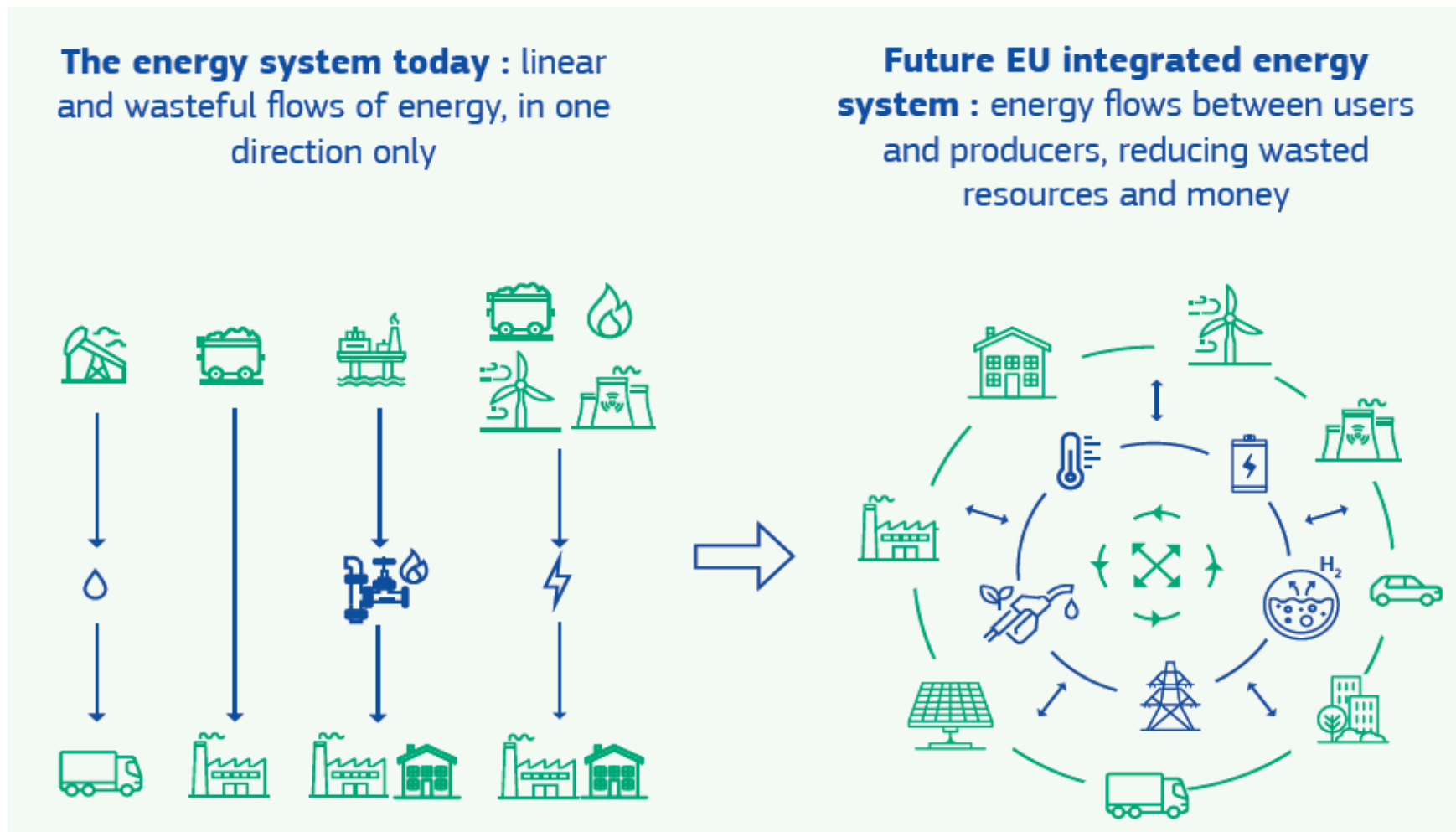


Overview of EU Clean Energy Market

Junichi Ogasawara

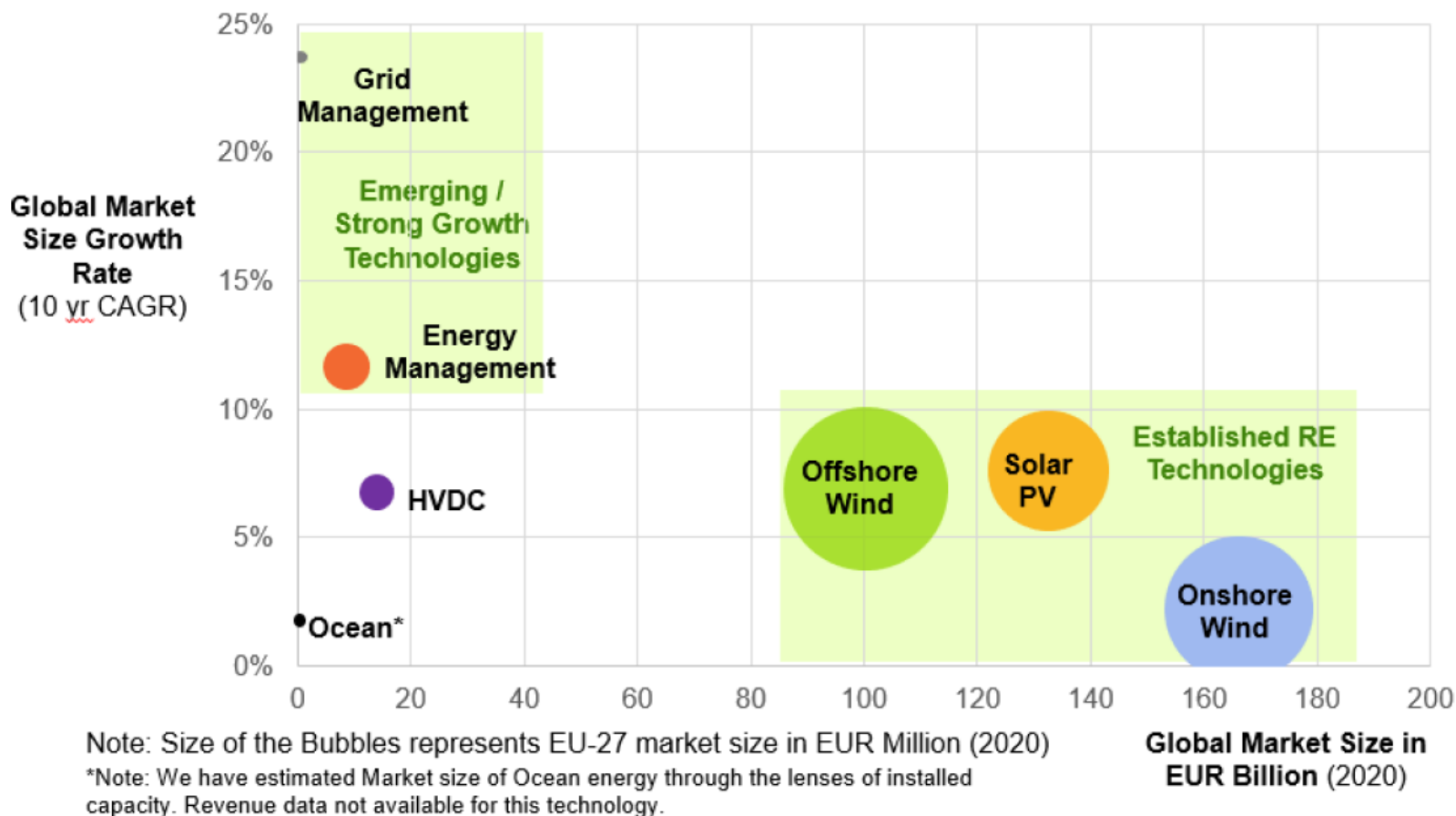
Senior Research Fellow, Manager, Electric Power Group,
Assistant Director, Electric Power Industry & New and Renewable Energy Unit,
The Institute of Energy Economics, Japan

- European Commission aims to transform from current energy system of one-direction flow into future integrated energy system of interactive and bidirectional flow for producers and users in each energy source.



