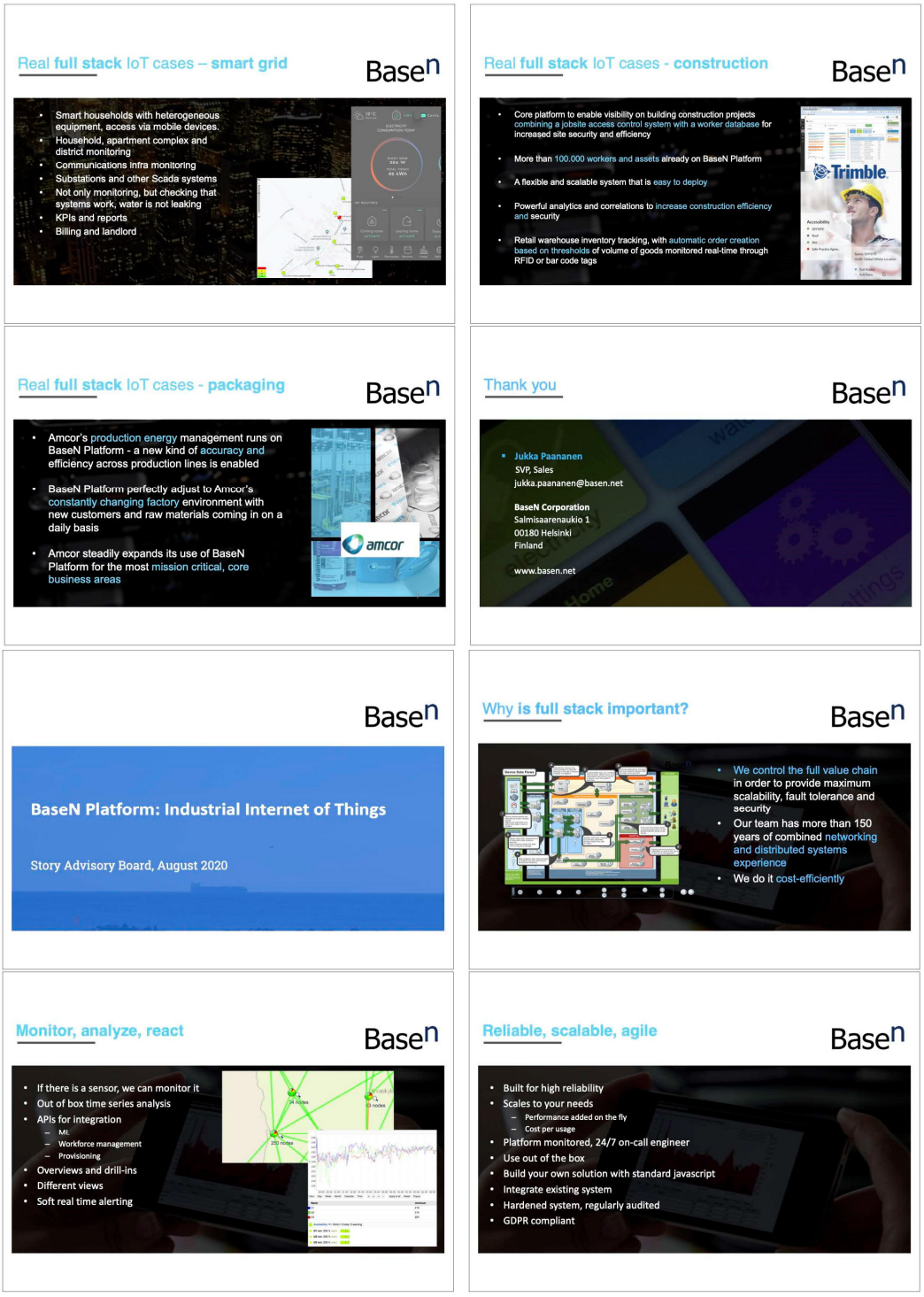

Figure 5.1. Introduction to the offering proposed by BaseN (problem statement and proposed solution).

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Project STORY - H2020-LCE-2014-3

5.3 Value Proposition

The value proposition canvas as presented by BaseN is shown in Figure 5.2. Note that:

- at the right side of the figure, the analysis of the target customer is shown, in terms of customer jobs (activities relevant for the value proposition), customer pains and gains;
- at the left side, the figure shows the corresponding pain relievers, gain creators and products & services - together constituting the value proposition.

Reactions from the participants to the Advisory Board meeting have been recorded as digital post-it notes and are presented in Figure 5.3.

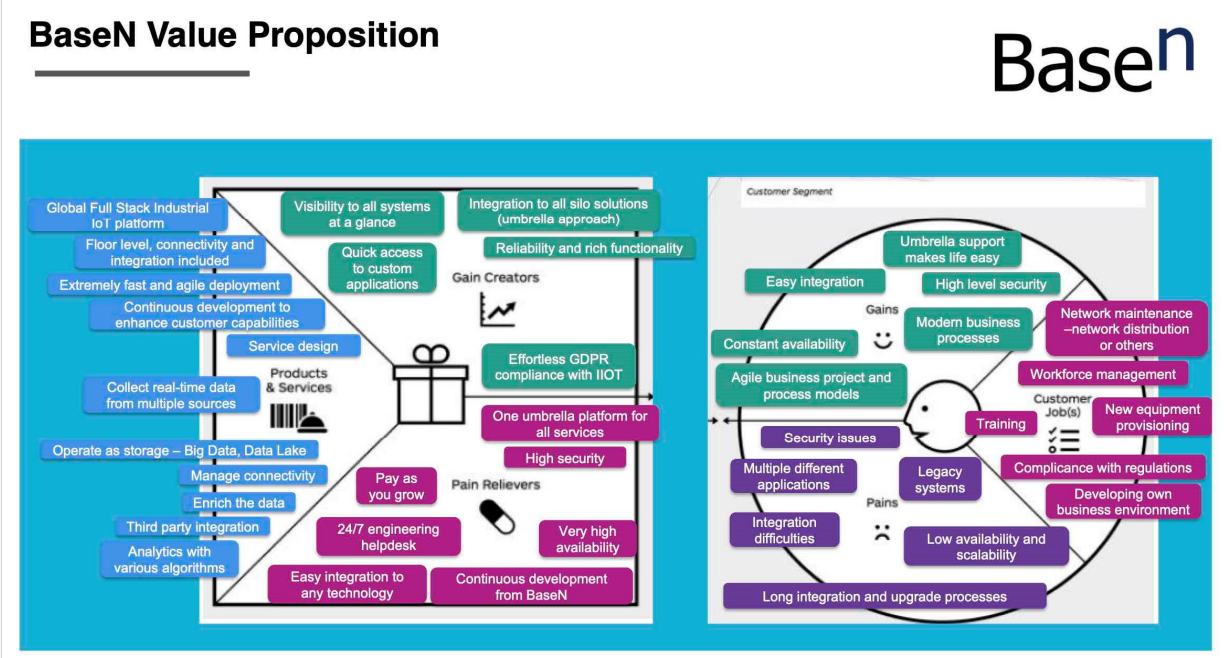

Figure 5.2. Value proposition canvas of the offering of BaseN.

