



Institut de Recerca en Energia de Catalunya
Catalonia Institute for Energy Research



Task 28 HEV TCP IEA “V2X insights and applications”

11th October 2017

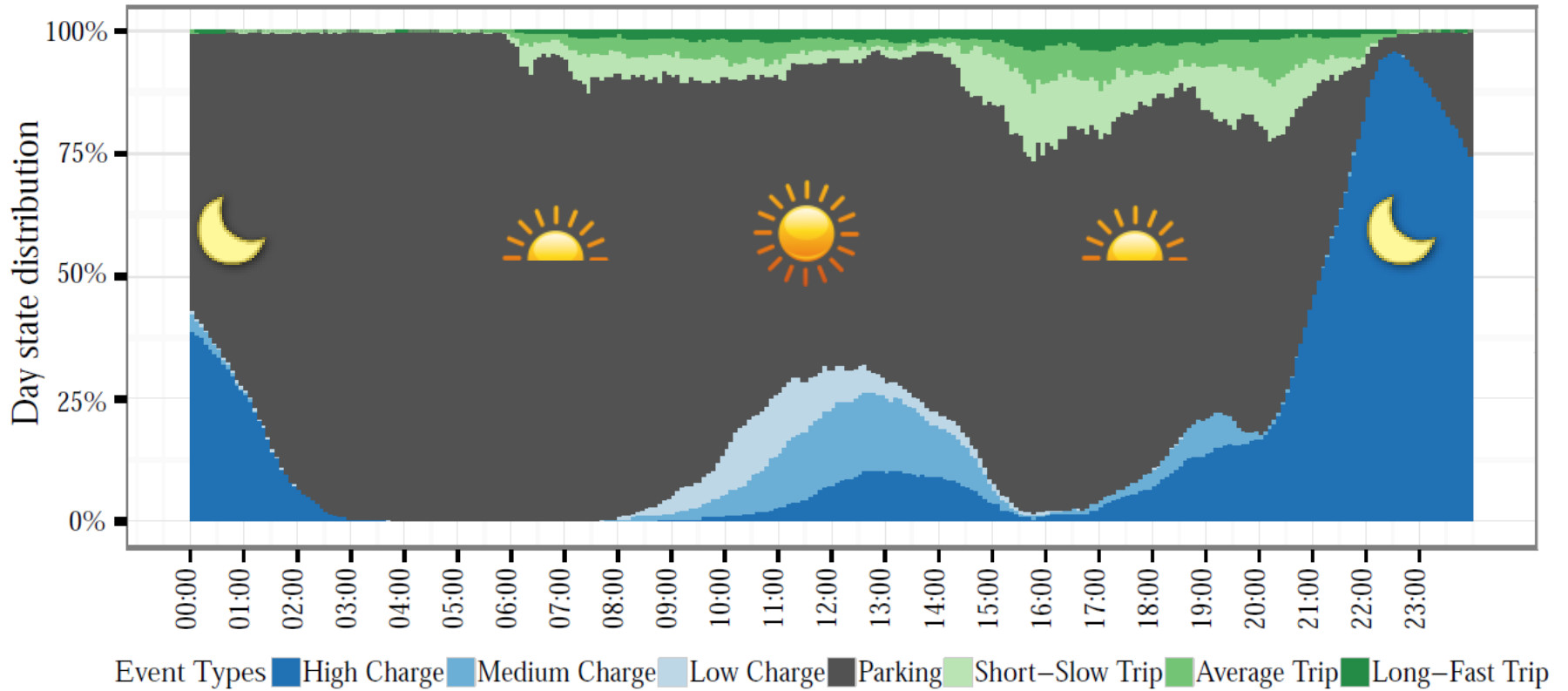


Cristina Corchero
Task 28 Operating agent

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1. Task 28
2. V2X Research and demonstration
3. Conclusions and Task 28 outputs

On average, EVs charge 52% of the time they are plugged-in

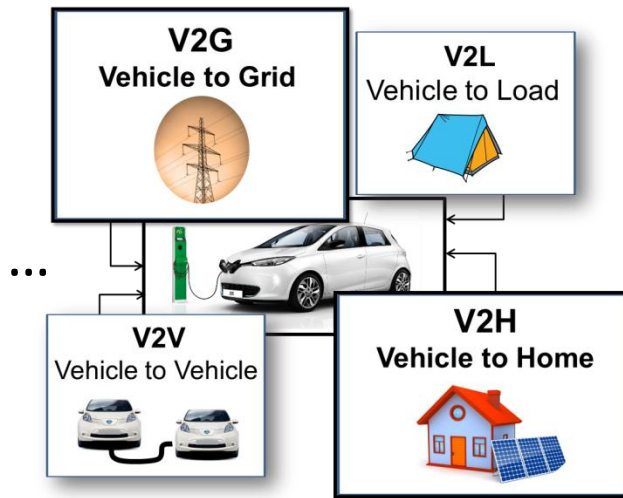


Business case

Source: Green eMotion Project

INTRODUCTION & SCOPE

The IA-HEV Executive Committee (ExCo) unanimously approved the Task 28 at the Executive Committee meeting in May 2014 held in Copenhagen



