TECHNOLOGY REVOLUTION DAY

TRANSCRIPT

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Carlalberto Guglielminotti - CEO & General Manager

Welcome to Engie EPS Technology Revolution Day and thank you for being with us today.
We are in our industrial plant in Cosio Valtellino, in Northern Italy, the beating heart of the Energy and Mobility industries.
I am really excited for today and the news we have to share with you.
Today is “THE” day, because we will unveil our 2023 Technology Roadmap.
But let me take a quick step back.
In 2015 during the IPO process we presented our products,
like ElectroSelf, one of the first ever developed hydrogen batteries in the world,
but we also presented our first Technology Roadmap:
developing HyESS, a hybrid technology, vertically integrated into an open architecture,
able to integrate renewables and batteries or even hydrogen,
with the national grid, diesel generation or even thermal power plants.
To address the energy storage market and off-grid applications at the grid scale level.
This was the ambition.
Think about it.
This was clearly written into our IPO prospectus.
And, 2 years later, we made it.
Becoming the n.1 player in the world for microgrids, and integrating the first largest multi-MW storage systems in Europe.

Then, with 36 projects realized, 47MWh in operation and 86 people at that time, in May 2017 we launched the 2020 Technology Roadmap.

In essence:

- Distributed Smart Storage, advanced Energy Storage Systems for enhanced frequency regulation, spinning reserve and capacity firming.

- But also eMobility, with clear projects related to Vehicle-to-Grid and Fast charge for electric vehicles. This was 2017.

And we made it again, with over 175MW in operation and over 700MWh of projects awarded and under construction.
So today, we are here launching our new 2023 Technology Roadmap.
Just from a new, different, perspective.
I mean, in 2015 EPS was a tech start-up moving its very first steps in the energy world.
Today we are one of the few international and competitive players in this space, a Technology Company and even more importantly an Industrial Player.
One of the most successful storage system integrators in the world and certainly one of the eMobility leaders in Europe,
able to transform technological disruptions into industrial products.

But EPS is mainly its people:

- In 2015 EPS had 38 employees, today we are over 140 people.

- In 2015 we were almost all Italians, now we have 18 nationalities.

- And one third of us has a PhD or MBA, because in EPS we choose Talents and we make our best to raise them

Thanks to our Talents, in these years we have been able to file more than 130 patents and more than 1,200 Industrial secrets,
Introducing iconic innovations in energy storage and eMobility Sectors,
from the very first battery powered black-start of a national grid with the Terna Storage Lab in 2016,
to eventually the easyWallbox, our unique charging device for electric vehicles launched in 2020.
This led us to become in 2020, although it was a year marked by the devastating Covid-19 pandemic, a worldwide tier 1 player.
We have been awarded with over 700MWh of storage projects worldwide,
we are manufacturing more 50,000 charging devices for electric vehicles,
and we recently signed a JV with Stellantis, one of the largest automaker in the world, to create a major European player in the eMobility sector.
But again this is the past.
And it’s now time to announce what’s next.
Because thanks to EPS people’s extraordinary work,
today we launch our 2023 Technology Roadmap that will revolutionize the future of energy,
unveiling the seamless link between Energy Storage and eMobility.
And this will not be made by me. No, no.
This will be made by our extraordinary people, that you deserve to meet.
And for this reason I then leave the floor to our Technology, Research and Development teams: the epicentre of change for EPS and the future of energy.

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Daniele Rosati - CTO Storage Systems

Every 3 years EPS presents its Technology Roadmap.

Today, we define once more the innovation and technology strategy to maintain our pioneering leadership in Energy Storage and eMobility.
In a world that changes rapidly, our mantra is to keep our eyes open to capture any market evolution, and react as soon as possible, focusing only on the main deliverables to produce.
So, even if EPS is already one of the most advanced System Providers and a solid industrial player, we continue to push technological limits beyond any state-of-the-art, adapting our nature and structure to the booming of our reference markets with the philosophy “Evolve or Die”.
We do not believe in incremental innovation, nor in cost optimizations, we focus entirely our R&D efforts in technological disruptions, in innovations that can create a tangible impact in this world.
For our evolution we have always followed a clear roadmap, and looking back every 3 years we felt proud.
Before unveiling our next roadmap, let’s focus on the main results we achieved in 2017 and 2020 plans.
In the last six years we shaped and completed our unique HyESS Technology Platform.
Today, HyESS is composed by 4 Technology Families and more than 30 products designed and developed entirely by EPS.
HyESS is the outcome of more than 15 years of Research and Development, started when we were young researchers in our spin-offs from Politecnico di Milano and Torino.
We started from the pivotal element of our power conversion system family:
C-BESSHD, a storage inverter designed specifically for high power dense energy storage.
We then developed the new HyESS HD containers: 6 new solutions with High Power and Energy Density that allowed us to secure projects for over 700 MWh
Thanks to the iconic PROPHET project, launched in 2018 with Politecnico di Milano, our control platform evolved to cutting-edge digital products, namely PROPHET EMS and K-WIZE.
In addition, we extended the HyESS platform to the Technology Family “Move”, to include EV charging solutions, V2X and Second Life applications.
We realized the Mirafiori 2MW Vehicle-to-grid charging station, the largest in the world, and launched on the market the first Wallbox that you can install yourself, which is now distributed in 19 European countries.
But such results didn't come out of the blue, but from a 4 year collaboration with FCA, now Stellantis, to support the launch of their electric platform.
Driven by such great successes and with a development roadmap in common, we decided to launch a New eMobility Company: an ambitious Joint Venture with an immense potential.
To tell you more about it, I’ll hand over to Giorgio.