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Project STORY - H2020-LCE-2014-3

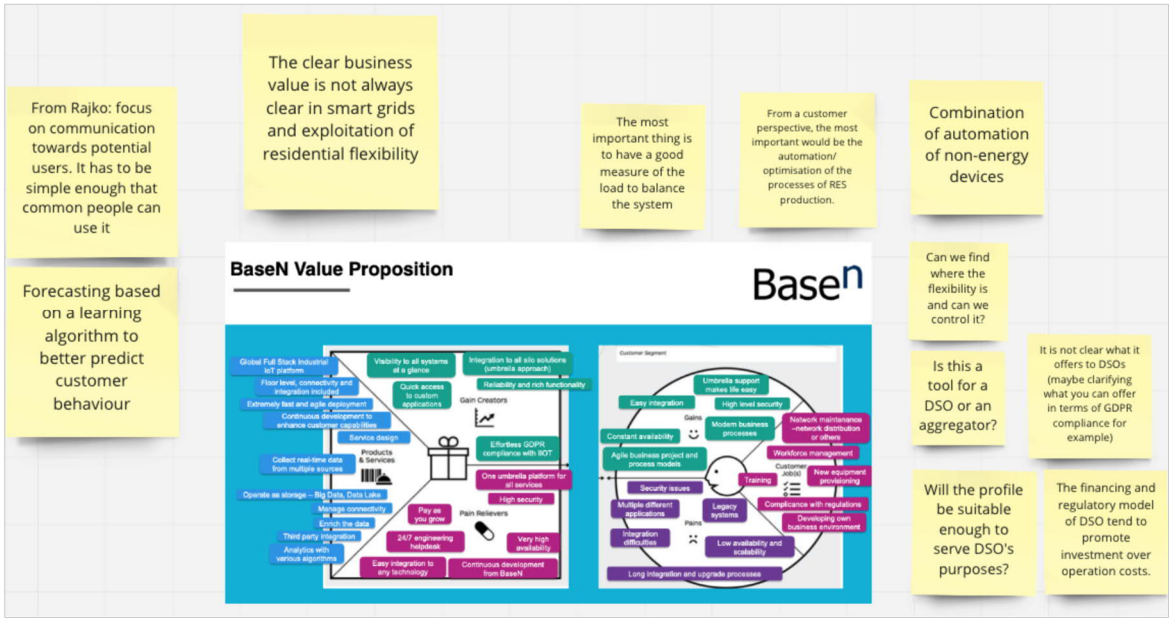

Figure 5.3. Value proposition canvas of the offering of BaseN, with the yellow post-it notes indicating the feedback from the Advisory Board.

5.4 Market specifications

The market specification as presented by BaseN are shown in Figure 5.4. Reactions from the participants in the Advisory Board meeting have been added as digital post-it notes.

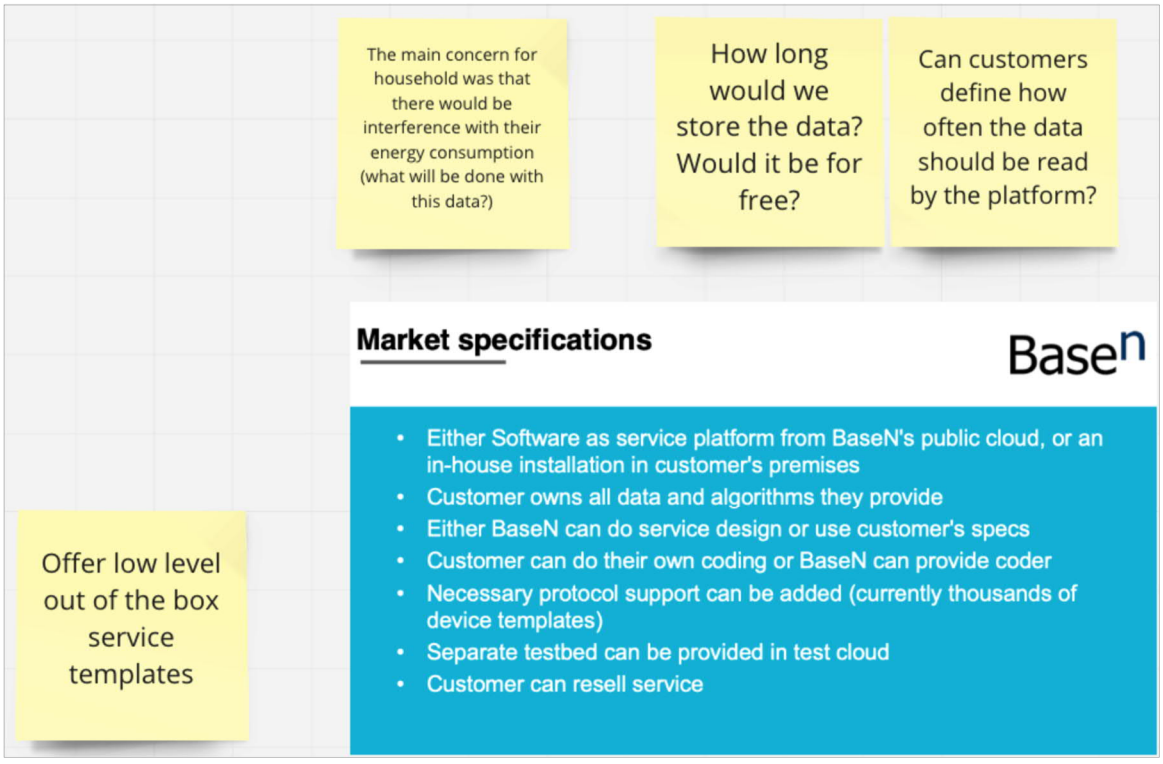

Figure 5.4. Market specifications as presented by BaseN.

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Project STORY - H2020-LCE-2014-3

5.5 Commercial agreement

More information on the type of commercial agreement as presented by BaseN is shown in Figure 5.5. Reactions from the participants in the Advisory Board meeting, together with reflections on items that, according to the participants, need to be covered in the commercial agreement, have been included as digital post-it notes in Figure 5.6.