V2X
 VEHICLE
 TO
 EVERYTHING

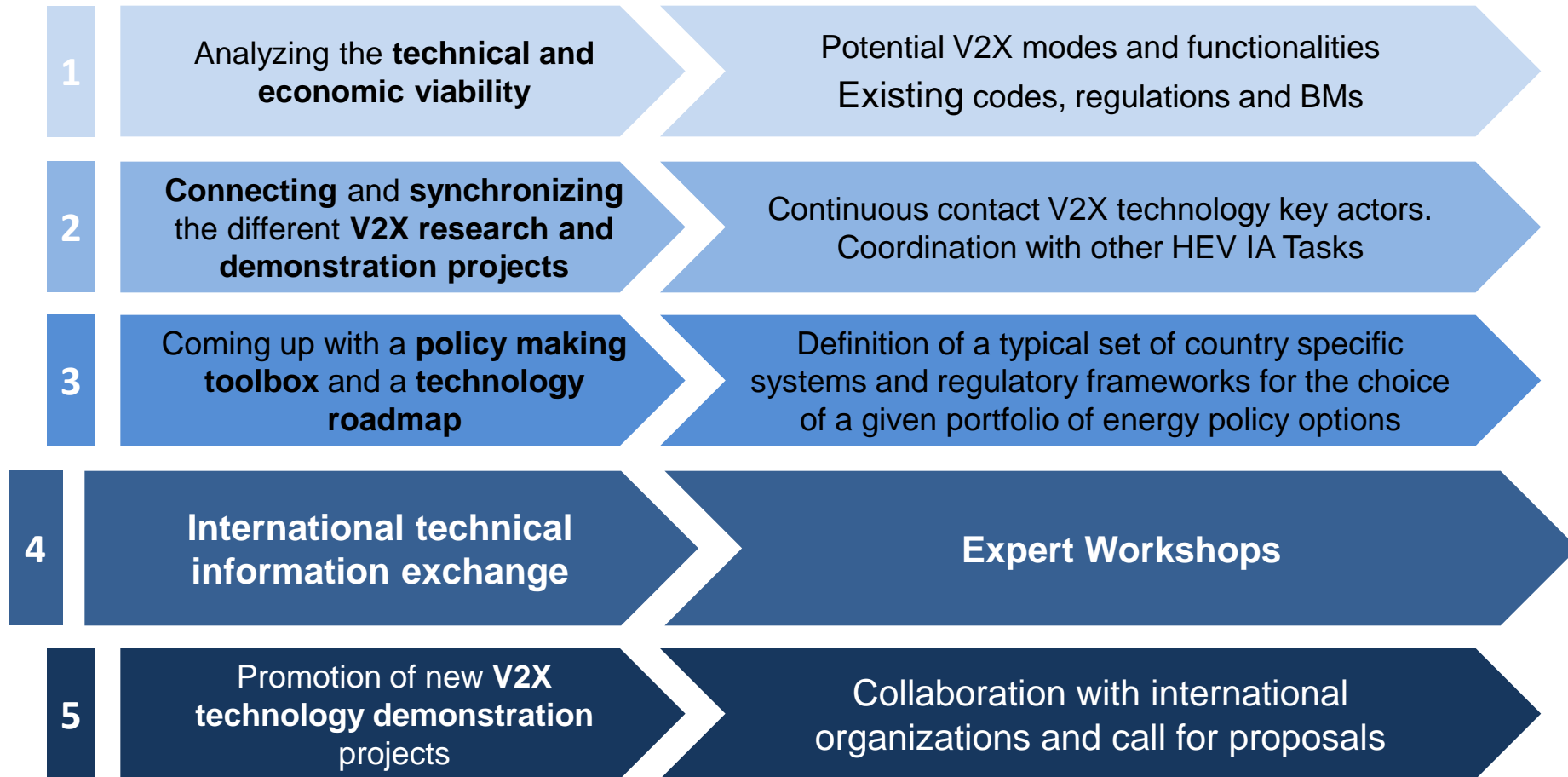
(NIST, 2010)

Task 28 explores the technologies and accompanying issues associated with the use of electric storage from PEVs for uses other than powering the vehicles

There remain technological and economic "knowledge gaps" in realizing the full potential of V2X technology

Task 28 addresses these gaps by means of creating an international network of experts who conduct bi-annual meetings on different strategic topics

OBJECTIVES & WORKING METHOD



GENERAL TASK INFORMATION

Countries

Spain



Operating Agents



Switzerland



France



Republic of Korea



Denmark



Canada



United States



Germany



Ireland



Netherlands



Companies



External collaboration
 SEEV4-City



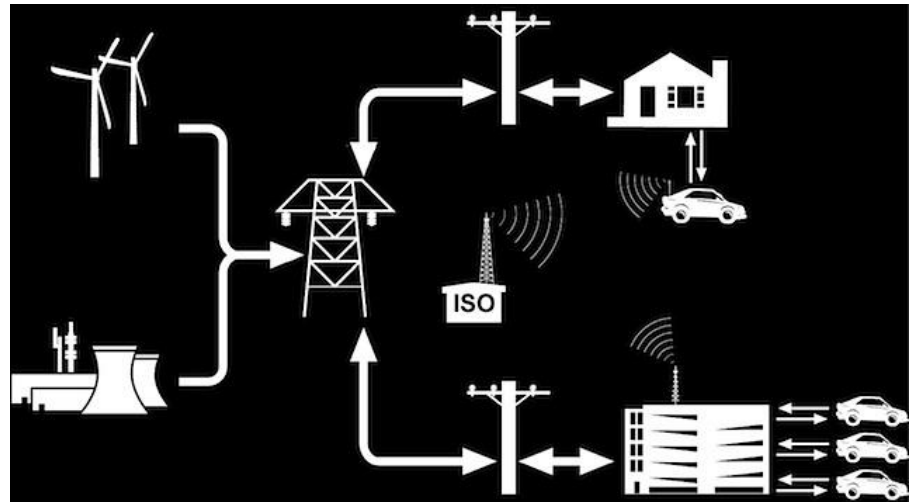
V2X: VEHICLE TO EVERYTHING – OPPORTUNITIES AND CHALLENGES

● Opportunities enabled by V2X technology

- Energy related applications:
 - Energy arbitrage for cost reduction, CO₂ emissions and peak shaving
- Power related applications
 - Renewable energy sources integration
 - Load following
- Fast response applications
 - Power quality and islanding. Security of supply