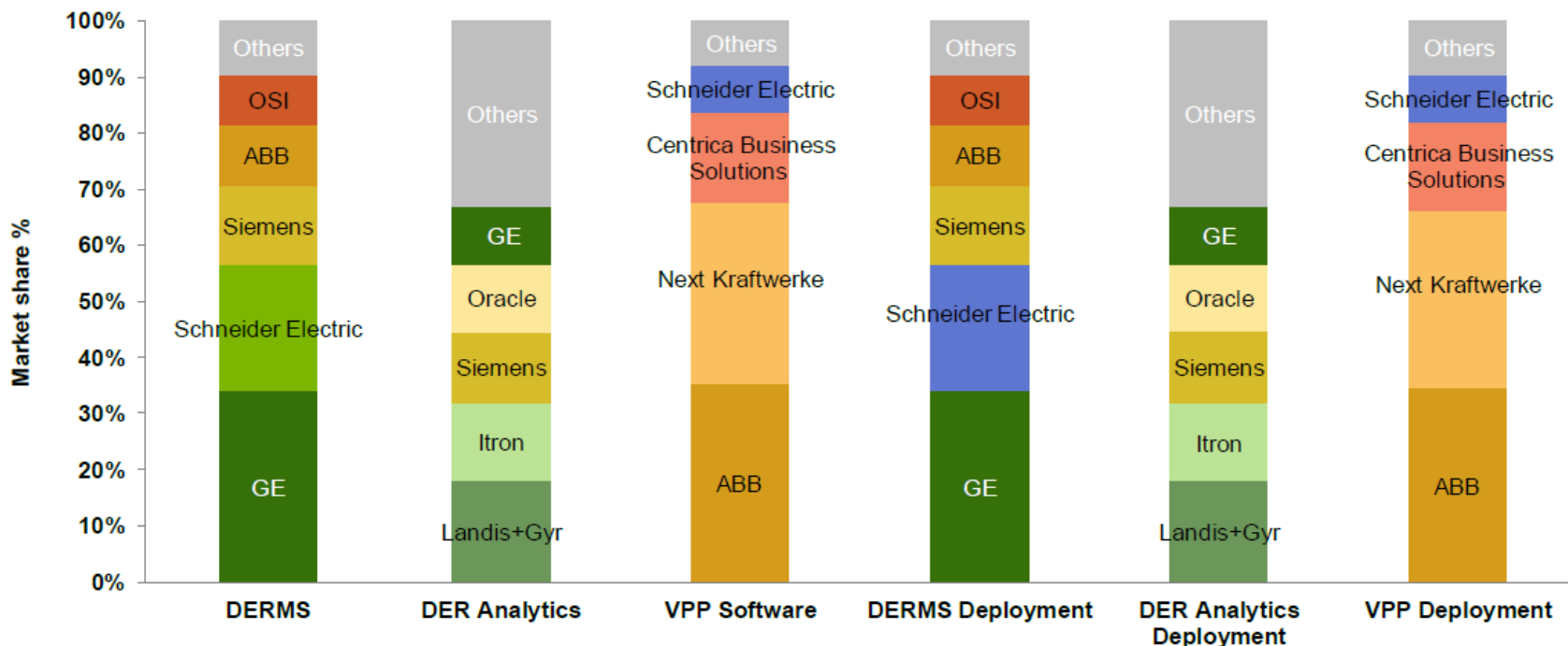
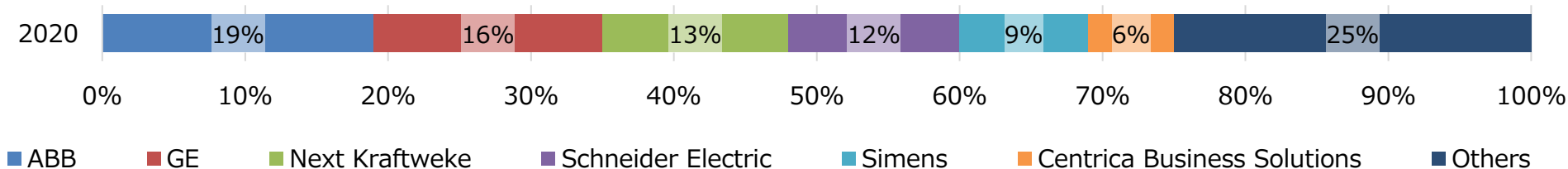
Clean Energy Technology Market