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Giorgio Crugnola - CTO Storage Systems

I am excited to tell you more about the NewCo stemmed from the collaboration between EPS and FCA, now Stellantis.
The JV will focus on the development and supply of innovative and unique products and services.
In the wake of our recent achievements, we will deliver a full platform of EV charging devices for B2C, B2B and public infrastructure. We will also provide charging package services and even large turn-key solutions with storage, V2G functionality and battery life management.
Thanks to the combination of our extraordinary skills and the strength of a global carmaker as Stellantis, the NewCo will be an unparalleled player in the booming electric mobility market.
EPS will share its know-how and experience in designing, developing and realizing innovative eMobility and Storage solutions to guarantee the NewCo’s success.
To boost EPS growth and the NewCo ambitions within a very short time, we outlined our 2023 Technology Roadmap: a joint development plan that is at the same time futuristic and very concrete.
The entire roadmap revolves around a crucial axis: the synergic integration between eMobility and Energy Storage.

We shaped the plan on 5 clear pillars:

1. Seamless connection between Energy Storage and eMobility as we are the only team that can handle its entire technological complexity.

2. Restless focus on strategic battery procurement, reinforcing partnerships with selected preeminent suppliers leveraging on our position in the eMobility segment.

3. Variety Reduction Program, building innovative and flexible product families exploiting our HyESS technological platform.

4. Driving eMobility disruption: we will launch products that competitors cannot even imagine such as Vehicle-to-X functionalities, EV batteries used as stationary storage, and advanced services for private and public charging.

5. Military-grade processes with a 100% AGILE organization, to enhance productivity and minimize time-to-market.

We divided such an ambitious 2023 Technology Roadmap into 18 specific R&D projects, led by a team of 43 researchers, for a total investment of over 25 Million euros!

Our HyESS technological platform is composed of 4 Technology Families, where we funnel our vertically integrated expertise:

- Move: a complete suite of AC and DC Electric Vehicles charging solutions for a quick and “easy” electrification of mobility.

- Store: with a range of containerized housings for battery and hydrogen storage fulfilling world-class density, operational, safety and affordability requirements.

- Convert & Connect: systems designed to interface batteries and electrical vehicles with the surrounding electrical environment, from microgrids to continental grids.

- Control: a ground-breaking suite of cutting-edge digital control systems to maximize safety and performance of all our products

Sure to have increased your curiosity, it’s time to get ready.
I’m now leaving the floor to our team to lead you on this exciting journey, to discover details and key aspects of our 2023 Technological Roadmap.
Enjoy.

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Martino Bosetti - Head of eMobility Products R&D

We created our Technology Family “Move” to design and craft revolutionary solutions to make the charging experience easy.
We don’t just supply Wallboxes.
Leveraging on 15 year expertise in Microgrids and Energy Storage Systems, we provide unique solutions, from a 2 kW domestic AC charger to a 25 MW DC Fast Charging station in a single Vehicle-to-Grid EV Facility.
For our R&D team, “easy” is not just a slogan: it is a technological driver during each phase of a solution development, as we already proved last year with easyWallbox.
We started from the market segment that needed the simplest user experience: charging electric vehicles at home.
easyWallbox is an AC single-phase Wallbox with a revolutionary Plug&Play design that tears down installation costs.
Any user can complete the setup in about 20 minutes, plugging easyWallbox directly in an existing socket, up to 2,3 kW.
If more power is needed, it can be extended to 7,4 kW with a Power Upgrade.
Also, we wanted to avoid blackouts while charging, so we implemented the Dynamic Power Management.