● Challenges to be faced by V2X

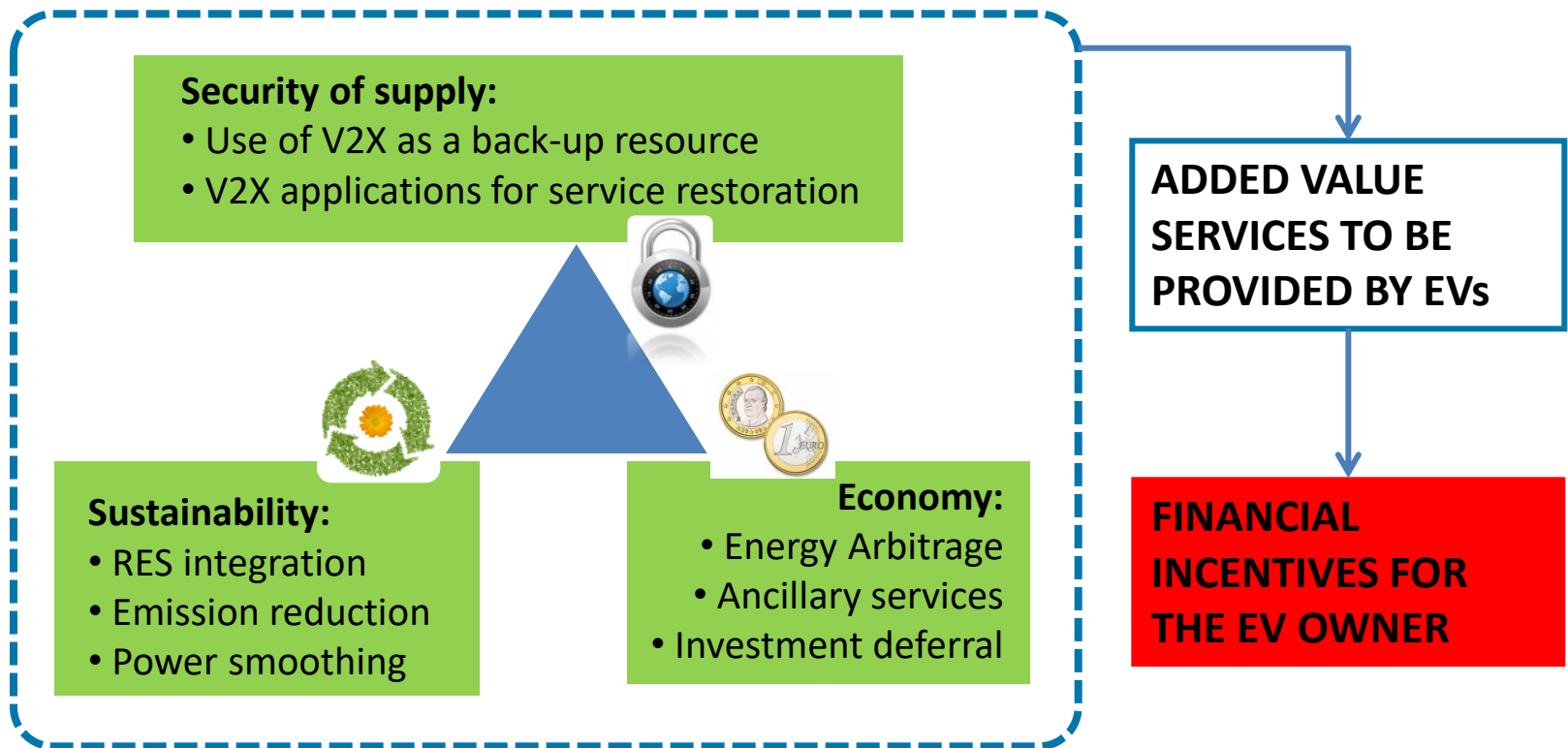
- Regulatory framework definition
- Need for coordination with grid operators
- New stakeholders: EV aggregator
- Bidirectional power and communication infrastructure. Standardization.



