eMobility information challenges, IBM EV enablement platform and the FP7 Green eMotion overview

Information Marketplace on a cloud

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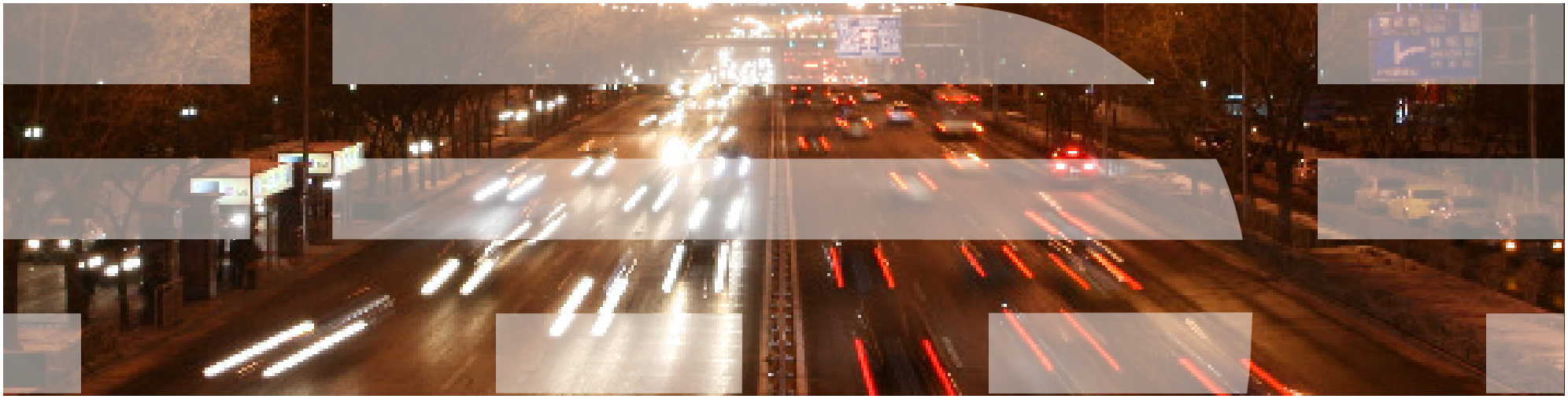
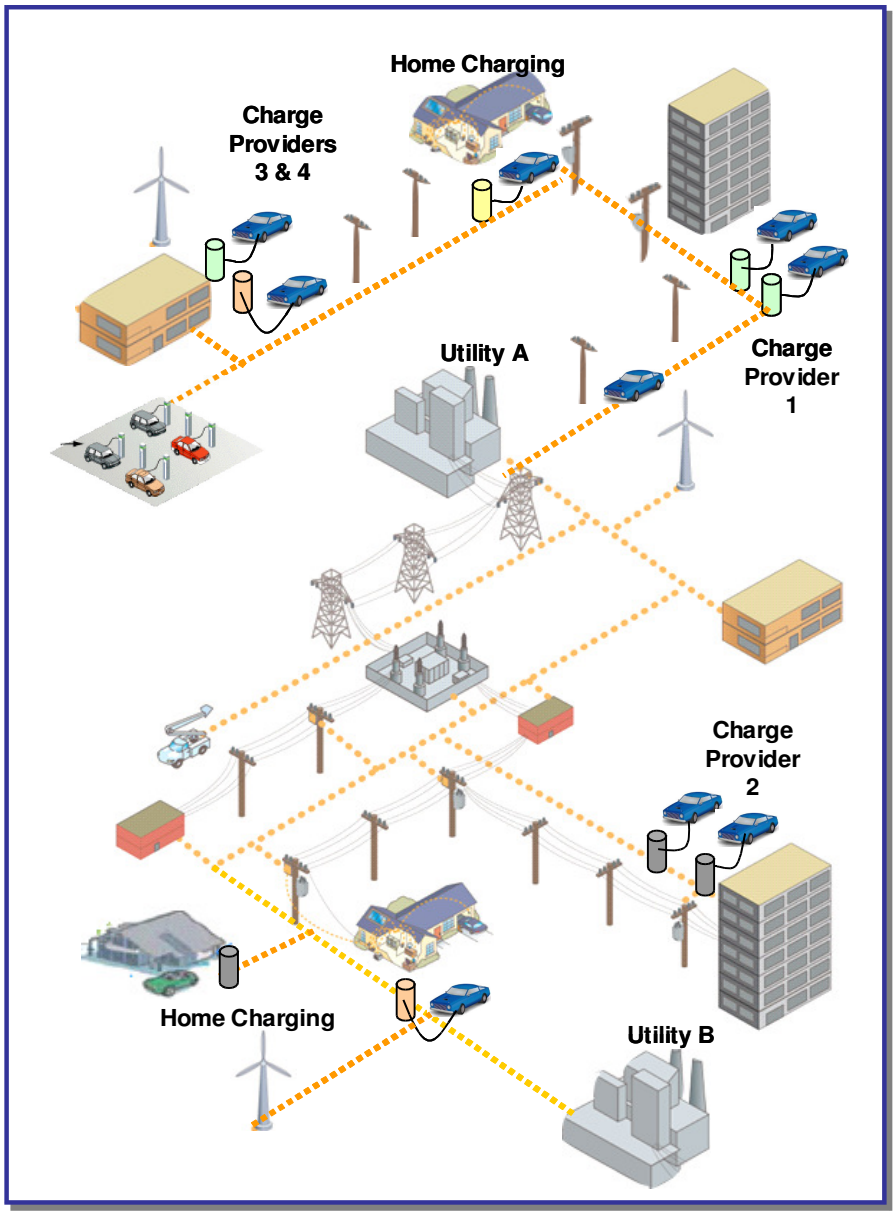