- In April 2021, European Commission released its report, “ASSET Study on Gathering data on EU Competitiveness on selected Clean Energy technologies”, which ranks on forecasted market size and major players in such clean energy technologies as HDVC, Solar PV, Onshore Wind, Offshore Wind, Energy Management, and Grid Management. Grid Management, the sector in the highest growth forecast among them, is on today’s main agenda.



Overview of Grid Management market

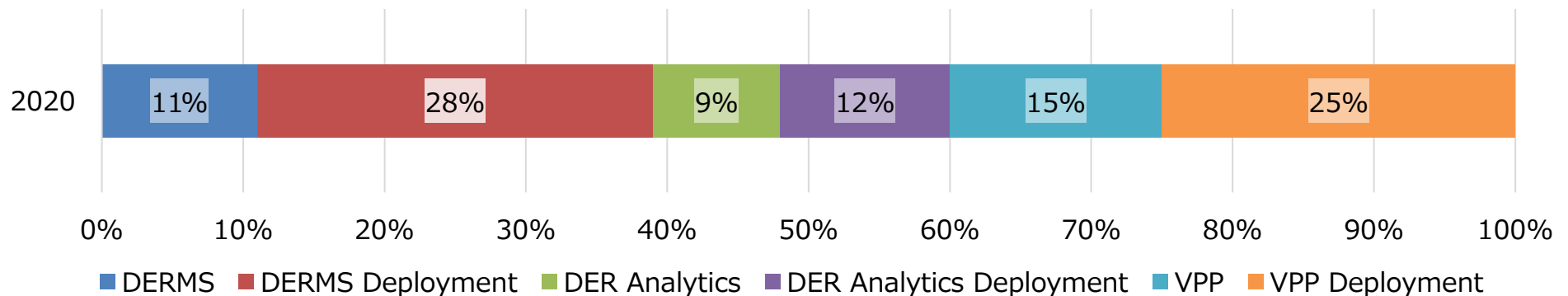
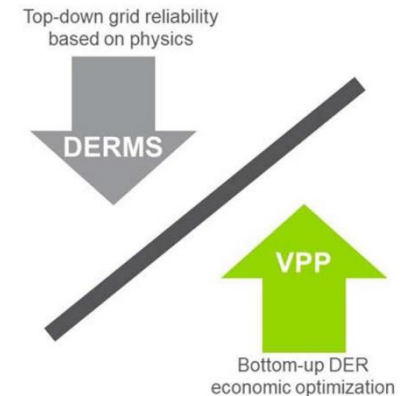
- For each market share of DERMS (Distributed Energy Resource Management System), DER Analytics, VPP Software, DERMS Deployment, DER Analytics Deployment, and VPP Deployment in 2020, you can refer to the graphs below.