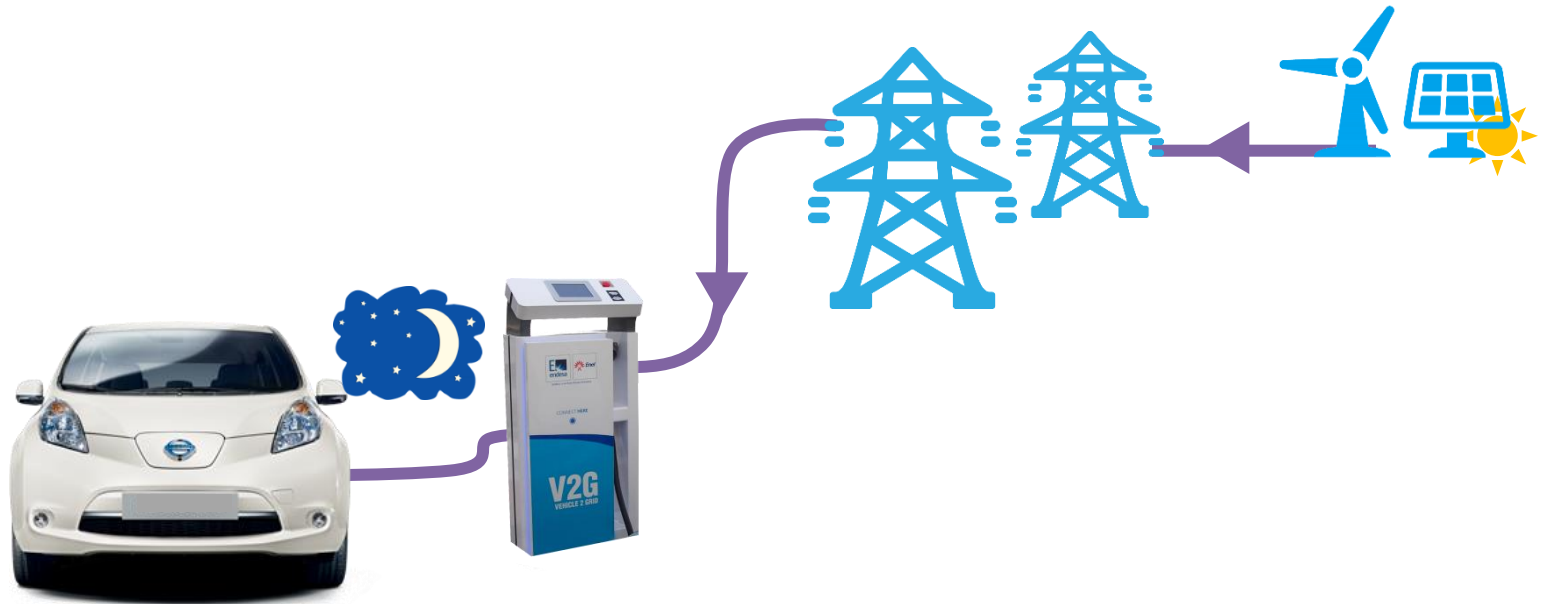
Source: Willett Kempton, 2010.

V2X: Vehicle to everything

V2X technology contributes to ensure a **secure, sustainable and competitive energy supply**. Countries will be pursuing **different objectives** depending on their **specific energy context**.



MAIN BENEFITS OF V2X



MAIN BENEFITS OF V2X

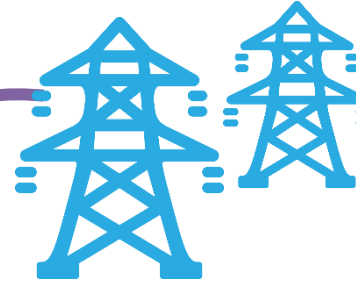


Wholesale power market participation

Decrease investment new power plants

Generate revenues

Reduce peak power demand



Better integration of renewable resources

Enhance grid stability, reliability and security

Renewable energy storage

Provide grid services

V2G

Higher independence

MAIN BENEFITS OF V2X



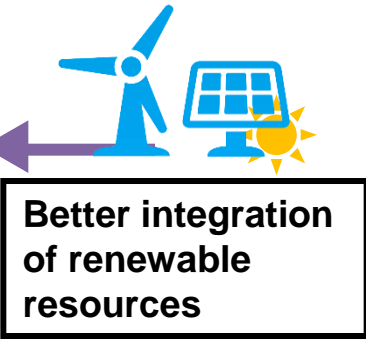
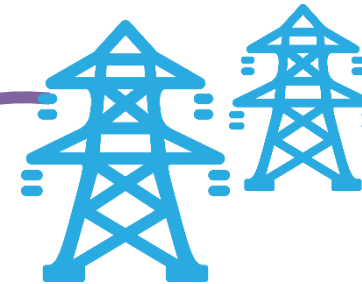
Wholesale power market participation