Agenda

- Information challenges of e-mobility
  - Smart grid perspective: physical constraints, controlled charging
  - Retail perspective: driving, charging, roaming, services, payment
- IBM's role in addressing the information challenges
- Green eMotion EU project:
  - Overview of the consortium and work packages
  - Zoom-in to the creation of central information hub (WP3)
  - Expected added value

Overview of challenges for eMobility stakeholders



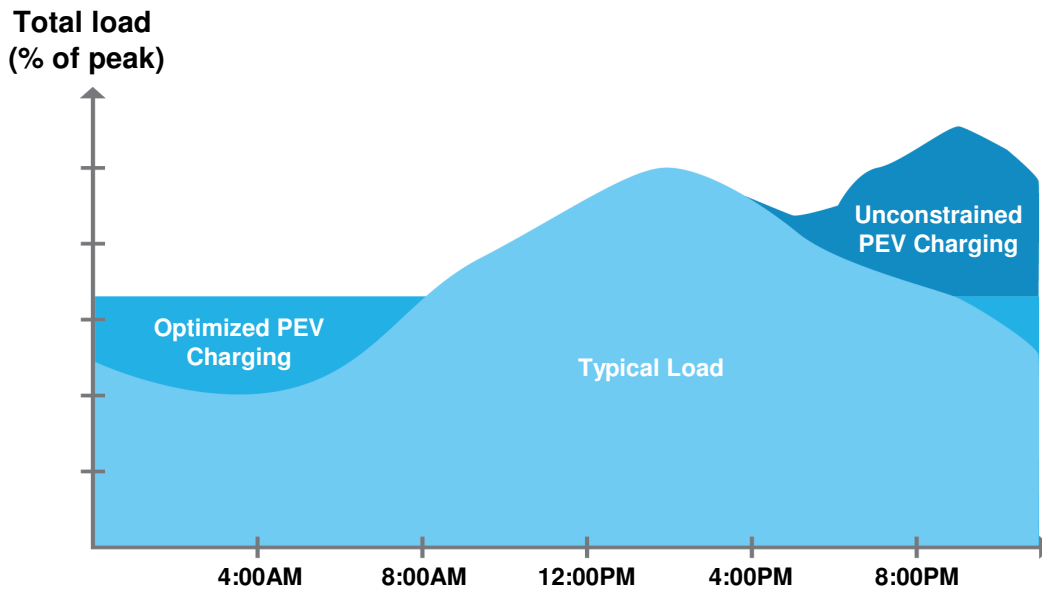
Market Challenges	Utility	Service Prov	Automotive	Government	Consumer
Large and mobile load requires proper management to minimize impact on grid operations	●	●	◑	◑	●
New services and customer interactions require new business processes	●	●	●	○	●
Recharging times & transactional complexity require new metering and charge calculation capabilities to support PEVs	●	◑	○	○	◑
High volume of sensitive transaction data requires data security	●	●	◑	●	●
Multiple Charge Service Operators leads to interoperability issues	◑	●	◑	○	●
Travel to different utility service territory leads to charge roaming challenge	●	●	○	◑	◑
Theft and vandalism of public charge posts	◑	◑	○	◑	○
Anticipated PEV 'fueling' taxes will require report and audit to government entities	◑	◑	○	●	○
Public charge posts will require appropriate siting, installation and maintenance	○	◑	○	◑	○
Need to capture data on vehicle and battery performance for future improvement	○	◑	●	○	○
Consumers will likely demand multiple payment options– an expensive challenge for service providers and utilities;	●	●	●	○	●
Secondary Uses for batteries, battery disposal / recycling	◑	◑	◑	○	◑
Insufficient public charge spots will lead to range anxiety	●	●	●	◑	●
Consumer anxiety on seamless payment availability & security	●	●	●	◑	●

Impact: High ● Moderate ◑ Low ○

Grid related information challenges

- **Even in the short term, energy providers will need to find ways to motivate the end consumer to charge off-peak (a challenging proposition)**
  - Time of Use pricing to incentivize users to charge vehicle at night
- **Ultimately, additional management tactics required to shape EV load**
  - Real-time pricing can be communicated to EVSEs - Smart EVSEs and/or Smart Vehicles can use this information to schedule charging
  - Active Management of EV load by aggregate or by logical grouping
- **How do you motivate users to enroll in Demand Response Programs**
  - The need for charge guarantees?
- **Congestion management on LV substation is considered a priority and can be addressed by several approaches:**
  - **Centralized:**
    - TOU charging
    - Direct control of EVSE
  - **De-centralized (by aggregator service):**
    - ADR (interrupt charging, load shedding)
    - V2G, V2H (ancillary services)
    - Virtual power plant (balancing market)

Typical Utility 24 Hour Load Profile
with the addition of Plug-in Electric Vehicles



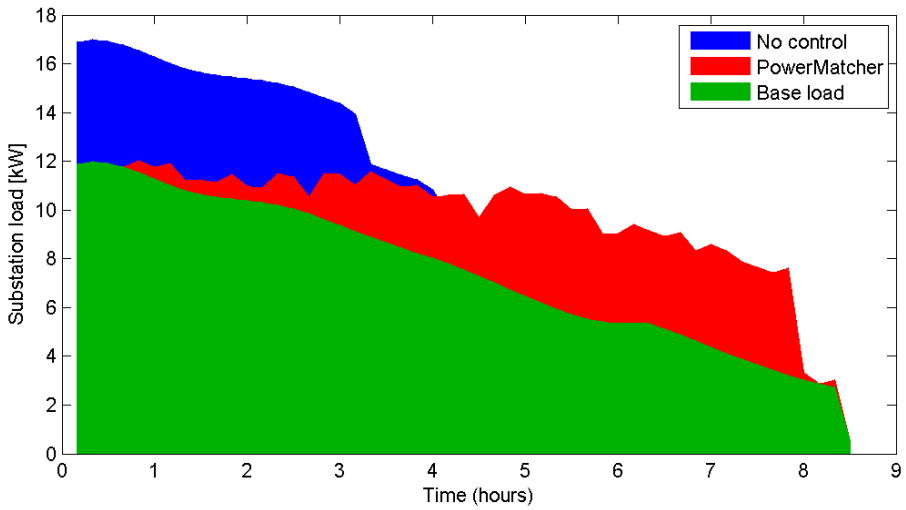
Example: smart charging flexibility for grid operator and energy producer