Source: European Commission (April 2021) "ASSET Study on Gathering data on EU Competitiveness on selected Clean Energy technologies"

Differentiated attributes of each software platform

DERMS Software	VPP Software	DER Analytics Software
<ul style="list-style-type: none"> Control system that enables optimized control of the grid and DER (to the extent that a utility may be able to dispatch and control DER) Common use cases include VVO, power quality management, and the coordination of DER dispatch 	<ul style="list-style-type: none"> Remotely and automatically optimize DER dispatch via an aggregation and optimization platform linking retail to wholesale markets Enable energy trading in wholesale markets on behalf of DER owners who would otherwise not be able to participate on their own ; VPPs can act as an arbitrageur between DER and diverse energy trading floors 	<ul style="list-style-type: none"> Consists mainly of load and solar forecasting capabilities May suffice for low levels of DER integration, however, growing DER penetration may call for more capabilities DER analytics are being integrated into competitive VPP software and grid DERMS platforms and are less frequently a substantial offering



Source: European Commission (April 2021) "ASSET Study on Gathering data on EU Competitiveness on selected Clean Energy technologies"

Major company profiles in Grid Management sector

Name	Key Financials	Short Description	Operational Track
ABB <Zurich, Switzerland> (DERM, VPP)	Turnover: €7.17M(DERMS); €2.06M (DER Anal.); €29.96M (VPP); €68.5M(Deploy.) Profit:€14M	<ul style="list-style-type: none"> • promotes four core functionalities: resource management, resource optimization, market participation, and commercial settlement • offers ABB Ability DERMS Network Manager including volt/volt-ampere reactive optimization, cloud- based registration capabilities for end users, and BTM forecasting data 	<ul style="list-style-type: none"> • Belgium, France, Germany, Italy, and Poland • United States
Centrica Business Solutions <Antwerp, Belgium> (VPP)	Turnover: €13.64 M(VPP); €23.84 M(Deploy.) Profit: €2.8M	<ul style="list-style-type: none"> • offers its FlexPond patented VPP solution allowing utilities to engage with clients through automated DR (ADR) programs and mixed asset VPP • also offers a FlexTreo platform, a cloud-based energy management system for large C&I customers to reduce power costs and maximize income from DSM programs • provides grid management products enabling clients to cover trading needs • integrates residential customers into its platform, with 50,000 homes enrolled via its 15 partnerships in this space, primarily focused on energy storage as DER grid assets 	<ul style="list-style-type: none"> • EDF, 50Hertz, National Grid, TEPCO
Enbala <Vancouver, Canada> (DERMS, VPP)	Turnover: €1.29M(VPP); €2.26 M(Deploy.) Profit: €0.5M	<ul style="list-style-type: none"> • provides a real-time energy balancing platform for utilities, grid operators, and energy service providers that can toggle between VPP and DERMS applications • has broadened its client portfolio with more diverse assets, delving into EV charging as a VPP asset, for example, while expanding the type and size of other DER load assets, including aggregated residential customers. 	<ul style="list-style-type: none"> • North America • EU, Australia, and Japan
Enel X <Rome, Italy > (VPP)	Turnover: €1.73M(VPP); €3.02 M(Deploy.) Profit: €1.0M	<ul style="list-style-type: none"> • in the flexibility market closely aligned with VPPs, has activities in all open wholesale markets in North America and in many countries in Europe and Asia Pacific • acquired eMotorWerks in 2017, the US- based mobility platform technology firm, offering its customers residential EV charging infrastructure (JuiceBox) running on an IoT charging management platform (JuiceNet) • through its proprietary energy management system platform (DER.OS), which has the ability to serve as both a microgrid controller and a VPP platform, has the ability to increase the economic returns • estimates that two years are needed to integrate the three platforms from EnerNOC (DR), Demand Energy (DER), and eMotorWerks (EVs) to offer a comprehensive mixed asset VPP solution 	<ul style="list-style-type: none"> • Projects in: United States, Italy, Poland, Japan • Non-DERMS/VPP: Argentina, Brazil, Colombia, and Peru