Decrease investment new power plants

Generate revenues

Reduce peak power demand

Self Consumption



Enhance grid stability, reliability and security

Provide grid services

Renewable energy storage

V2G
V2L

Provide power in remote sites



Generator when outages

Higher independence



Emergency power

MAIN BENEFITS OF V2X



Wholesale power market participation

Generate revenues

Decrease investment new power plants

Reduce peak power demand

Self Consumption

Better integration of renewable resources

Enhance grid stability, reliability and security

Renewable energy storage

Provide grid services

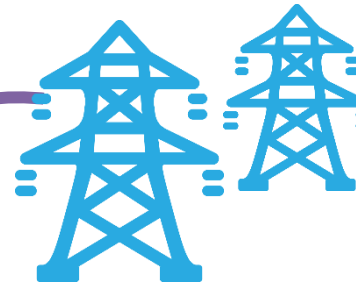
V2G
V2L
V2H

Provide power in remote sites

Generator when outages

Higher independence

Emergency power



MAIN BENEFITS OF V2X



Wholesale power market participation

Generate revenues

Decrease investment new power plants

Reduce peak power demand

Self Consumption

Help other EVs

Better integration of renewable resources

Enhance grid stability, reliability and security

Renewable energy storage

Provide grid services

Efficient EV parking management

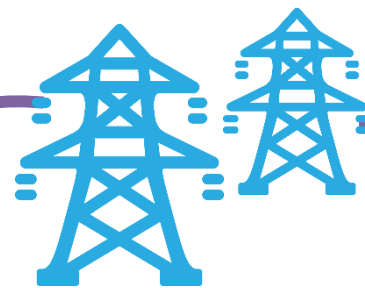
Provide power in remote sites

V2G
V2L
V2H
V2V

Generator when outages

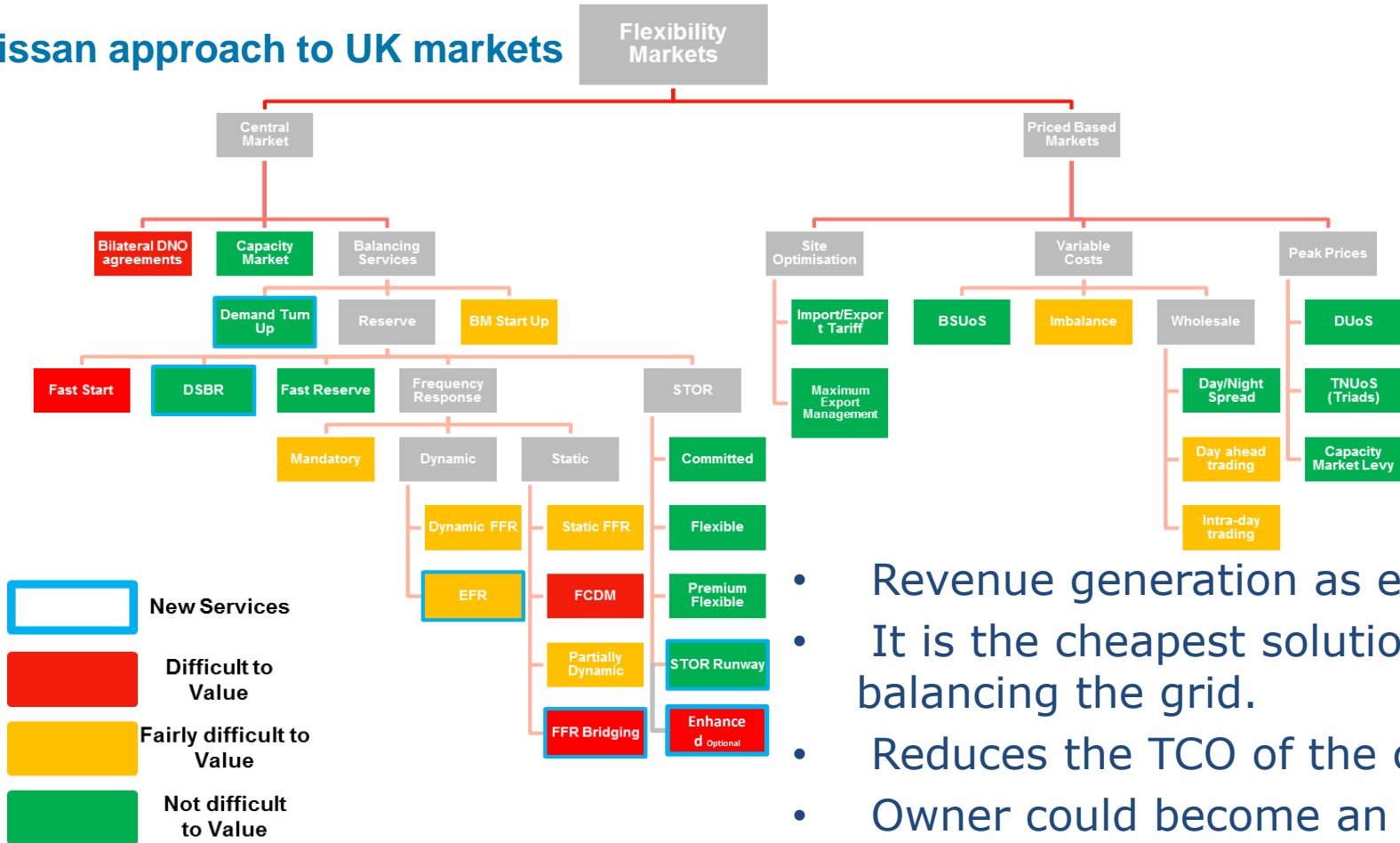
Higher independence

Emergency power



POTENTIAL MARKETS/OEM PERSPECTIVE

Nissan approach to UK markets

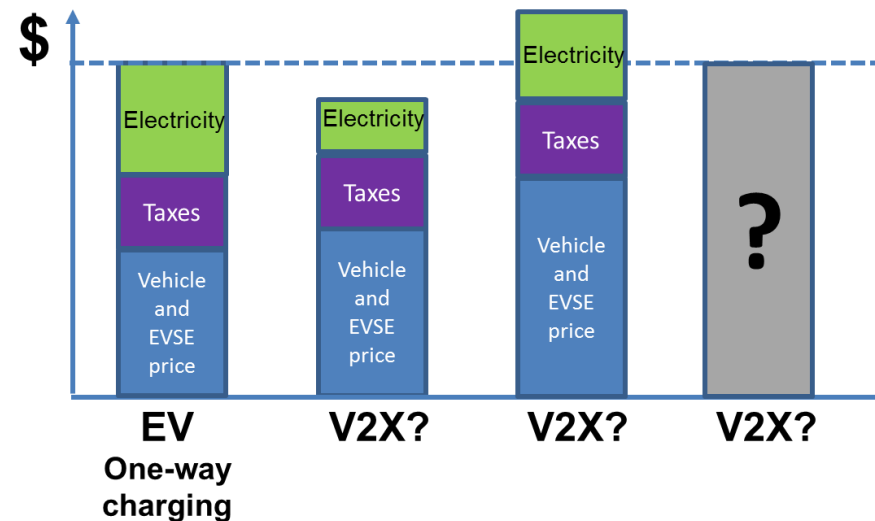


- Revenue generation as expected
- It is the cheapest solution for balancing the grid.