EV controlled charging – grid congestion management:

Case: 200 households using **A: 66% and B: 103%** of substation capacity at peaks. Both neighborhoods replace cars with EV (full penetration)

- **A: peak increase from 66% to 92% (not 119%)**
- **B: peak increase from 103% to 111% (not 180%)**

Without controlled charging the peaks would increase to 119% and 180% and grid would need to be reinforced

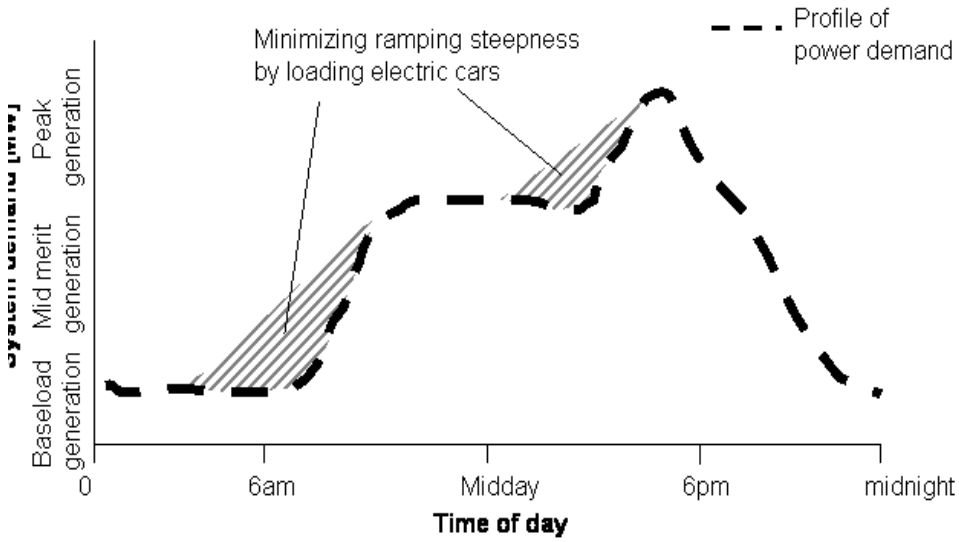


Synchronized increase in EV charging load - slowing the ramp up of peak power-plants:

Peak power plant (CCGT) is required to ramp up less quickly

- Heat rate penalty is avoided (**20% fuel reduction**)
- **Gas and CO2 savings**
- Longer life cycle of power plants
- Lower maintenance costs

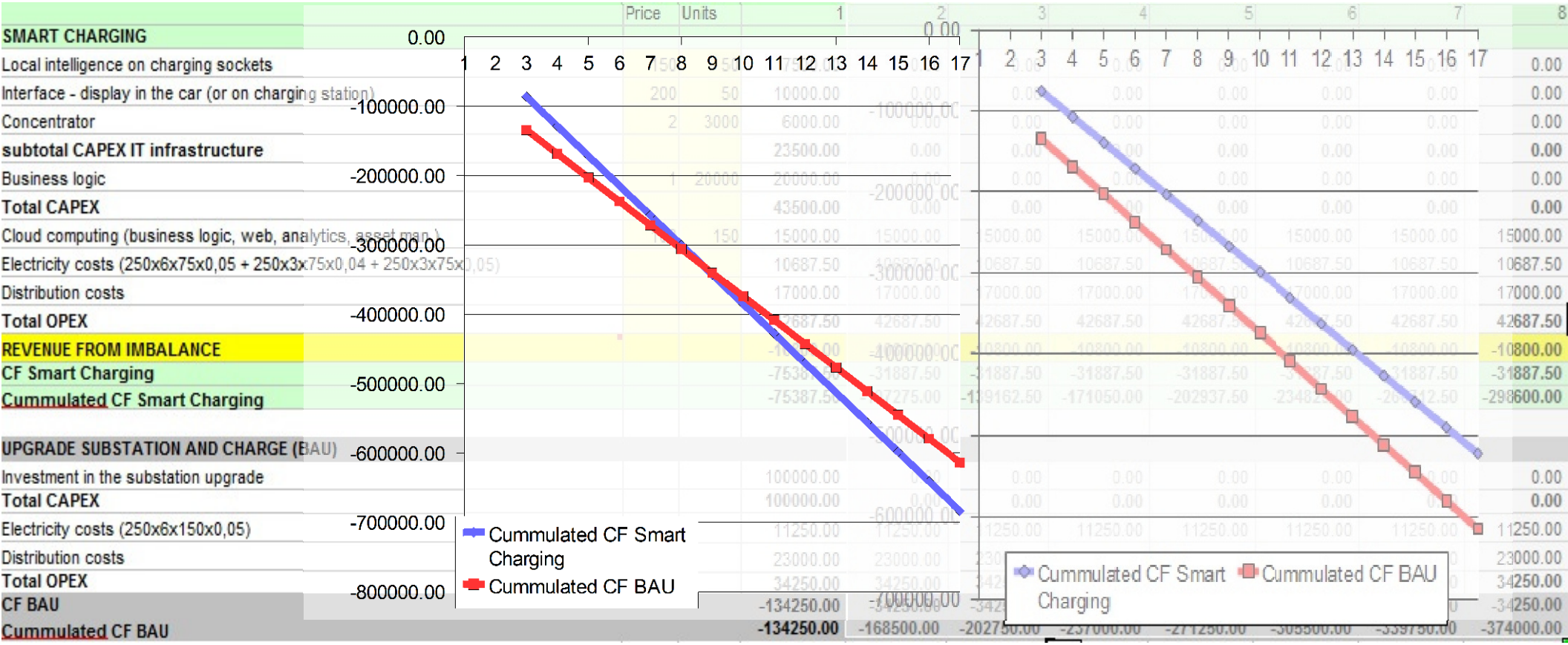
Renewables will require increased use of peak power, controlled load can slower this demand and save costs