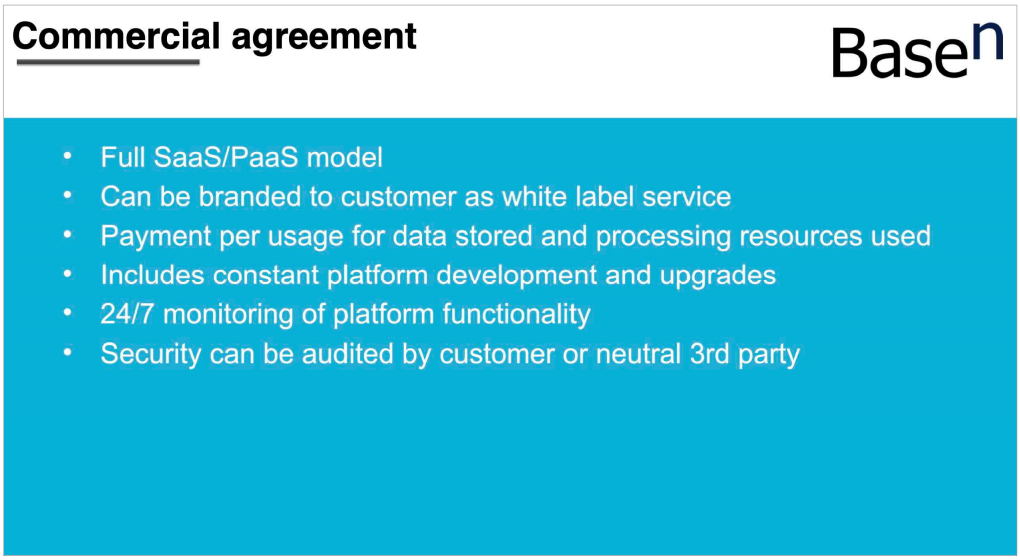

Figure 5.5. Components of the commercial agreement associated to the offering, as presented by BaseN.

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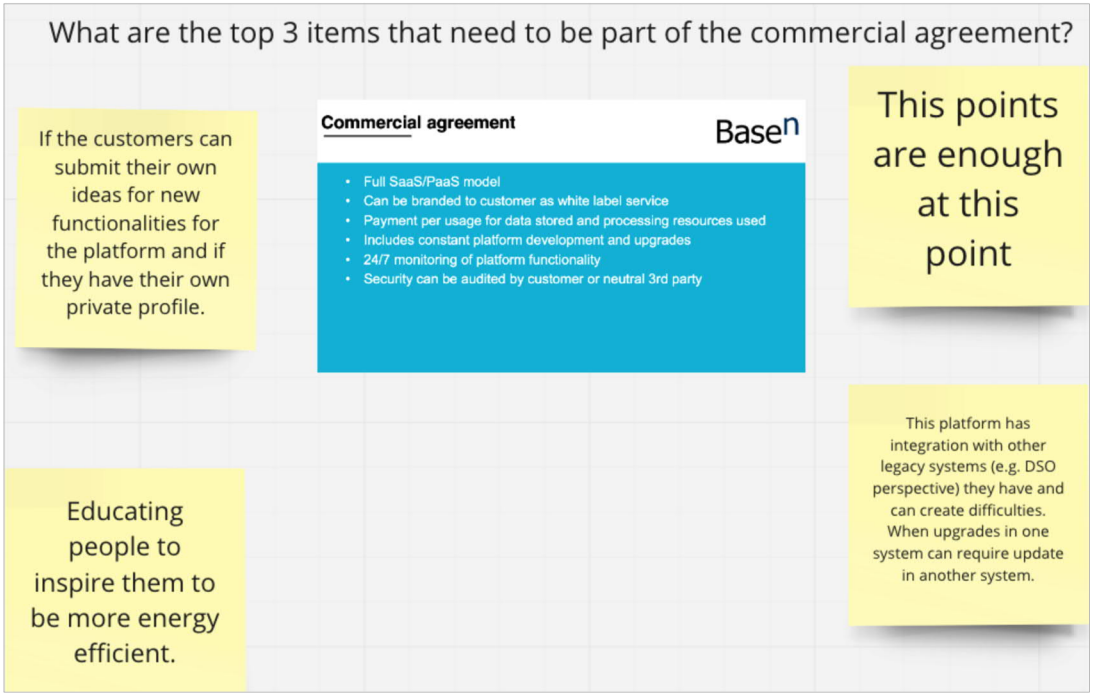

Figure 5.6. Feedback from the Advisory Board members on the commercial agreement presented by BaseN.

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6 KER-2: Energy content of water storage tanks (VITO)

6.1 Participants in the Advisory Board Meeting

Offering: Energy content of water storage tanks	
VITO	Participants
• Johan Van Bael (Activity Leader Optimisation Thermal Energy Systems) • Erik De Schutter (Business Development Manager)	• European associations, researcher, DSO network group.

6.2 Introduction to the offering

With the increased complexity of energy systems, it is becoming vital to monitor the energy content of thermal storage systems in order to optimally operate them and integrate them into the energy management systems. Within VITO/EnergyVille, we have developed methods to determine the state of charge of different thermal energy storage techniques. Those techniques include small water and larger water storage tanks.

The method proposed is able to determine the energy content of the storage tank with the lowest number of sensors. This reduces investment costs in monitoring equipment while keeping the accuracy high. In order to reach that goal, we use a combination of a model and input from a limited number of sensors at different optimal selected locations within this storage system. Next, a series of tests to characterize the storage type is performed. The outcome is an algorithm that is able to predict the energy content of the system with the lowest number of sensors.

To exchange the data, a specific API has been developed and tested within the H2020 project STORY. The following data are sent to the API:

- total volume of the storage tank
- maximum temperature of the storage tank Tmax (°C)
- minimum temperature of the storage tank Tmin (°C)
- number of sensors
- position of each of the sensors
- height of the storage tank
- temperature data of the sensors (°C)
- electrical power of the storage tank (if applicable).

Based on these data, the algorithm calculates:

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Project STORY - H2020-LCE-2014-3

- Amount of water that can be delivered at or above the comfort limit
- Amount of energy that can be stored.

Note that the method is patent protected:

SOCESS (State of charge estimation of energy storage systems). Application number: EP 16 207 504.8. Inventor: De Ridder F., Van Bael J. et al., Submission date: December 30th, 2016. This patent describes a method to estimate the state of charge of heat buffers. This innovation will be most useful in the determination of the state of charge of the heat storage system.

The slides used by VITO to introduce their offering are presented in Figure 6.1a & b.