- Reduces the TCO of the car
- Owner could become an agent in the Energy market.
- Combines with PVs and Storage.

EV USER REQUIREMENTS/PERCEPTION

- **Reduce Total Cost of Ownership (TCO)**
 - Proper regulation needs to be ensured.
 - While bearing in mind that EV objective is transportation!
- Ease of use (standard back-end)
 - EV user engagement, education
- Privacy and cyber-security
- EV Warranty

“Total cost of ownership” (TCO)



EV USER REQUIREMENTS/PERCEPTION

Emerging market and value proposition: USA and Netherlands

Source: JeDLix EEVC17



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PROPRIETARY AND CONFIDENTIAL

Key Features:

- Lightweight, portable
- Slim indoor/outdoor footprint
- NEMA 14-50 compatible



See website and ask for spec sheet

Creative



Go to www.menti.com and use the code 66 23 89

Which would be your main concern about letting your EV for V2G applications?



Concern	Count
Battery degradation	18
Revenue	4
Range anxiety	8



Smart smart charging at home

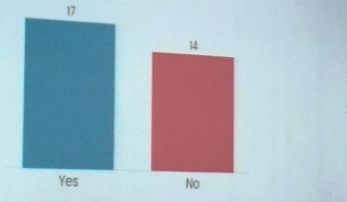
JeDLix #ichargesmart app is now available for smart home with Tesla. Get it now!

Available on the App Store, Google Play, and Web App.


Models: TESLA, BMW, Renault, ENECO

Go to www.menti.com and use the code 66 23 89

management of your EV battery for V2G application to a EM or Aggregator?



Response	Count
Yes	17
No	14



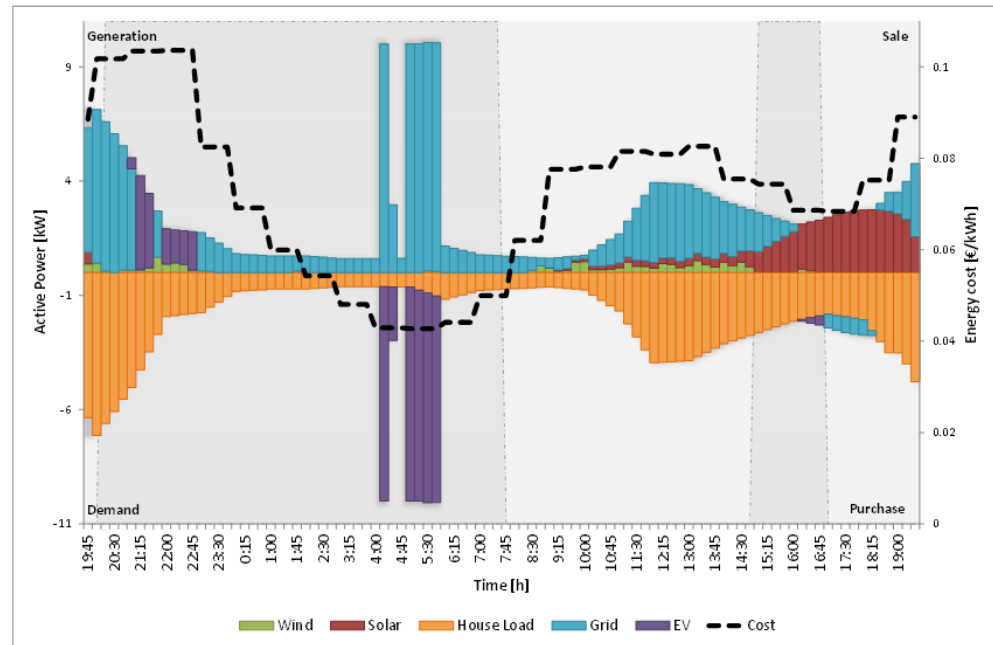
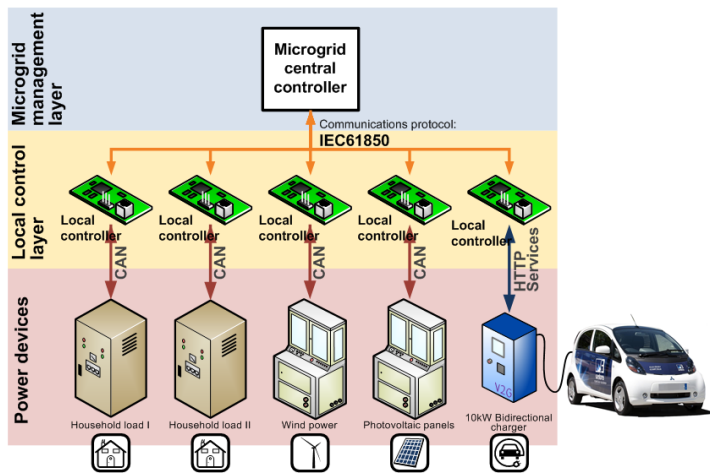
Source: RT EEVC17