Everything needed is included in the product package: the current sensor, the connection interface and the software.
With easyWallbox, we started from the hardest challenge, as our Technical Team had to switch from designing Multi-MW Power Plants to a mass-scale tiny product.
easyWallbox was a success: we started selling eMobility products 9 months ago and we are currently delivering 50 thousand Wallboxes.
But this was just the first step, as our ambitious plan aims at more than 1.2 million units delivered within 2030, spreading the "easy" revolution even further.
To do that, we are extending the product line-up with 5 new Products.
Let's start with eproWallbox, a three-phase AC Wallbox, that inherits all easyWallbox advantages.
With a wide span of charging configurations, from 2 to 22 kW, eproWallbox pushes the flexibility even forward.
Plug & Play connection in Mode 2 and Power Upgrade, both single- and three-phase connection supported: eproWallbox takes any ambitious customer through his electrification journey.
We innovated also the connectivity, exploiting the Power Line Communication to make the Dynamic Power Management seamless.
Also, eproWallbox will solve in advance the connectivity problems in areas with low wireless and 4G coverage such as home garages or underground parking lots.
eproWallbox will be a crucial innovation, but the global easy electrification is not complete without public and semi-public applications.
The development of easyPublic was just our first step in that direction: an AC charging station with 2 Charging Points of 22 kW each.
easyPublic is designed specifically to satisfy the needs both of eMobility Service Providers and Charging Point Operators, thanks to an integrated dedicated backend platform and a robust design.
Our backend platform is offered for installation on premises or according to the Software as a Service paradigm.
It also supports roaming, load management, and the entire payment definition and process, to enable and support any business model.
However, the real added value for public applications will be offering a full Fast Charging experience.
But this would imply a shock for the electrical distribution grid, as installing only 4 fast charging points can require up to 600 kW
As the average size of a step-down transformer in Europe is 500 kW, Fast Charging seems impossible, at least without a huge amount of grid transformation and civil works: quite a problem, especially in an urban context.
This is why we designed and patented ePost Cityway, a revolutionary DC fast charging solution born to exploit all tramway and trolleybus existing infrastructures.
ePost Cityway will deliver DC Fast Charging up to 100 kW getting the energy directly from tramway and trolleybus DC power supplies.
It will fully exploit an existing infrastructure, also helping energy recovery while tramways brake.
The connection of ePost Cityway will have zero impact on the AC distribution network and will require no civil works, making also the fast-charging experience easy.
But it is not enough for us.
EPS has its maximum experience in handling microgrids and complex power plants.
This is why our greatest effort in the Move Family in 2023 Technology Roadmap will be in designing bi-directional DC Fast Charging solutions for large EV parking areas, as an evolution of our 2MW Vehicle-to-Grid plant in Mirafiori.
Francesco will tell you more.

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Francesco Lamberti - Head of eMobility Application Engineering

The Mirafiori Pilot Project is one of our 2020 greatest successes.
It's a fully operating vehicle-to-grid DC Fast Charging station, with 2MW of installed power.
It is currently testing grid services from the batteries of Nuova 500 to optimize vehicle-to-grid functionalities.
With this project we unlocked all our microgrids and storage experience by transforming Eletric Vehicles into the largest form of flexibility for the European electrical grid.