Major company profiles in Grid Management sector

Name	Key Financials	Short Description	Operational Track
General Electric <Boston, United States> (DERMS, Limited VPP Offering)	Turnover: €22.17M(DERMS); €5.47M (DER Anal.); €48.03M(Deploy.) Profit:€7.8M	<ul style="list-style-type: none"> provides GE DERMS offering a DER orchestration software solution that encompasses technologies such as advanced energy management, ADMSs, real-time insights, DER orchestration, and geospatial services aims to cover energy value chains beginning with GIS asset mapping, distribution operator services, transmission operator services, and market operator and player solutions. offers a technology- agnostic solution allowing energy companies to integrate small-scale renewables produced at the distribution-level, connect new smart buildings to the grid, manage energy storage systems (ESSs) to adjust offers with demand. It also enables EVs charging in an optimized way, and to manage and shave end-user consumption via its DR function 	<ul style="list-style-type: none"> Grid Solutions operations in 80 countries
Indra – Advanced Control Systems <Madrid, Spain > (DERMS)	Turnover: €1.96M(DERMS); €3.42M(Deploy.) Profit:€1.0M	<ul style="list-style-type: none"> provides a combined IT/OT value through the addition of Advanced Control System (ACS) extending its overall offering with an OT solution composed of real-time software solutions such as SCADA, feeder automation, and DERMS focused on DERMS as an extension of its ADMS, while its offered other capabilities, specifically an Internet of Things platform to manage and optimize DER assets in the grid. It is still early in the integration process, but the combined solution could develop into a competitive edge-to-edge DERMS 	<ul style="list-style-type: none"> ACS primarily targeted US mid-market utilities; Indra acquisition brings global presence
Next Kraftwerke <Cologne, Germany> (VPP) *ENECO has acquired a minority share of 34%	Turnover: €27.19M(VPP); €47.53M(Deploy.) Profit:€10M	<ul style="list-style-type: none"> helped launch and operate NEXT Pool, now the largest VPP in Europe (and the world), covering Germany, Austria, Belgium, France, Netherlands, Poland, Switzerland, and Italy. owns its in-house developed VPP platform (NEMOCS) offered to utilities. NEMOCS trading portal is dubbed NEXTRA. NEMOCS offers monitoring, asset optimization based on market and weather data, and fully automated control based on individual asset rules and is offered as a software as a service (SaaS) product 	<ul style="list-style-type: none"> NEMOCS’s officially announced customer, the British supplier called Ecotricity, and its several pilots running in South Korea and Japan. A partnership with Toshiba to jointly develop VPP solutions