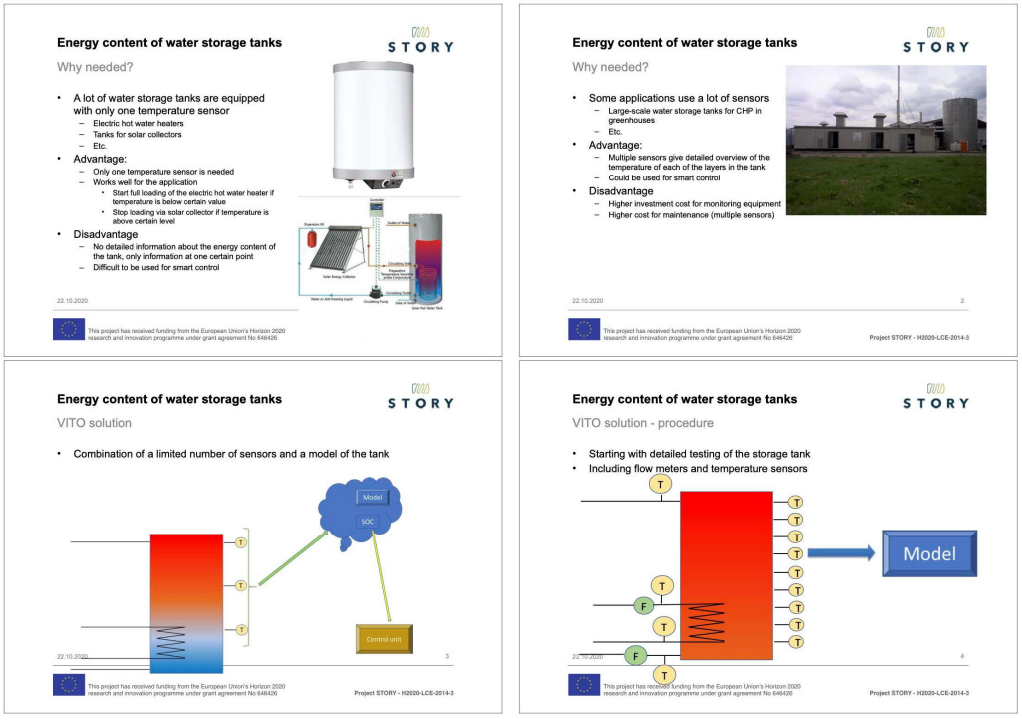

Figure 6.1a. Introduction to the offering of VITO (problem statement and proposed solution).

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Project STORY - H2020-LCE-2014-3

Figure 6.1b. Introduction to the offering of VITO (problem statement and proposed solution).

6.3 Value Proposition

The value proposition canvas as presented by VITO is shown in Figure 6.2. Note that:

- at the right side of the figure, the analysis of the target customer is shown, in terms of customer jobs (activities relevant for the value proposition), customer pains and gains;
- at the left side, the figure shows the corresponding pain relievers, gain creators and products & services - together constituting the value proposition.

Reactions from the participants to the Advisory Board meeting have been recorded as digital post-it notes and are presented in Figure 6.3.

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Project STORY - H2020-LCE-2014-3

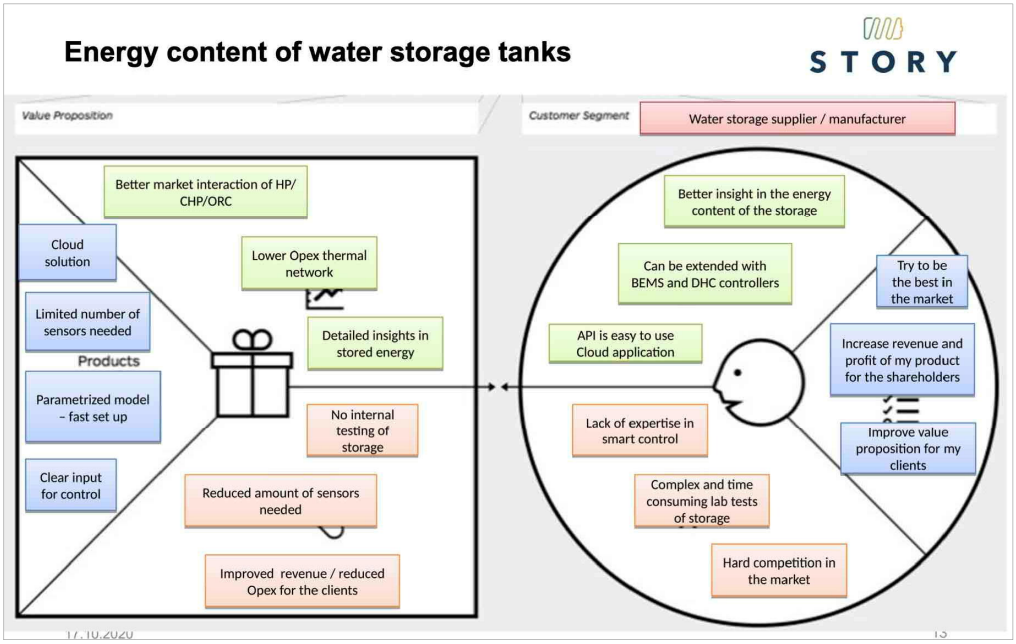

Figure 6.2. Value proposition canvas of the offering of VITO.

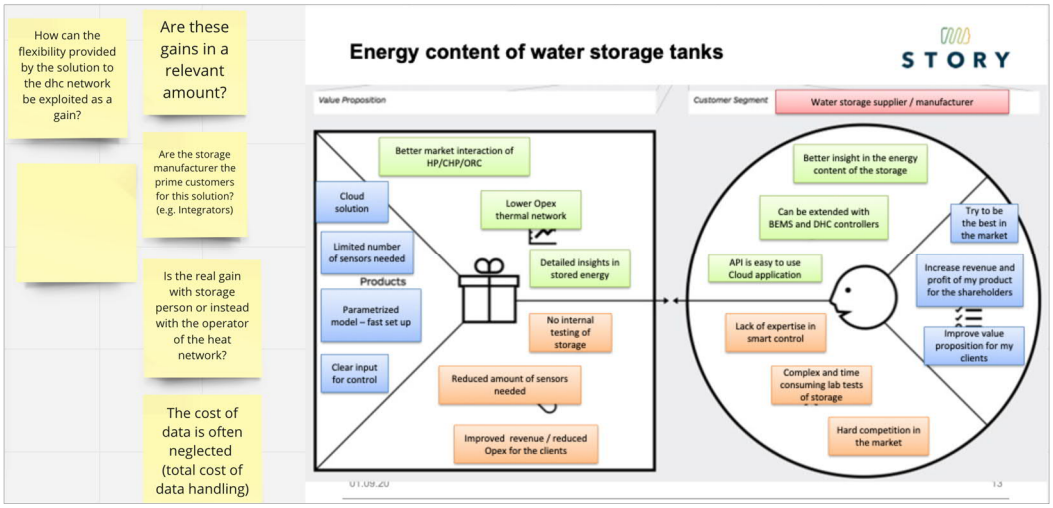

Figure 6.3. Feedback from the Advisory Board (yellow post-it notes) on the value proposition as presented by VITO.

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Project STORY - H2020-LCE-2014-3

6.4 Market specifications

The market specification as presented by VITO are shown in Figure 6.4.