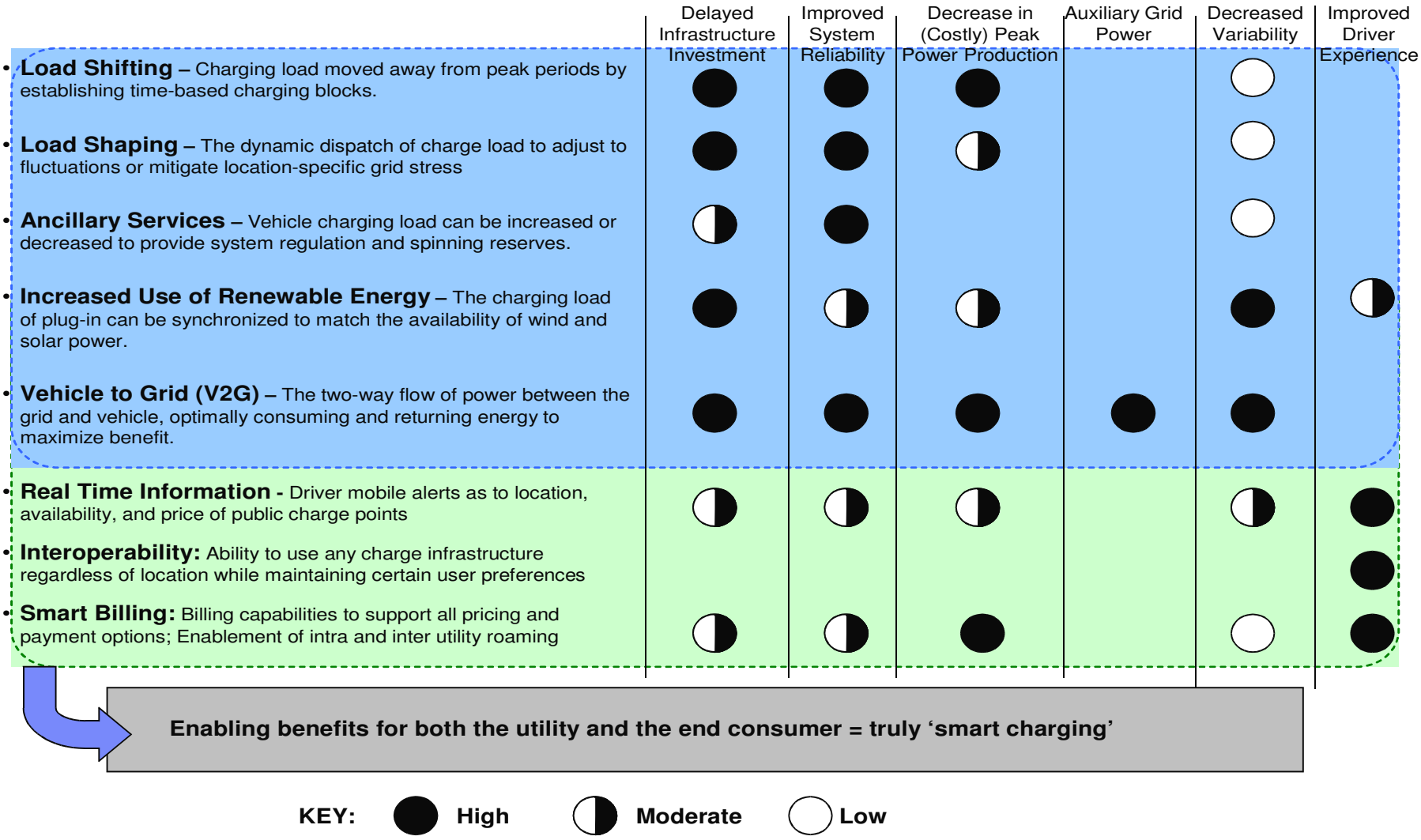
Example: investment case

Smart charging in an office building with 1MW LV substation (used 90% at peaks)
150 charging points (3kW), working hours 9AM-5PM, all EV need 6kWh at day end

a. Reference case (BAU): all come, connect and charge (new substation needed)
b. Smart charging case: synchronized charging with PowerMatcher (EV-VPP)



What is “Smart Charging” in our view?



Driving related information challenges

- **Charging**
  - Search for charging point
    - Nearby, near a destination
    - Speed of charging (fast charge, battery switching, normal 3kW charge)
    - Availability / scheduled use, compatibility
    - Cost of charge (connection/reservation fee, electricity rate, parking, special offers)
    - Environmental/energy parameters (CO2 intensity, type of energy, DR scheme)
  - Reserve charging point (one time, recurring, advanced)

- **Security and privacy**
- **Roaming** (2 approaches: financial markets, communication markets)
  - Between countries
  - Between EVSE operators / DSO/ energy suppliers

- **Value added services**
  - Eco-routing, feedback on driving
  - Analytics and reporting: CO2 monitoring, charging history, monitoring of current EVSE use
  - Remote charging, remote vehicle access, preventive maintenance
  - Infotainment and link to social networking

Payment and billing challenges

Multiple Payment Options

Prepaid

- Typically requires RFID card or other method to ID unique user
- User authenticated and usage debited by central entity or charge operator
- Cost of other methods + initial policy is leading toward these systems

Subscription

- Similar to prepaid, however, usage appear on monthly statement (e.g., utility bill)
- Cost of other methods + initial policy is leading toward these systems