Within the end of the year, the innovative plant will be extended to 25 MW, operating as Fast Reserve Unit for Terna (the Italian Transmission System Operator): 600 electric
vehicles connected together acting as a single Storage System to improve the stability of the grid frequency.
To help fast response in less than 300 ms, the plant will also integrate a stationary system based on 140 second-life Nuova 500 batteries.
Such a pioneering power plant will be deployed with our new product line: eFleet, our centralized solution to DC fast charge EV fleets and provide Vehicle-to-Grid services.
eFleet is an 800-1500 V DC microgrid, composed by our ePost, a distributed 100 kW Bi-directional charging unit, and our proprietary centralized Power Conversion System with the Medium Voltage Grid Interconnection.
eFleet is scalable from 20 to 1 thousand Electric Vehicles, each one charged and controlled independently by PROPHET EMS, our proprietary control platform.
What today is just an innovative 25 MW V2G parking, is already the product that we will provide to commercial EV fleets, airports, malls and large parking areas in the next 3 years.
In 2025, 25% of future public installations will be in DC and commercial vehicle charging points will be 4 times the ones installed in 2020.
But DC Fast Charging booming has a tough obstacle to overcome: the challenge of expensive grid upgrades.
For this reason we are developing eFast. It will allow us to unlock DC fast charging everywhere. eFast is equipped with a grid inverter up to 22 kW, a 50 kW DC fast charger and an embedded stationary Battery up to 85 kWh.
The battery pack affects up to 55% of the total cost; for this reason, we equipped eFast with second-life battery modules coming from Electric Vehicles, reducing the product cost by 35%.
Exploiting the existing interconnection, eFast can provide more than 100 km of autonomy in less than 30 minutes: just the time for a shower or a business video call.
Thanks to our vertical integrated know-how and our Machine Learning algorithms, eFast optimizes the use of the embedded battery to provide the easiest charging experience.
Also, exploiting its bidirectional grid inverter, eFast unlocks V2X functionalities including power peak shaving, energy time-shifting and black-start in case of grid outage.
We have both Product and System design in our DNA. So we already conceived eFast as a flexible product Family.
With our eFast Maxi we combine three eFast units, to reach Ultra Fast Charging up to 150 kW.
This a flexible and scalable solution for Fuel Stations, Hotels, Commercial Buildings and small EV Fleets.
With an add-on, eFast Maxi reaches 500 kWh of installed capacity: more than 1000 km fast charging without getting energy from the grid, in less than 8 square meters.
eFast solution is extremely compact, anyway we know that it requires a space not always available; as an example, adding a dedicated storage system in a domestic garage is pretty much impossible.
To overcome this problem, for our 2023 Technology Roadmap, we designed and patented the eFast Carpet:
a flat charging solution to push the easy DC fast charging experience even forward.
eFast Carpet includes all eFast features with a new engineering approach:
a 30 cm high mechanical platform with an optimized design to exploit a usually wasted space.
Now, eFast Carpet is designed with a traditional DC dispenser with socket and cable, but when the vehicle will allow it, we will equip it with an automatic robotic charging device, to enable EV charging with no human effort.
With our Technology Family “Move” we are fostering an easy Charging Experience for everyone, unlocking Fast Charging everywhere.
Our solutions exploit EV batteries at their most, with V2G Grid Services and second-life applications.
How can we be confident that we optimize battery usage?
How can we be sure that there is no impact on their performance and safety?
Nicola from our Battery Center of Excellence, will give you the answer.

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Nicola Zanon - Battery Center of Excellence Leader

I am here to present you our Technology Family STORE, starting from its core, the batteries.

EPS has 15 years of battery integration expertise with a long and proven competence in battery integration out of more than 20 different chemistries.
A couple of examples are here: this is the latest generation of NMC lithium ion 714 kWh 1500V battery racks that are integrated in our High Density containers for storage, while on this side there is an example of a 42kWh EV battery that will be integrated in a second life application in our eFleet and eFast.
Battery modules are the core components of our solutions having a great impact on our systems' final cost: from 50% in a 1-hour storage system up to 85% in a 4-hours storage system. I mean, access to best prices is vital.
And that's the reason why we are working with the top global battery manufacturers such as Samsung SDI, CATL, LG CHEM.
And of course we will do the same with car manufacturer partners in order to remain a top player in the energy storage market.
A market that is continuously evolving proposing new solutions and chemistries for stationary and electric vehicles.
We are so flexible and reactive in battery integration thanks to our Proprietary software for Battery Management System developed to manage performances and safety of batteries.
It allows us to design systems compliant with the main Automotive and Stationary Storage international standards.
Dealing with batteries, safety-related aspects must be a top priority: this requires a deep knowledge of cells and modules' details and a continuous quality and performance check, as we proved being the first to certificate our system for the new IEC 62933 standard.
We have a Strong focus on Battery Safety, based on 3 key pillars:
FIRST We pursue the maximum safety level by design, in fact in any battery container we implement and set 33 risk reduction measures, on the basis of a project specific Risk Assessment Analysis.
SECOND We perform a Severe Supplier Selection through audits and In-House Battery validation Tests to verify the declared performance and safety parameters, reducing long-term technological risks.
AND THIRD We carefully focus on the Monitoring of Common Mode Voltages since, according to several international studies, Uncontrolled Common Mode Voltages have been the main cause of storage plant fire hazards in the last 3 years.
In this context, we have developed a specific Control Board to monitor and reduce CMV among Battery Racks.
This small control board can save any plant from a fire accident!

For our 2023 technology roadmap we clearly identify the technological trends to take into account for our development:

- Continuous increase of cell capacity
- A necessary reduction in the use of Cobalt
- Voltage increase up to 1500 Volts
- Adoption for stationary of a liquid cooling system typical of EV batteries
- The necessary Harmonization of standards and regulations
- And the increasing connection between E-mobility and Storage

Leading Battery Know-How to anticipate technology evolution is crucial .
For this reason, in the next years we will continue developing our online battery ageing and performance monitoring system, based on the integration of the MoniCa platform developed with Engie Laborelec.
This is a Near real-time data acquisition system which monitors and forecasts battery health and performances, thanks to an adaptative model based on advanced big data analysis and Machine Learning algorithms.
Estimation of future capacity degradation and an early fault detection enables the possibility of optimizing the operating condition increasing the battery lifetime.