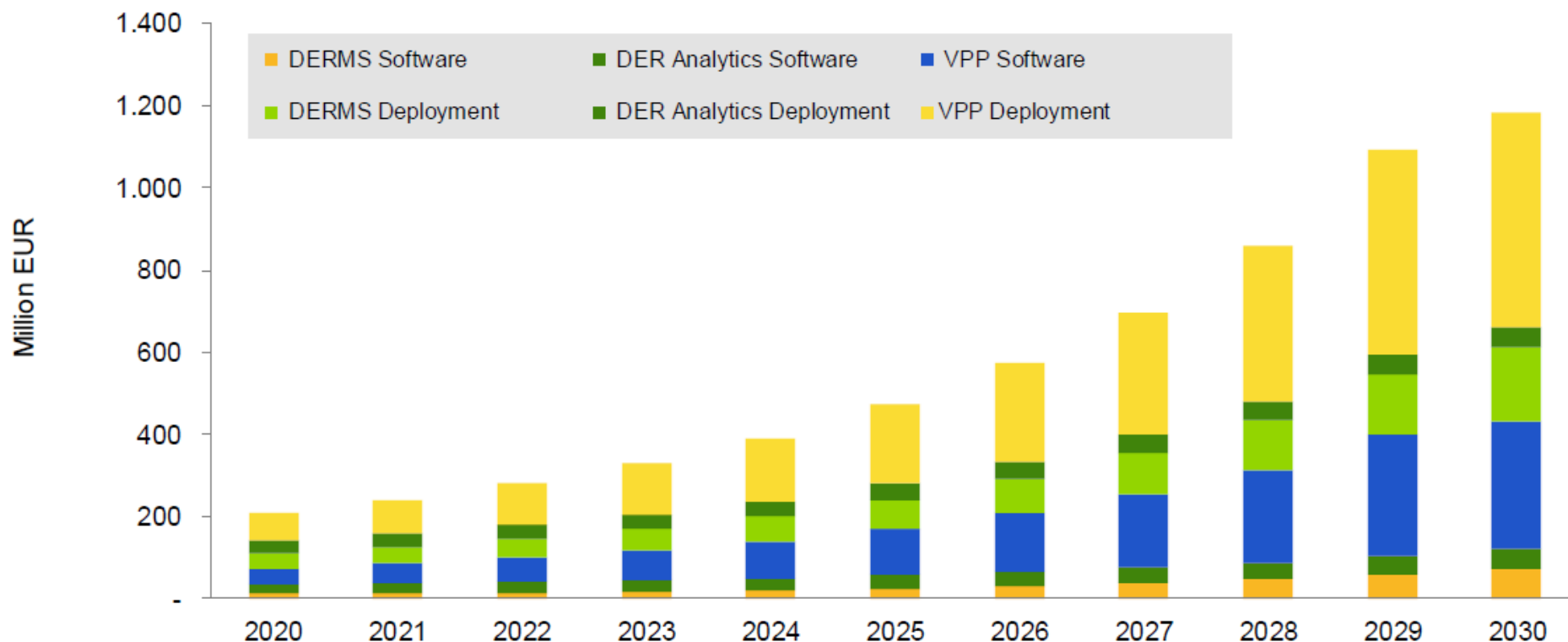
Major company profiles in Grid Management sector

Name	Key Financials	Short Description	Operational Track
OSI <Medina, United States> (DERMS)	Turnover: €5.87M(DERMS); €0.97M (DER Anal.); €11.94M(Deploy.) Profit:€2.8M	<ul style="list-style-type: none"> Key components of OSI's DERMS include real-time system interfaces, cybersecurity with North American Electric Reliability Corporation (NERC)/Federal Energy Regulatory Commission (FERC) standards, and extensive management functionality beyond generation and distribution 	<ul style="list-style-type: none"> Ramping up international efforts (currently ~15% of sales)
Schneider Electric <Paris, France> (DERMS, VPP)	Turnover: €14.67M(DERMS); €2.41M (DER Anal.) €7.25M(VPP); €42.53M(Deploy.) Profit:€13.1M	<ul style="list-style-type: none"> offers integrated energy solutions across multiple market segments. Segments include residential and commercial buildings, industries and machines manufacturers, utilities and infrastructure, and data centers and networks has partnered with AutoGrid to serve as a global reseller of the AutoGrid Flex platform; this joint solution integrates it EcoStruxure ADMS. The company thus has vast VPP share in Europe despite not serving as a standalone VPP provider Its DERMS solution can serve as a standalone solution or be embedded with existing ADMS. Embedding it with ADMS allows complete visualization of DER in the distribution network in geographic, schematic, and substation internal views 	<ul style="list-style-type: none"> Operations in more than 100 countries Strong coverage across Europe; making successful inroads across US
Siemens AG <Munich, Germany> (DERMS, VPP)	Turnover: Turnover: €9.13M(DERMS); €6.76M (DER Anal.) €0.86M(VPP); €29.27M(Deploy.) Profit:€5.1M	<ul style="list-style-type: none"> is a global technology provider positioned in the electric power value chain by offering solutions for generation, transmission and distribution, smart grids, smart cities, and energy efficiency offers its Decentralized Energy Management System (DEMS) - a DERMS which has also been applied to VPPs. Although Siemens offers a comprehensive solution for grid-to-edge customer management, it does not offer a specific VPP solution offering and sees more near-term opportunities with microgrids in the DER space 	<ul style="list-style-type: none"> Deployments in a wide range of geographies and regulatory environments, giving it top marks.