Point of Sales

- Model most familiar to end users as it replicates petrol refueling
- Expensive card readers and PCI compliance
- Would require new metering capabilities to provide on demand meter read to enable PoS

Mobile Pay

- Model most familiar to end users as it replicates petrol refueling
- Expensive card readers and PCI compliance

Unique challenges of paying for charging an electric vehicle

- **Clearing and settlement process to enable charge roaming**
- **Public transactions may be 'composite charges'**
- **New tax implications (electron per mile, clean energy)**

Role of IBM in addressing the eMobility information challenges

- creation of eMobility information exchange platform (GeM)
- integration of the platform within the existing systems (EDISON)

Work Management	Investment Planning	Asset Management	Supply Chain & Procurement	Billing	Tax Collection	
Maintenance	DMS	Field Service	Call Center	CRM	Metering	GIS

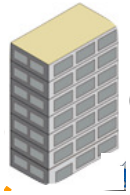
Utility Enterprise(s)

Utilities
(Grid Operator & Retailer)

Payment Support | **Optimization & Load Control**
Settlement | **Asset & Service Mgmt**
Charge Calculation | **Mobility Services**

Systems Management
Transaction Management
Process Orchestration
Integration Services | **Security**


Automotives



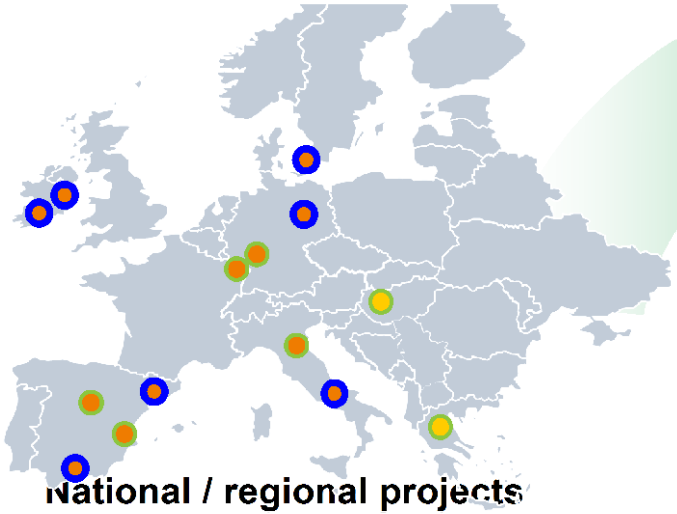
Governments

Drivers

Charge Service Operators
(Municipalities/Companies)

EVSE NOC / Head End

The Green eMotion project



National / regional projects

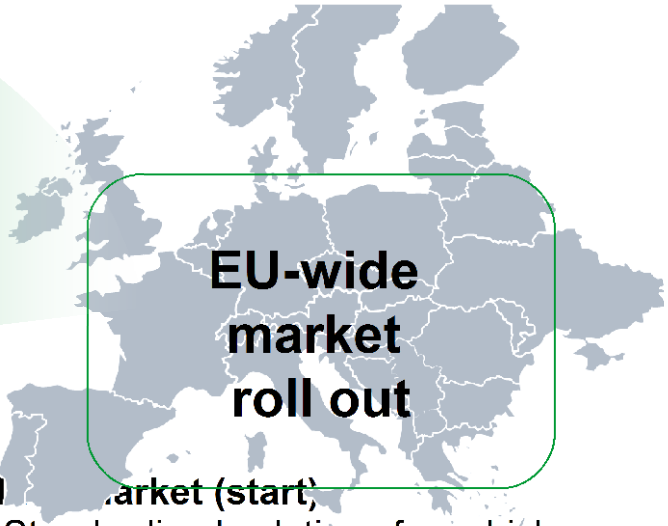
- Proof technology (equipment level)
- Test of operation and billing
- First business models
- Initial local consumer awareness

Green eMotion

- **Connection of national / regional projects**
- **Market place**
- **Interoperability and standards**

EU project Green eMotion

- Proof of interoperability
- Future proofing of protocols and interfaces
- Introduction marketplace an advanced services
- Wider consumer awareness and acceptance