Finally, in our 2023 technology roadmap we will also take full advantage from the partnership with a car maker. This partnership will give us a simplified access to competitive prices and new battery technologies as well as to hundreds of MWh of second-life battery modules per year, to power our new HyESS HD containerized product line.
To tell you more on this product line, let me pass to Enrico.

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Enrico Casalini - Systems Standardization Project Leader

Here at EPS we have an obsession for continuous improvements in technical design. Our HyESS HD container family is the result of this drive.
We have developed this new family, raising the DC bus voltage level from 1000 V to 1500 V and increasing by more than three times the power and energy density of our solutions, reaching up to 14.4 MVA of Power Conversion Systems and 6 MWh of battery racks in a 40ft ISO container.
This new technological platform had an outstanding application last year, allowing EPS to design the Battery Storage Systems that won some of the most aggressive PV-plus-storage and utility scale storage tenders worldwide, proving our great competitiveness.
We have secured contracts for more than 700 MWh of storage plants to be commissioned in the next three years.

For example:

- In Puako, Hawaii, a 240 MWh usable storage system will be AC-coupled to a 60 MW solar plant;

- On the Guam island, Micronesia, a total of 300 MWh storage system will be DC-coupled to more than 50 MW of solar plant in two solar-plus-storage projects;

- In New England, USA Mainland, EPS will install 50 MWh of utility scale storage systems to provide grid services to the local utility;

- In Italy, in the context of the highly competitive Fast Reserve Frequency Regulation project, EPS will install more than 70 MW of storage plants, having won about 30% of the total capacity auctioned by Terna.

If you are wondering how we manage to be so successful. Here it is the answer.
We adopt a smart industrial concept.
Leveraging on lean manufacturing and AGILE management processes, we go beyond the pure product manufacturing to play the role of a full system provider, with an unparalleled combination of pioneering technology and extensive know-how.

The key-points of our successful model are:

- Proprietary sizing optimization tools through advanced Artificial Intelligence based algorithms prioritizing both competitiveness and system stability and reliability;

- Use case modelling starting from detailed energy and power flows, down to the single component of the system, adding the overarching economic layer;

- Vertical integration and experienced commissioning capabilities, thanks to the presence of multisectoral teams that can manage all on-site activities from installation to system start-up;

- Competitive capacity maintenance packages, thanks to our proprietary augmentation strategy and holistic approach on the entire plant lifecycle;

- Finally an evolution from customized solutions to standardized products, we leverage on proprietary technologies and solid partnerships with the most important battery manufacturers, to reach cost competitiveness, modularity and replicability.

In our 2023 roadmap we will complete the industrialization of HyESS HD container family, which is composed of:

The EnergyHouse HD, that is our battery storage system designed for a wide range of power and energy intensive applications. It is suitable for giga-scale projects to provide Grid Services, Renewable Capacity Firming and Time-Shifting, including Solar-Plus-
Storage applications. It is available in two versions:

- The first one up to 6 MWh for long energy storage duration (more than 2 hours);
- ·And the second one up to 3.5 MWh for up to one-hour applications;
- They achieve maximum energy density with 1500 Vdc lithium-ion modules;
- With a Full redundant and modular conditioning;
- And a Full integration of firefighting systems.

The HybridHouse HD is an all-in-one battery energy storage solution, suitable for Utility-Scale projects to provide Ancillary Services, Renewables Integration and Power Quality services.
It is available in three versions:

- 3.6 MVA / 3.5 MWh for up to one-hour applications;
- 2.8 MVA / 4.7 MWh for two-hour applications;
- 1.4 MVA / 5.3 MWh for four-hour applications;

They have an optimized layout to reduce installation costs and commissioning time.

Finally, The PowerHouse HD is a containerized solution hosting a Power Conversion System and is powered by our HyESS C-BESS converter family, with a remarkable power density up to 14,4 MVA in a 40 ft container, which is the most power dense ever worldwide for standard technical requirements and is in line with market cost forecast; It is Air cooled and requires just a little effort for installation.

New PowerHouse HD leverages on our proprietary C-BESSHD inverter, which will be the fundamental building block to realize our future most complex systems.
To tell you more on this, here's Massimo.