Source: European Commission (April 2021) "ASSET Study on Gathering data on EU Competitiveness on selected Clean Energy technologies"

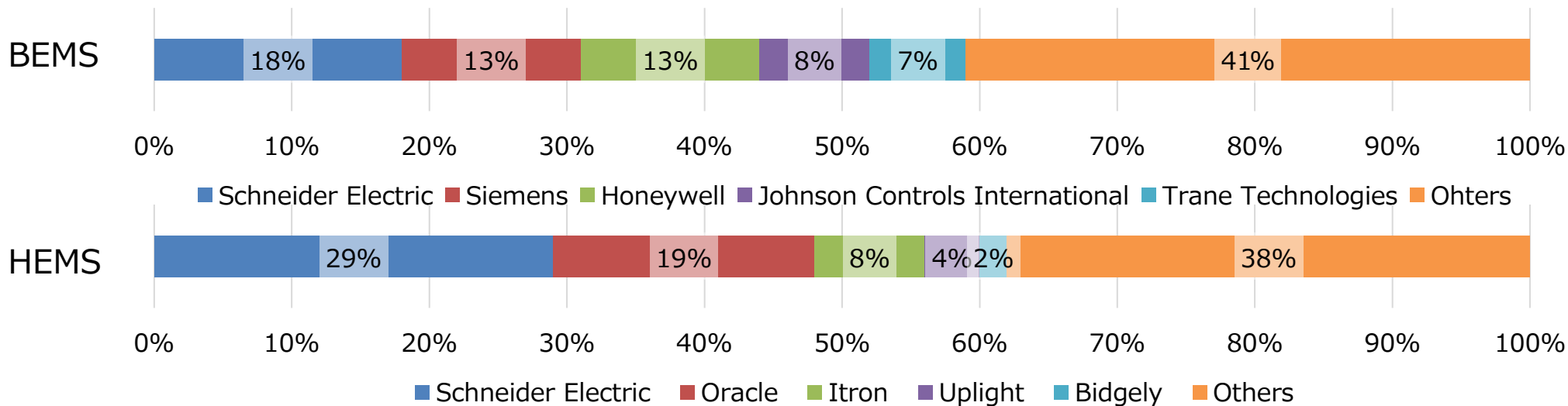
EU's Grid Management Market Forecasted Growth towards 2030

- In 2020 the size of EU 27 countries' Grid Management market is €197.7M; the market size is expected to reach €12,000M by 2030, at 19.6% annual CAGR growth during forecast period of 2020 to 2030.



Source: European Commission (April 2021) "ASSET Study on Gathering data on EU Competitiveness on selected Clean Energy technologies"

<Ref.>Overview of Energy Management (BEMS · HEMS) Market



	Short Description
Schneider Electric (France) Turnover(BEMS) €1,360M	Energy management and automation in homes, buildings, data centers, infrastructure, and industries
Johnson Controls (Ireland) Turnover(BEMS) €643M	HVAC, building automation and controls, security, fire detection and suppression, digital, and other solutions for intelligent buildings
Oracle Opower (United States) Turnover(HEMS) €172.6M	A suite of customer digital engagement tools and communications, energy insights and alerting, energy efficiency, and DR
Bidgely (United States) Turnover(HEMS) €18.1M	An AI-powered call center solution aimed at helping improve the customer experience

Source: European Commission (April 2021) "ASSET Study on Gathering data on EU Competitiveness on selected Clean Energy technologies"

Conclusion

- The standpoint from “manufacturing” has been traditionally the focal point of electric utilities since they have been involved in infrastructure development. However, for utilization of users’ facilities as well as of decentralized facilities is a key contributing factor to electric power companies in the coming future, the perspective from “system and software” will be more and more crucial to their success.
- Electric utilities need to seriously consider about how they should ally with unconventional players who have secured a significant share of DER and VPP market.