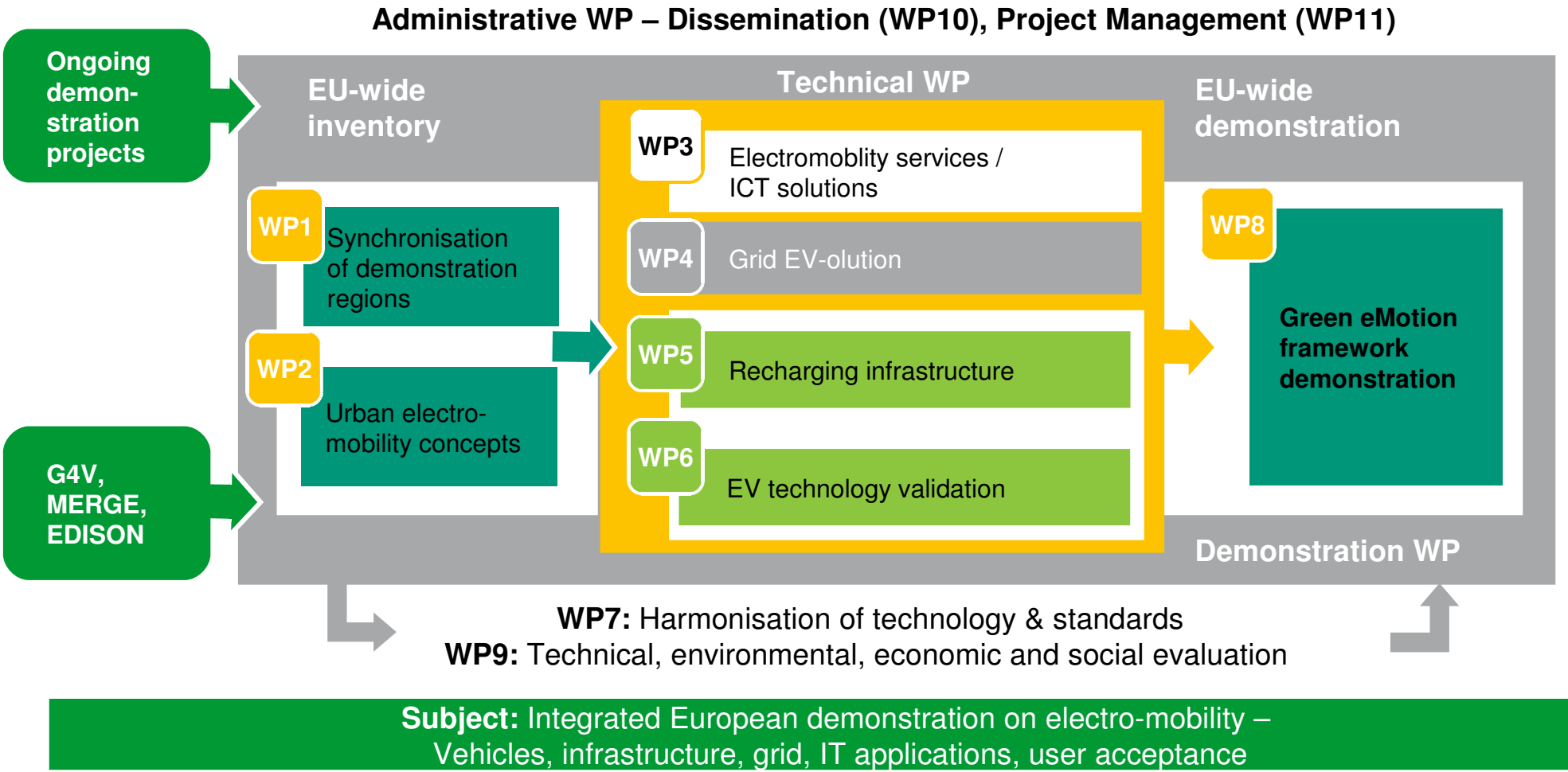


M arket (start)

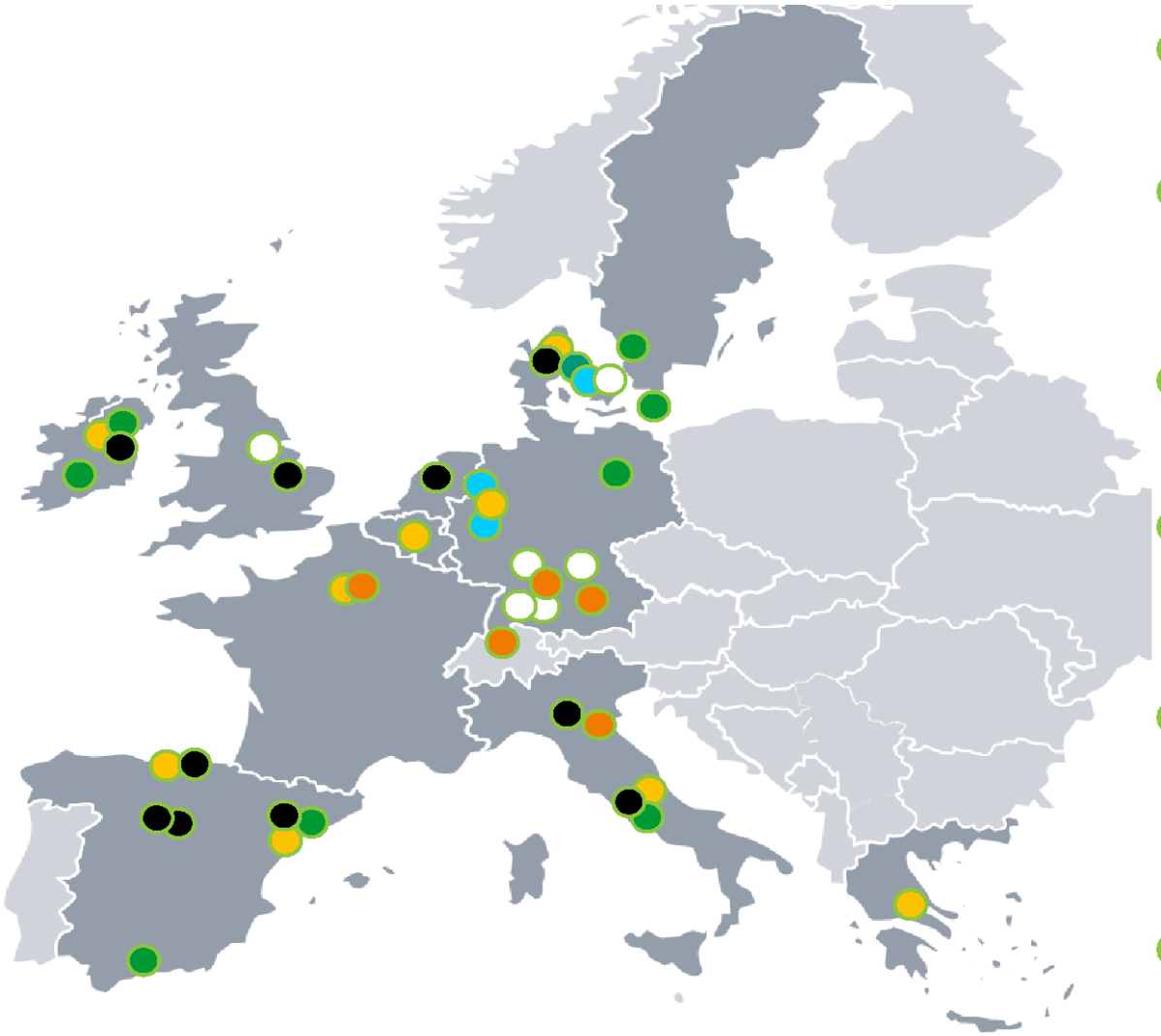
- Standardised solutions for vehicles infrastructure, network and IT applications available
- Preconditions and user acceptance established