API Application Performance Interface
Client request : json format

Parameter	Description	Type
Vol	total volume of the boiler (l)	number
Tmax	maximum temperature of the storage (°C)	Number Tmax > Tmin
Tmin	minimum temperature of the storage (°C)	number
Num_sens_M	number of sensors	number
Pos_sensors	Array with position of M sensors (cm)	Array with numbers The length of the array is equal to the number of sensors M. First element is the sensor at the lower height and last element is the sensor at the higher height. The position of the sensors is <=height of the storage.
Height	height of the storage (cm)	number
Temp	temperature measured by the m sensors (°C)	Array with numbers The length of the array is equal to the number of sensors M. First element is the sensor at the lower height and last element is the sensor at the higher height.
Power	electrical power of the storage P (kW)	number
Effic	electrical efficiency of the storage μ	number

Parameter		Description	Type
id		Unique identifier generated by the Client	number
energy			
	unit	Unit used for expressing energy	string
	value	Amount of energy that can be injected as heat (units: energy [kWh/J])	number
SOC – energy content			
	unit	Unit used for expressing the state of charge	string
	value	Amount of water that can be delivered at or above the comfort limit (units: energy [kWh/J])	number

Figure 6.4. Market specifications as presented by VITO.

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Project STORY - H2020-LCE-2014-3

Reactions from the participants to the Advisory Board meeting have been added as digital post-it notes, presented in Figure 6.5.

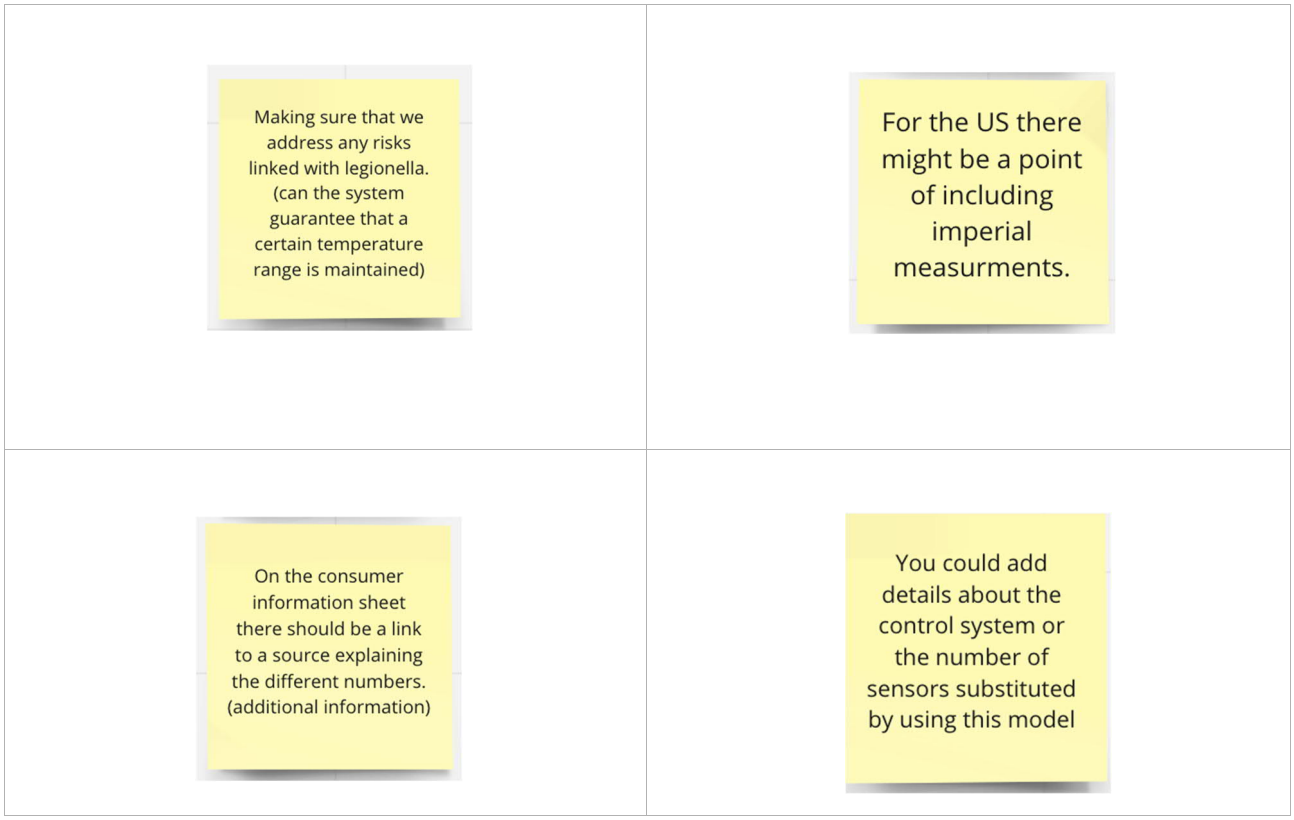

Figure 6.5. Feedback from the Advisory Board on the specifications presented by VITO.

6.5 Commercial agreement

With respect to the type of commercial agreement that would be used for its offering, VITO preferred to use the Advisory Board to address a series of questions. The questions are presented in Figure 6.6, the reactions from the Advisory Board members are presented in Figure 6.7.

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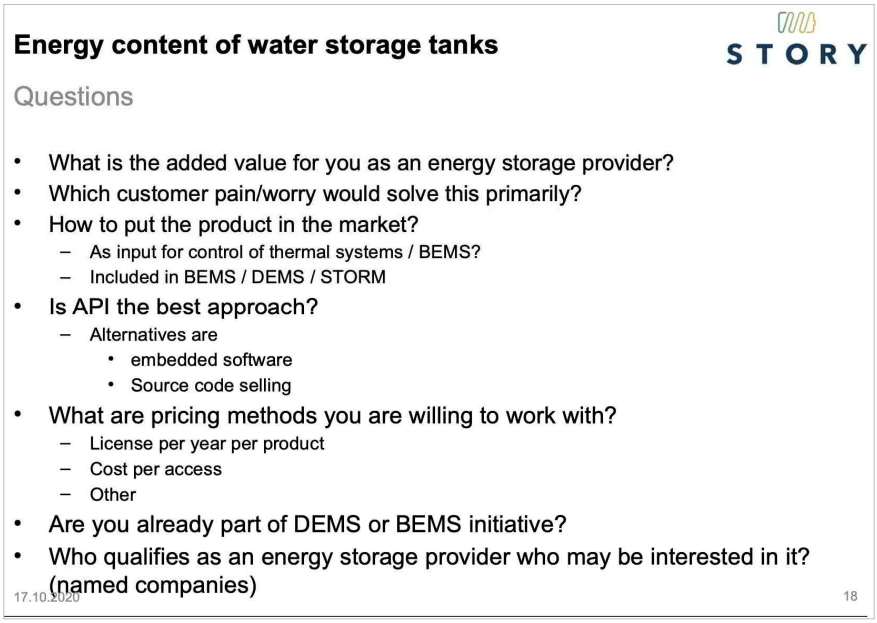

Figure 6.6. Questions from VITO to the Advisory Board members, to better develop the commercial agreement.