TESTING A 10KW V2H SYSTEM AT IREC LAB

GOAL:

To analyse the technical viability of V2H systems in an emulated household environment

Test scenario: cost minimization Emulation platform



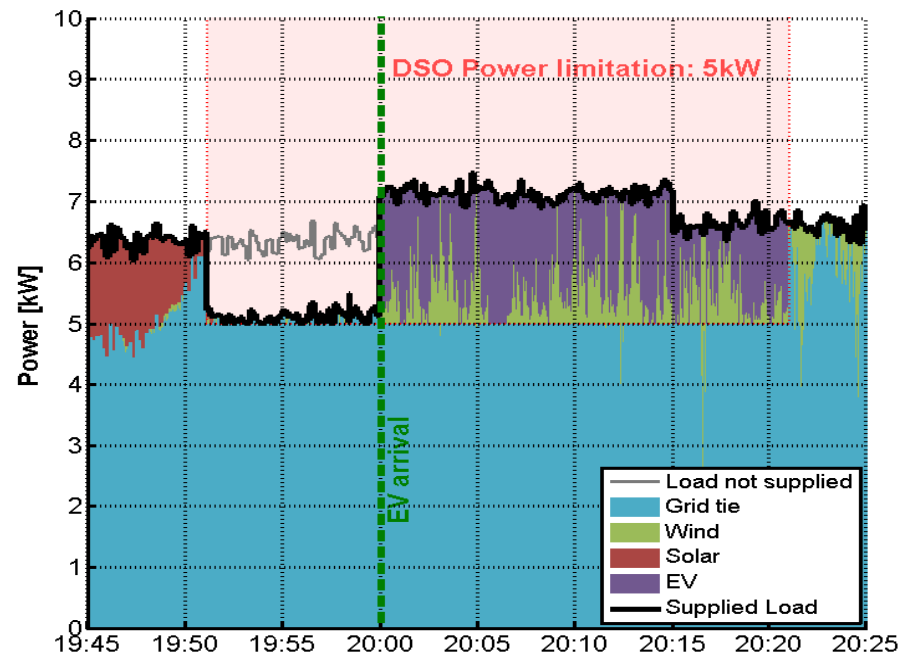
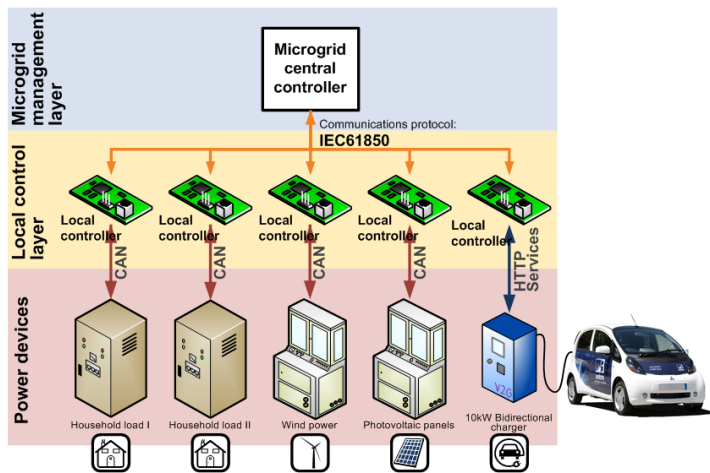
- EV discharged during peak hours to supply house demand
- EV charged on early morning hours (4:00-5:30)
- Notice: from 15:30-17:30 there is solar surplus used to charge the EV

TESTING A 10KW V2H SYSTEM AT IREC LAB

GOAL:

To analyse the technical viability of V2H systems in an emulated household environment