Legislative support
Incentivising policies and regulation
Consumer incentives

Work organization at Green eMotion



Green eMotion project consortium



Industries:
Alstom, Better Place, Bosch, IBM, SAP, Siemens

Utilities:
Danish Energy Association, EDF, Endesa, Enel, ESB, Eurelectric, Iberdrola, RWE, PPC

Electric Vehicle Manufacturers:
BMW, Daimler, Micro-Vett, Nissan, Renault

Municipalities:
Barcelona, Berlin, Bornholm, Copenhagen, Cork, Dublin, Malaga, Malmö, Rome

Research Institutions and Universities:
Cartif, Cidaut, CTL, DTU, ECN, Imperial, IREC, RSE, TCD, Tecnalia

EV Technology Institutions:
DTI, FKA, TÜV Nord

+ External Stakeholders to facilitate the access to information not held by the consortium, to disseminate Green eMotion knowledge and encourage its application outside the consortium

IBM´s role in the Green eMotion Project

- IBM is a **founding member** of Green eMotion
- IBM is **member of the executive board**
- IBM is the **leader of the technical board**
- IBM is the **leader of the central ICT Platform Solution** (ICT = Information & Communication Technology)
- IBM is responsible for **ICT reference architecture**, **core services**, **operational model** and **operations**

Person-Months per Participant	
Participant short name [11]	Person-months per participant
Siemens	101.00
Better Place	70.50
EDF	1.00
Endesa	4.00
Enel	11.00
IBM	140.00
Bosch	42.00
RWE	8.50
SAP	107.00
Daimler	7.00
BMW	7.00
Total	499.00

ICT is seen as the key enabler for electromobility, offering a multitude of basic and advanced services to the driver. The integration of these services will allow the usability for the end user without regional limitations (e.g. with roaming or recharging location services) and will enable the realization of economies of scale for advanced service offerings like fleet management.

DAIMLER

RWE The energy to lead

endesa

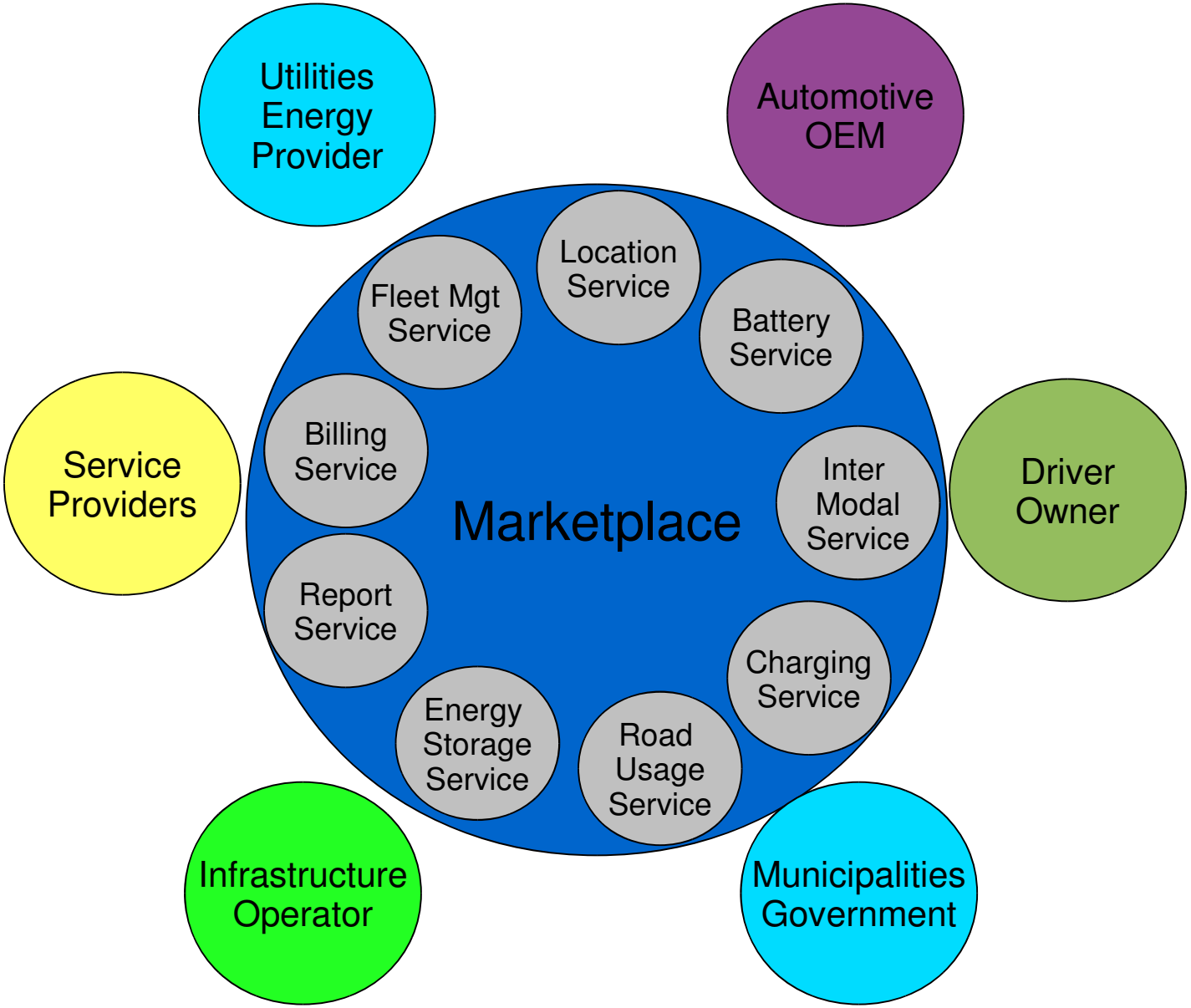
BOSCH Invented for life

IBM

SAP

SIEMENS

The Marketplace in GeM - The "Blue Thing"



To support the requisite business processes needed for European wide mobility of EV the Marketplace will be public and based on open architecture, common standards and protocols and open standard interfaces with flexible, scalable and state of the art technology.