Figure 6.7. Reactions from the Advisory Board members to VITO's questions on the commercial agreement.

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Project STORY - H2020-LCE-2014-3

Finally, in Figure 6.8, we present the reactions from the Advisory Board members to the question on top priorities that need to be covered by a commercial agreement regarding this solution.

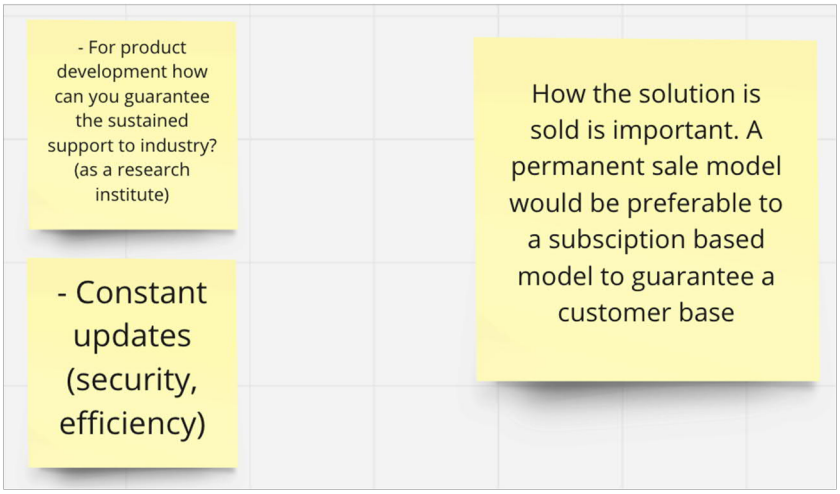

Figure 6.8. What are priorities for a commercial agreement on the proposed technology? - Reactions from the Advisory Board members.

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Project STORY - H2020-LCE-2014-3

7 KER-3: Energy Management System (CENER)

7.1 Participants in the Advisory Board Meeting

Offering: A platform to support the Industrial Internet of Things	
CENER	Participants
• Faisal Bouchotrouch • Clemente Gilardi	• Industry players, customer protection groups, researchers.

7.2 Introduction to the offering

The introductory slides used by CENER to pitch their solution, are presented in Figure 7.1.

Furthermore, CENER gave a real-time demonstration of their technology solution to the participants in the Advisory Board meeting.

Figure 7.1. Introduction to the offering of CENER (problem statement and proposed solution).

7.3 Value Proposition

The value proposition canvas as presented by CENER is shown in Figure 7.2. Note that:

- at the right side of the figure, the analysis of the target customer is shown, in terms of customer jobs (activities relevant for the value proposition), customer pains and gains;

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Project STORY - H2020-LCE-2014-3

- at the left side, the figure shows the corresponding pain relievers, gain creators and products & services - together constituting the value proposition.

Reactions from the participants to the Advisory Board meeting have been recorded as digital post-it notes and are presented in Figure 7.3.

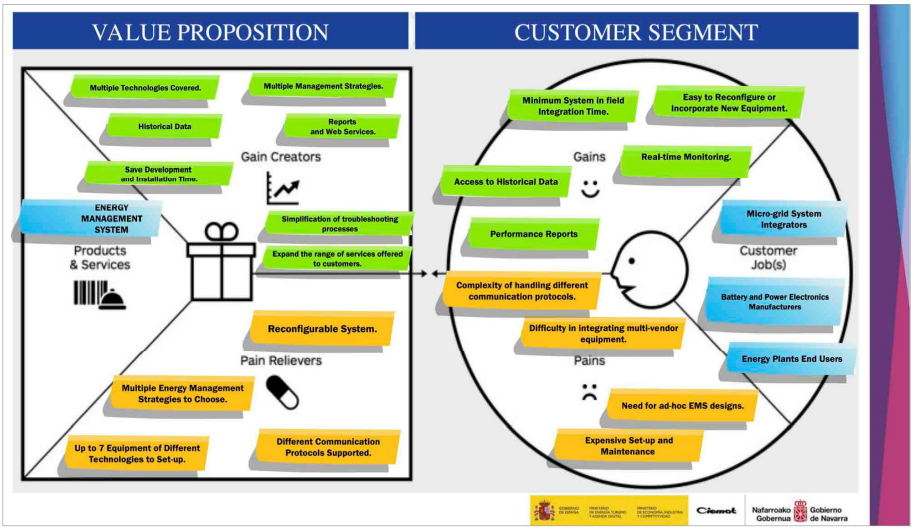

Figure 7.2. Value proposition canvas of CENER's offering.

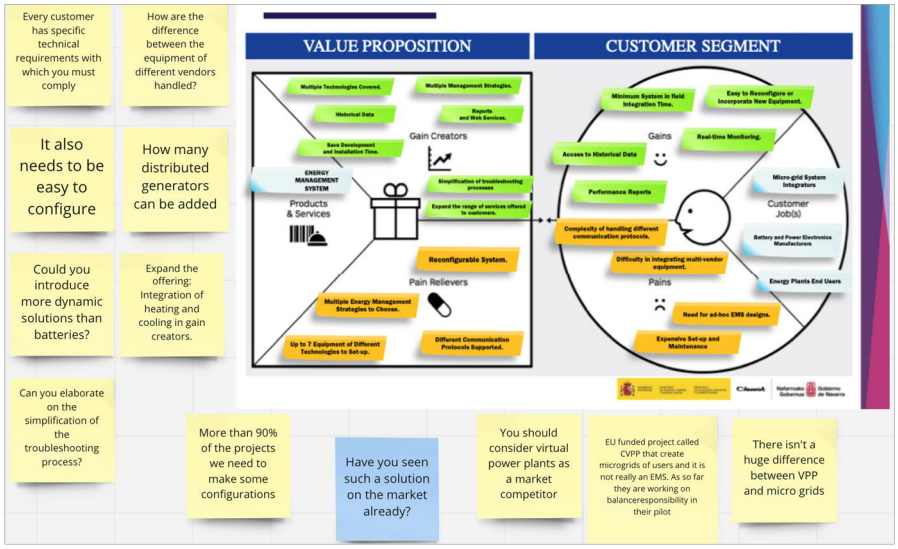

Figure 7.3. Feedback from the Advisory Board (yellow post-it notes) on the value proposition as presented by CENER.

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Project STORY - H2020-LCE-2014-3

7.4 Market specifications

The market specifications as presented by CENER are shown in Figure 7.4. Reactions from the participants to the Advisory Board meeting have been added as digital post-it notes.