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Massimo Pedretti - C-BESSHD Project Leader
I am here in front of our CBESS HD to present this product and the EPS' Technology Family CONVERT AND CONNECT.
But let's first give you some insights on this market.
Energy storage converters' price is going down reaching values around 30 k$ / MW, since Solar inverters manufacturers are jumping into storage market with mass-produced solutions.
But the increase of renewables and the switch-off of traditional thermal power plants call for specific inverter functionalities.
We want to lead Power Conversion to shy away from commoditization, in fact, in the next years, our products' competitiveness will be secured by the increasing complexity of technical specifications required by grid operators, particularly in large tenders.
We have been pioneers in innovative inverter functions for microgrids: it's time to introduce new advanced features also for Utility-Scale grid-connected plants, such as Virtual Inertia, spinning reserve, black start, grid forming capabilities and mitigation of asymmetric voltage sags with negative sequence current management.

We have a 5-year advantage in managing such challenges with our proprietary technologies as we demonstrated on the field through the full seamless inverter transition from on-grid to off grid and vice-versa in a Medium Voltage multi-MW plant as in our New Caledonia and Comoros microgrids.
C-BESSHD is the last piece of our 15 years' experience on C-BESS PCS family development. While we lead for advanced functionalities we compete with the first-in-class also in terms of costs, leveraging the historical Northern Italian manufacturing industrial district for power electronics.
C-BESSHD is a bi-directional Power Conversion System with a complete circular capability. It is based on a modular 1500 Vdc, 3-level NPC, IGBT-based, power stack and it is available in 3 different configurations (2) from 1,1 to 1,8 MVA with no thermal derating up to 45° C.
Thanks to the advantages of a full hardware and firmware design this inverter can operate in Transformerless configuration, with a consequent Balance of Plant cost reduction.
It has a full modular configuration with a wide range of overload capability which increases PCS reliability and maximizes plant availability, overcoming single-module faults, realizing an embedded N-1 feature.
Each column has been conceived to be a stand-alone unit. this design represents also a plus for the assembly and maintainability of the machine.
To reinforce our leadership in advanced control functions, in our 2023 technology roadmap we want to upgrade C-BESSHD to act as a full Virtual Synchronous Machine.
We are also running to complete C-BESSHD UL certification to meet US market needs and to integrate the use of C-BESS family in our eFLEET products.
However we will keep a Make or Buy approach for each project, in pursue of the most competitive solution for our customers.
We are conscious that the technology world is running fast, asking for even more product modularity and short development time. It requires a technological paradigm shift in our next product generation, and we are ready to face also this great challenge.
To tell you all about it, let me pass back to Daniele.

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Daniele Rosati - CTO, eBESS MMC Project Leader
To compete with giant industrial players, we must make the difference by being serial innovators.
Being followers, developing classic outdoor cubicle solutions as our competitors, would be a loosing strategy, as it would be a matter of pure cost competitiveness with low added value.
We need to apply the extensive knowledge we have developed in these years on eMobility to stationary storage applications.
This also because according to the most important market analysts' forecast, EV battery packs will reach in 3 years extremely low costs, below 100$/kWh, with a huge availability.
In our 2023 technology roadmap we decided to develop the eBESS-MMC system, a new storage system that will secure our competitiveness for the next decade.

1. The patented idea behind eBESS is to use EV batteries in Stationary Storage as they are; we will take them out from any car model and directly put them in our systems without any modification.

2. We will develop a machine that can integrate batteries with different characteristics and different states of health in the same storage rack.

3. Using EV batteries as they are, will allow us to maximize procurement flexibility and optimize time-to-market so to have batteries at car maker cost.

4. To do it, we plan to develop an innovative special Modular Multi-Level Converter, which enables a scalable and plug & play solution.

5. The MMC will have a rated power higher than 1 MW and will be composed of 20 to 30 insulated modules, depending on the application.

6. The modules will be medium frequency SiC technology based AC/DC power converters, with independent DC buses and AC outputs series-connected to directly create a three-phases Medium Voltage output.

7. Thanks to MMC topology, and particularly to medium-frequency small transformers placed into the converter modules, the full galvanic-insulation will be guaranteed and we will propose solutions without classic low frequency step-up transformers.

In our eBESS-MMC system:

1. We will strongly focus on new firmware algorithms to safely manage the Common Mode Voltage on different EV batteries and develop a dedicated advanced BMS.

2. EV batteries will be shipped on site placed in a liquid-cooled modular naked skid, drastically shortening the construction times and the related cost of the system.

3. Thanks to just two building blocks – the battery Naked Cubicle and the outdoor MMC cabinet – eBESS-MCC will guarantee a great scalability and flexibility also when different battery C-rate are required.

4. In addition, It will guarantee a very simple top-up strategy, in fact you could do a capacity augmentation simply by adding or replacing battery modules.

5. Finally, eBESS MMC will have an unmatched availability level, thanks to its embedded fault tolerant feature. That is the possibility to operate by-passing a broken module.