- Consumer convenience for EV-users
  - Enabling various driver services such as various charging fees, incentive structures and payment options
  - Enabling roaming for vehicles travelling beyond regional and country boarders
- New services for market actors
  - Reduction of costs of installing and operating in-home and public charging spots through open platform integration and scale economies for EV specific business processes
  - Support of intelligent transportation systems and innovative fleet management
- Operation of electricity grids and integration of renewable energy systems (RES)
  - Enable local energy storage and demand shift capability
  - Minimize impact on utility grid infrastructure due to localized charging concentration
  - Support integration of larger shares of RES
  - Support generation driven demand instead of demand driven generation

Business scenarios defined for GeM WP 3 – First Results

Category	Business scenario	Priority
C	Charging a. at home/ b. semi-publicly / c. publicly	1
	Differentiation of customer contracts, SLA- Check	2
	Mono-directional control of charging	2
	Bi-directional control of charging (V2G, V2H)	2
S	Marketplace: buying, selling, routing	1
	Service detail records for accounting and billing	1
	B2B contract management	1
	Service provisioning/registration/life cycle management	1
	Standardization of interfaces, messages (for remote customer service)	1
	B2B partner management	1
R	Roaming both between EVSE operators and between countries/regions	1
	Authentication (for all kind of services) -> contract	1
	Validation of contracts (from, to, scope, tariff info, ...)	1
O	Core driver scenarios (best charging, reservation)	1
	Additional value added services (analytics and reporting, eco-routing)	2
	Innovative services (advanced charging, maintenance)	3
E	Grid related value added services (Congestion management)	1
	Energy trading value added services (VPP, imbalance)	2
	Energy retail value added services	2

Example: IBM Grid Integration Project

Project EDISON

- **D**esign of an energy system for an entire country with support for large % EVs.
- **N**ational interest to optimize wind energy → prevent subsidized excess wind energy from crossing national borders
- **I**nitial phase: Real-life testbed on the Danish Island of Bornholm (pop. 40,000)
- **I**n scope: how do user profiles (e.g., ”Charge Guarantees” follow user when charging outside of ’home network’

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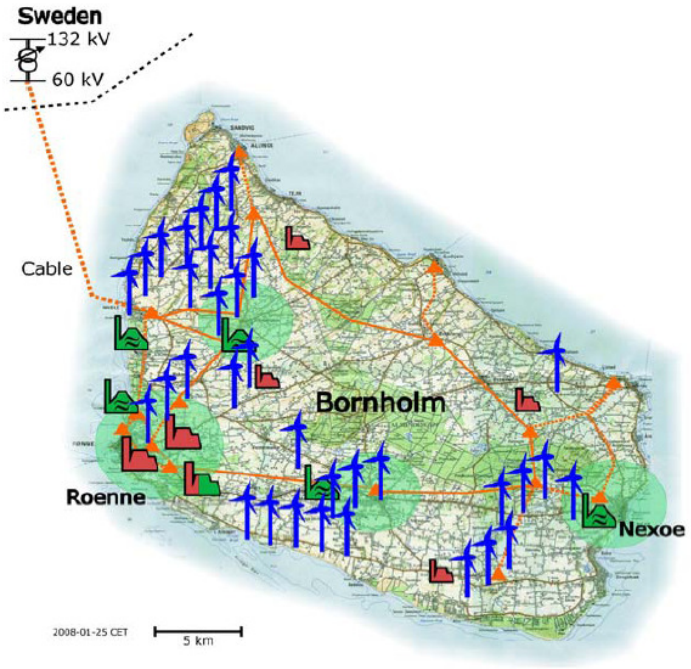

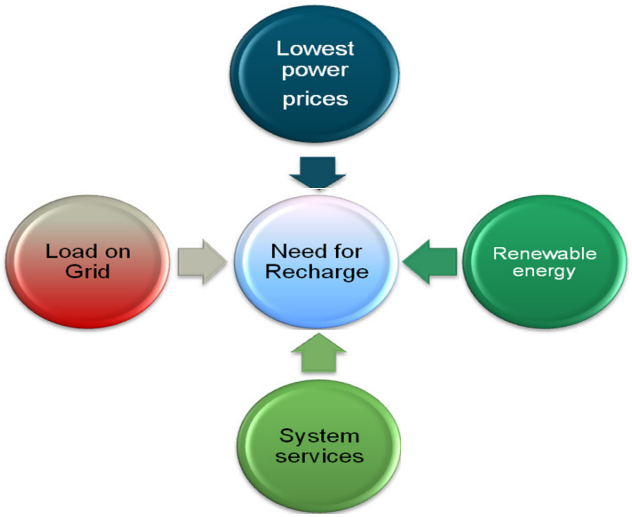

IBM’s contribution:
Development of management system to control charging of cars in accordance with the availability of wind energy while enabling optimal use of the electricity grid and enablement of charge roaming

Conclusions

- eMobility brings us multiple information challenges
  - From the energy perspective
  - New style of transport (planning, routing, charging, billing)
  - Number of new actors (E&U, Service providers, EVSE operation, communication)
  - Integration within existing systems
- IBM contributes to addressing the challenges with information platform and optimization
- Green eMotion is one of the largest EV demonstration projects aiming at real life implementation of a complex information exchange and multi-actor clearing platform

Thank you very much for Your interest, I am happy to answer Your QUESTIONS..

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