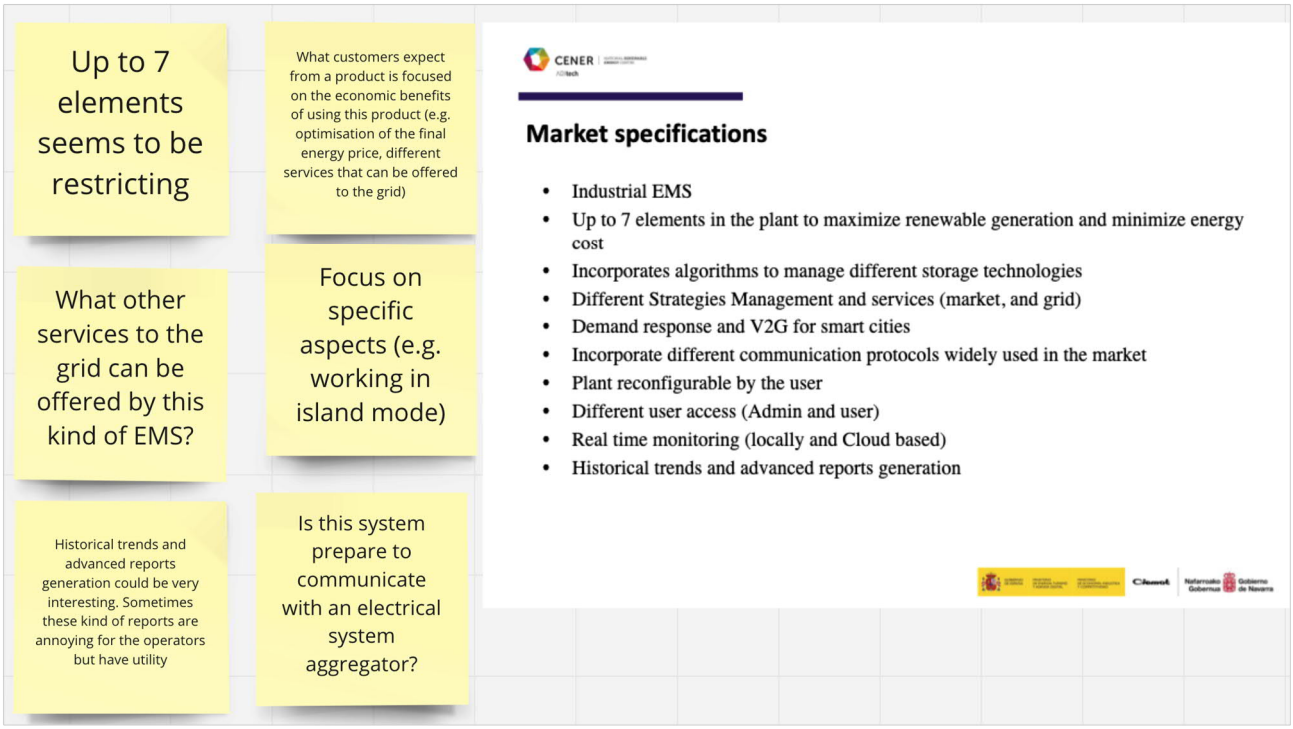

Figure 7.4. Market specifications as presented by CENER.

7.5 Commercial agreement

More information on the type of commercial agreement as presented by CENER is shown in Figure 7.5.

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Project STORY - H2020-LCE-2014-3

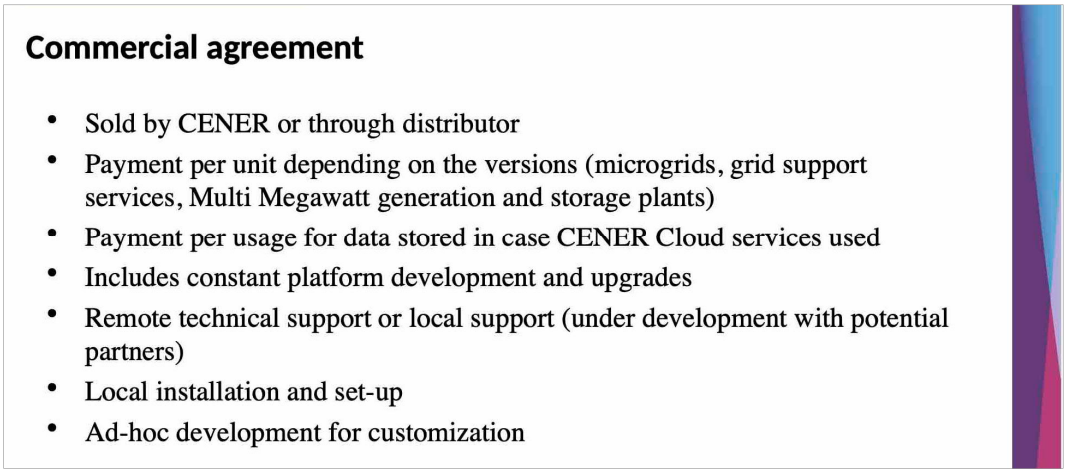

Figure 7.5. Specifics of the commercial agreement as presented by CENER.

Reactions from the participants to the Advisory Board meeting, together with reflections on items that, according to the participants, need to be covered in the commercial agreement, have been included as digital post-it notes in Figure 7.6.

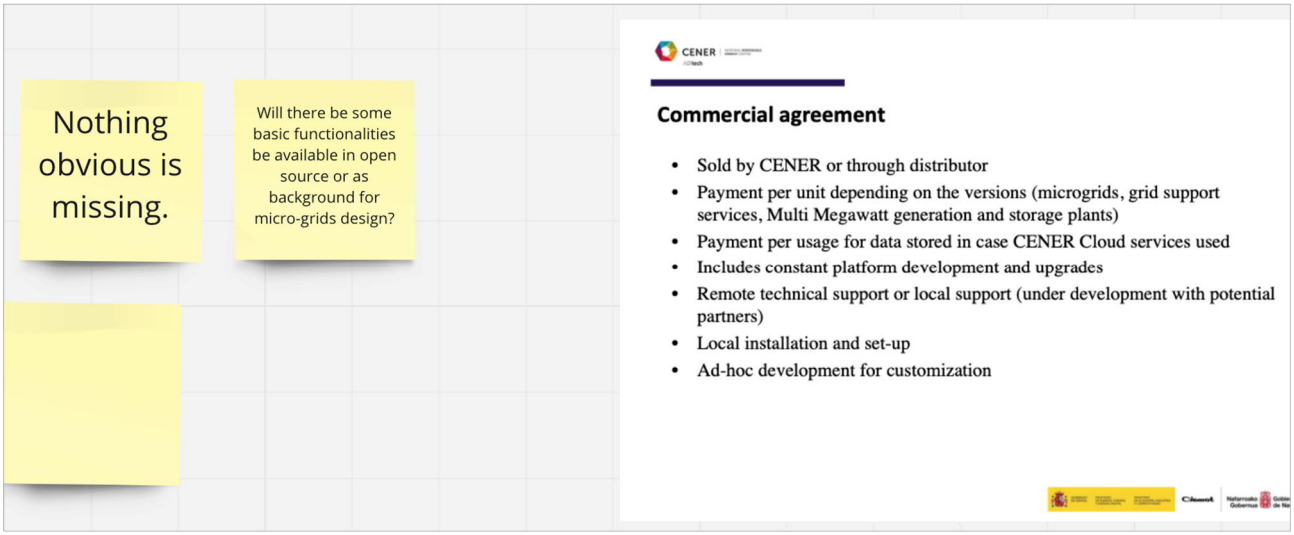

Figure 7.6. Reactions from the Advisory Board members (cf. yellow post-it notes) to the commercial agreement as presented by CENER.