In our 2023 technology roadmap we will design and develop an eBess full scale prototype, ready for industrialization providing EPS with a Storage Solution 15% cheaper than 2023 storage market forecast thanks to the use of EV batteries supplied by a car manufacturer partner.
eBESS, as well as all HyESS platform products, would be unexceptional without a cutting-edge digital control platform.
We are working on our control platform with the Politecnico di Milano since 2007 and in 2018 we start-upped together the PROPHET Project: the most complex microgrid ever developed, embedded with the most advanced power electronics controlled by artificial intelligence and neural networks.
We will continue to develop our Technology Family CONTROL on this platform.
Pietro and Lorenzo will tell you all about our Control systems.

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Pietro Raboni - Head Of System R&D

Do you realize the complexity of our technology? To unlock the full value of this complicated system we built the PROPHET EMS optimization & control platform: our plants Orchestrator!
Thanks to the collaboration with Politecnico di Milano on the PROPHET Microgrid project, in the last 3 years we have been developing our cutting-edge distributed Energy Management System control platform.
It operates through a network of smart control cabinets and maximizes system resiliency thanks to a well-structured modular hardware and software architecture.
The PROPHET EMS product family has been specifically designed for handling the plant optimization leveraging on a wide range of modular Artificial Intelligence-based optimization and predictive algorithms. They maximize the system efficiency while ensuring real-time control, monitoring, automation and safe operation.
The PROPHET EMS has already been installed in our off grid microgrids, grid connected systems and lately even in the Mirafiori V2G plant.

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Lorenzo Meraldi - PROPHET Project leader

The PROPHET EMS' full modularity is reflected also in its software architecture:

- The Forecasting module makes accurate prediction of renewable generation and load demand it exploits the power of A.I. and advanced statistical analysis.
- The Energy Management System unlocks the assets value on the base of the expected power profiles, using a mathematical optimization core.
- The Power Management System exploits a power plant controller to oversee the real time management of the facility with a closed loop regulation.
- The Safety and Automation Management System guarantees the safety of workers and assets .
- The Local Monitoring System gives full insight of the plant, managing and collecting field data, that will be then used for real-time control and Artificial Intelligence algorithms training.

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Pietro Raboni - Head Of System R&D

In our 2023 technology roadmap we will improve our platform embedding even more AI into the PROPHET EMS to keep the lead in the Energy Transition.
New advanced control functionalities that leverage on the integration of machine learning techniques will be pivotal in the control software of our awarded projects.

Let's deepen some of them:

- PV nowcasting will exploit the power of AI to predict the solar variability in the very short term allowing an improved ramp rate capability of the PV Plus BESS as well as the minimization of storage size.
- Predictive Islanding Detection will make grid supporting inverters compliant with the anti-islanding and intentional islanding requirements of modern grid codes.
- Power Oscillation Damping will contribute to safely and stably operate highly renewable penetrated grids.
- Smarter Dispatcher will improve the management of plants composed by batteries with uneven ageing and characteristics.
- E-fleet optimization will enhance the actual algorithm with the integration of A.I. for predicting EV parking pattern profiles.

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Lorenzo Meraldi - PROPHET Project leader

Control isn't just a matter of new functionalities, rather it's a modern industrial approach: the minimization of time-to-market, commissioning tests and software debug time is crucial to succeed.
In our 2023 technology roadmap we will work to satisfy these requirements:
On one side we will expand the Model Based Design to a Model 2 X approach / producing automatic porting of the code from a single simulation environment to every control level and hardware architecture
On the other, we will constitute a hardware-in-the-loop testbench for a complete, fast and reliable control software debugging.

The PROPHET EMS manages, schedules and optimizes all assets in real time. However, the high level of complexity of our plants / demands a digital transformation based on a robust foundation of technology, data and AI to unleash the full value of our systems.
To tell you more, here's Kanika.

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Kanika Dhyani - Head of computer science & artificial intelligence

The energy sector is undergoing a massive digital revolution and eMobility is rapidly catching up.
Thanks to the application of digital technologies and digital tools we have already improved accessibility, productivity and operability of all our installations and products.
In the last 3 years, we connected more than 4700 Battery Storage Modules, for a total of 109,000 battery cells working for over 120,000 operating hours.
Our Power Plants are a complex symphony of high-tech components working in harmony, with each one having to be closely analysed: every Battery Cell, every commutation of the power conversion system, every behaviour of the electrical grid might suggest the need for further optimization or might indicate existing anomalies.
And so, data availability and in-depth analysis are crucial.
This is why, in the 2020 technology roadmap we developed K-WIZE: a fully automated end-to-end solution for data acquisition, ingestion and visualization which is coupled with advanced analytics.
K Wize is a plug and play product, which caters to: Industrial microgrids, PV plus Storage Systems, Utility Scale Storages and Industrial Storage Solutions.
It connects to our installations remotely via Cybersecure communication channels.
Data with different sampling frequencies is acquired, collected and transferred to our fully automated cloud-based infrastructure, readily available for access, elaboration or visualization.
Currently, K-WIZE monitors performance evaluations via KPIs and advanced analytics and allows drill down analysis to uncover underlying issues.
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However, with the 2023 Technology Roadmap we will go even beyond.
We will be the first in implementing predictive analysis coupling Stationary Storage and eMobility for the Mirafiori 25 MW V2G project.
As part of the roadmap, we will further exploit Artificial Intelligence and Machine Learning techniques to develop K-WIZE addons for specific areas like Batteries, Power Conversion Systems and Plant Controllers.
For Batteries, we will track & monitor operations deviating from those set by the manufacturers, forecast battery ageing and predict anomalous behaviour
For PCSs and Plant Controllers, we will use pattern detection to identify deviation from normal operating conditions and provide root cause analysis
We will also design and develop an automated Alert Monitoring System & event-based notification system with advanced analytics and predictive capabilities.
These will be infused with domain knowledge to provide recommendations of actionable items.
All of this, of course, will be applied to each of our applications with a whole dedicated gamut of analysis
In the eMobility sector, K-Wize will provide an incredible added-value; there are infinite innovation possibilities to simplify and revolutionize the charging experience.
Giovanni and Juliet will talk more about it.

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Giovanni Ravina - Chief Innovation Officer

In order to succeed in our mission of making eMobility easier and more sustainable, we are building a comprehensive solutions suite to address any customer need.
These solutions will strongly leverage on our new eMobility Universal Digital Platform, to transform Mobility, Energy, and Financial products into a straightforward, fully digital customer experience.

This platform will make possible to:

1. Ensure a simple and effective User Interface, being the customer an EV Driver, a Fleet Manager or a Charge Point Operator.

2. Allow remote control, monitoring and data collection from different devices, with particular focus on Charging Stations and EV batteries.

3. Apply Artificial Intelligence & Machine learning algorithms to data collected from the field, to continuously improved operations and commercial activities.

4. Develop advanced Vehicle Grid Integration capabilities from Smart Charging to V2X, thanks to the eProphet Energy Management System and eWize functions, running locally and cloud based.

We will continue our Open Innovation strategy under which we collaborate with a network of partners: Companies, from industrial leaders to innovative startups, and leading Univerisities, with them we will continue to assess best in class opportunities to create cutting-edge innovation, without the need of reinventing the wheel (the wheel itself: one of the few things to survive the eMobility revolution).

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Juliet Boissiere - Program Manager eMobility

In 2023 technology roadmap, we are developing our eMobility Universal Digital Platform to transform EV charging into a revolutionary experience. The essence of our digital platform is to unlock services to provide an effective solution to EV drivers 'charging anxiety', which is, as of today, the most important barrier to the purchase of Electric Vehicles. We are working to develop an e-commerce platform that will enable the future launch of a subscription offer coordinating public and private charging. Our universal digital platform has a complex technical architecture, not only to collect customer data but to give a real meaning to its data.

In fact, it is composed of 4 main functionalities:

1. The e-commerce, It will include our product catalogue which will keep growing over time. The current product selection allows our customer to choose autonomously the best charging options based on its consumption.

2. The CRM, to manage customer subscription lifecycle: starting from the purchase of the subscription to the shipping of the easyWallbox then to the hardware installation and finally the daily charging experience of the customer.

3. The Billing System, which has two levels of action: an active one to manage the end-customer subscription and a passive one to manage the different counterparts and the customer actual energy consumption.

4. The Charging Service System covering Private and Public Charging Sessions. On the private charging side, the Customer will have access through a personalized dashboard to its private EV consumption, fully integrated with its home energy provider; and on the public charging side an access to more than 200.000 charging points in Europe through a single APP together with other features such as charging road optimizer granting the customer to drive more relaxed. This type of complex digital products will of course need permanent cybersecured connectivity, therefore we are working on different possible upgrades, leveraging our remote microgrid connectivity experience and cybersecurity know-how. EV drivers will finally experience their electric life in the easiest way with a complete solution calibrated on their charging habits.

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In the next 3 years, we will bring you all into an amazing fully electric eMobility experience
In the next 3 years we will demonstrate one more time to lead the booming of energy storage market!

In the next 3 years, not only we will fully implement this technology roadmap, but we have the ambition to position 3 years ahead of the market, and to continue to lead the energy transition.
See you in 2023.

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Carlalberto Guglielminotti - CEO & General Manager

Thank you for joining us, stay safe, and continue to follow us.