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8 KER-4: B9 Energy

8.1 Participants in the Advisory Board Meeting

The Advisory Board meeting aimed at discussing the offering proposed by B9 Energy could unfortunately not be organised within the time frame of the STORY project. Because the new B9 technology falls outside of the scope of energy storage, the stakeholders in our database did not show enough interest. At this late stage of the project due to a lack of time and resources it was not possible to undergo a new mapping process.

However, as part of the preparations to this meeting, B9 Energy has formulated the Value Proposition using the same canvas structure applied for the other KER presented in this document. These can be found below but as the session has not taken place, no comments from stakeholders are added to them.

Offering: Excess electricity to green hydrogen	
B9 Energy	Participants
• John Harrison • David Surplus	• N/A (see above)

8.2 Introduction to the offering

B9 Energy (www.b9energy.co.uk) was created in 1992 and specialises in developing renewable energy projects. The business is based in carbon neutral offices in Northern Ireland.

The B9 Energy Storage market proposition centres around Power-to-X Project Development where excess electricity from renewables can be stored as green hydrogen and used, or converted to other forms of energy, for the decarbonisation of the electricity, heating and transport sectors.

As part of the H2020 STORY project they have developed control system algorithms for the valorisation of Energy Storage that provided them with an insight of how multiple revenue streams, across different energy vectors, can be combined to develop viable economic business models.

The B9 model has now been validated by Ernst and Young and used to secure NI Water board approval for an Outline Business Case to purchase an innovative 1MW membrane free electrolyser from CPH2 in Doncaster. The Pre-Qualification Questionnaire was advertised in OJEU in week commencing 19/10/2020.

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Project STORY - H2020-LCE-2014-3

8.3 Value Proposition

The value proposition canvas as prepared by B9 Energy is shown in Figure 8.1. Note that:

- at the right side of the figure, the analysis of the target customer is shown, in terms of customer jobs (activities relevant for the value proposition), customer pains and gains;

at the left side, the figure shows the corresponding pain relievers, gain creators and products & services - together constituting the value proposition.

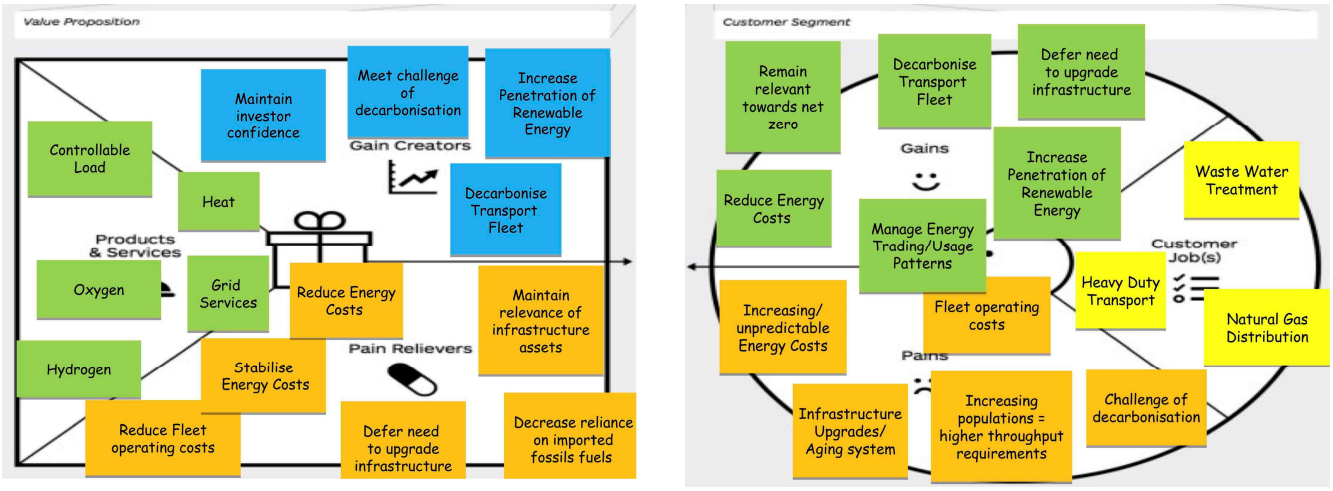

Figure 8.1. Value proposition canvas of the offering of B9 Energy.

9 Final Stakeholder Workshop and Closing Event – STORY Product Showcase

9.1 Introduction to the STORY Final Stakeholder Workshop and Closing Event

The final event of the STORY project was organised on 20-22 October, 2020. The three-days event focused on a variety of issues related to small-scale energy storage with a view on sharing the learning from the STORY project while at the same time looking at how these learnings can help addressing ongoing issues preventing the large-scale roll-out of storage technologies.

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Project STORY - H2020-LCE-2014-3

9.2 Outcomes of the STORY Product Showcase

The penultimate session of this event was dedicated to offering STORY partners an opportunity to present the products and/or services that they developed during their work on the STORY project to the participants of the event. The four deployment strategies listed above were presented during this STORY product showcase, they were adapted and finetuned on the basis of the comments received during the Advisory Board meeting.

In addition to these, other STORY partners also used this opportunity to present their deployment strategies for additional products and services developed within the course of the STORY project. These included Elektro Gorenjska, Hitachi ABB Power, Flexcity, Lopta Film and VTT which had all fine-tuned existing products and services or created brand new ones as part of their work on the STORY project.

This session showed the work done by STORY partners and their efforts in identifying and detailing their products and services coming out of the STORY project. While the project might be coming to an end, it is without any doubts that its positive effects will be felt in the coming years once these products and services will be marketed by STORY partners.

Further information on the replication potential of the different solutions developed within STORY as well as the way forward to ensure an uptake of these solutions can be found in D9.8 *Replication Plan.*

10 Conclusion

This deliverable highlights the process taken in the STORY project to provide partners with external support in the development of KER coming out of the project. This engagement process evolved throughout the project duration, focusing at first on wide areas of interest for the STORY KER to a very specific review of customer solutions already on the market or soon to be. The input of external stakeholder was instrumental in help STORY partners further develop their approach to the KER that were coming out of the project.

The main goal being to help ensure a long-lasting legacy to the STORY project by supporting the output of KERs and guiding these to the market. The involvement of these stakeholders who are active on specific markets and have this ‘hands-on’ experience is necessary to help guiding partners involved in research projects into recognizing the potential value and taking further KERs that are interesting for the market.

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