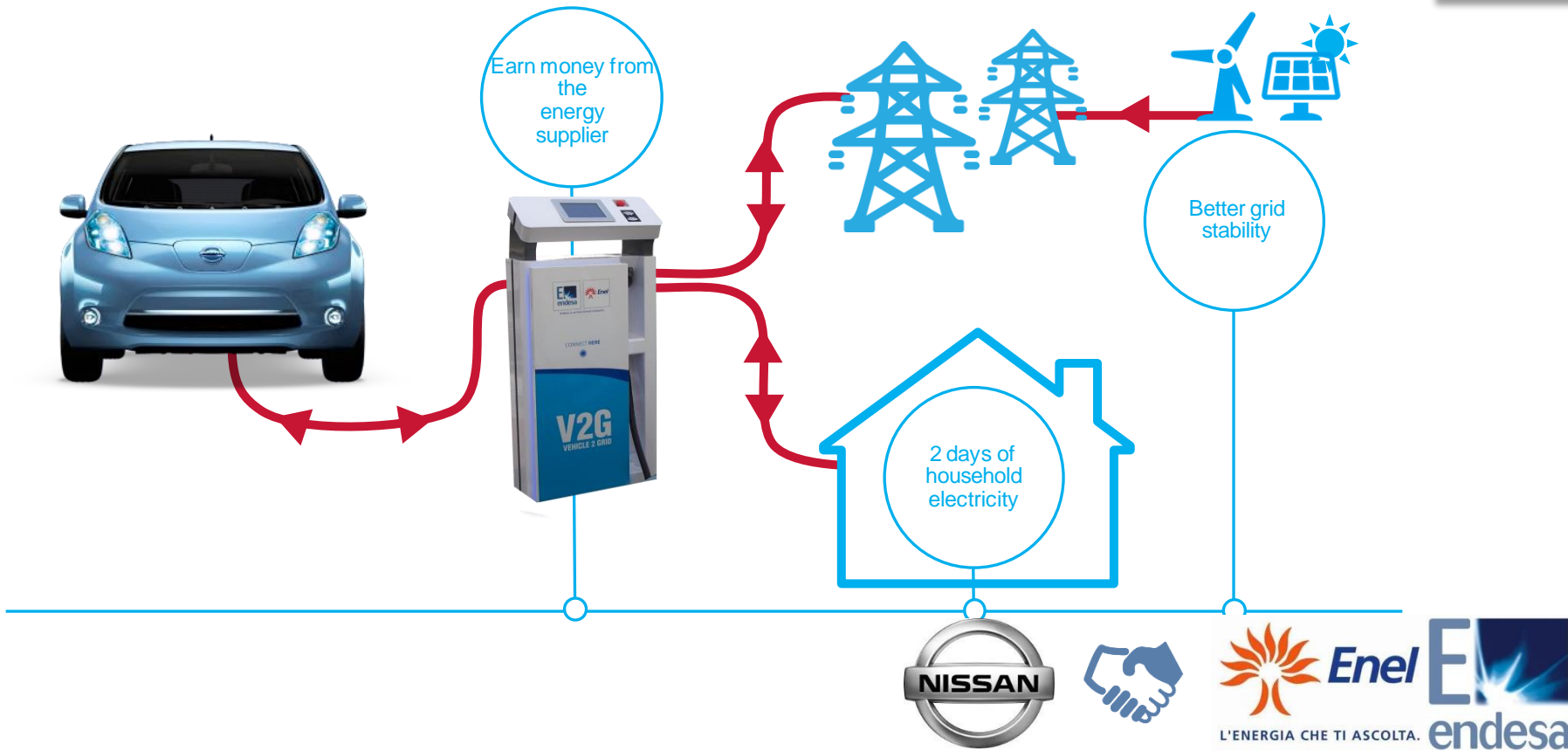
Test scenario: Power balancing Emulation platform



- The distribution network capacity considered to be temporary halved
- While the EV is not connected the set points do not follow DSO limitations
- When DSO limitation is removed, the grid tie power flow can supply all loads again

PRODUCT AND TECHNOLOGY DEVELOPMENT

Partnership announced at 85th International Motor Show (March '15)



PRODUCT AND TECHNOLOGY DEVELOPMENT



INTERNATIONAL PROJECTS

Denmark V2X Living Lab – NIKOLA project

January 2016

Civil Works + after sales

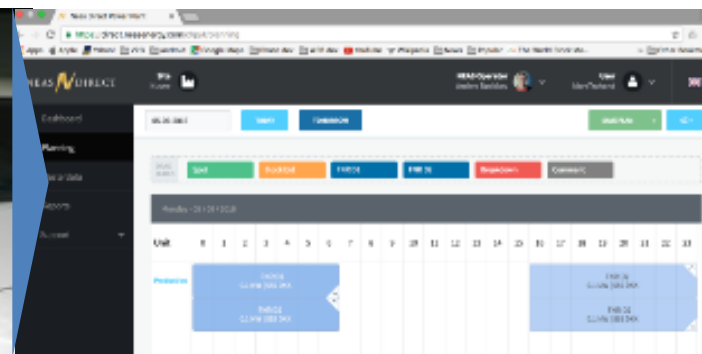
Aggregation



Factory production

Engineering Tuning

Commercial bidding into DK2



Source: ENEL, V Workshop Task 28, Paris October 2016

INTERNATIONAL PROJECTS

Denmark V2X Living Lab – NIKOLA project



- 10x Nissan eNV200 electric Vans
- 10x ENEL V2G units (bidirectional 10 kW)
- Used mainly for maintenance and service tasks.
- Usage hours = Work day 7 AM – 4 PM

Potential earning with 10kW V2G units (FCR-N, ~14 h/day)

120 Euro/Month per Vehicle

Source: DTU, V Workshop Task 28, Jeju Island, March 2017

INTERNATIONAL PROJECTS

Denmark V2X Living Lab

- 40 V2G chargers
- Tech assistance
- V2G Balancing service
- Tech tuning



- US company
- Expertise



- Customers selection
- 40 EVs discounted price, leasing contract



- First tests already
- Market test for new technology in ancillary services



Danish utility

- Free chargers and
- 2-years free of charge maintenance

INTERNATIONAL PROJECTS

V2H available as back-up storage and bill saving tool in Japan



- About 10% take rate
- Strong government incentive (about \$2,500 after rebates)
- 3-4 different V2H/V2B devices are now available
- Use covered by LEAF warranty in Japan

Use Opportunities:

- Back Up Power - Emergency power
- TOU Rate Arbitrage - if utility has Time-of-Use rate, opportunity to use VE battery at peak hours, then charge at night.
- Renewable Energy Self-Consumption - Consume excess solar in the day, with PV-over generation

Source: Nissan Motor Company

INTERNATIONAL PROJECTS

BMW i ChargeForward Program



Goals

- Demonstrate DR at home
- Aggregation of stationary second use batteries with in use vehicles

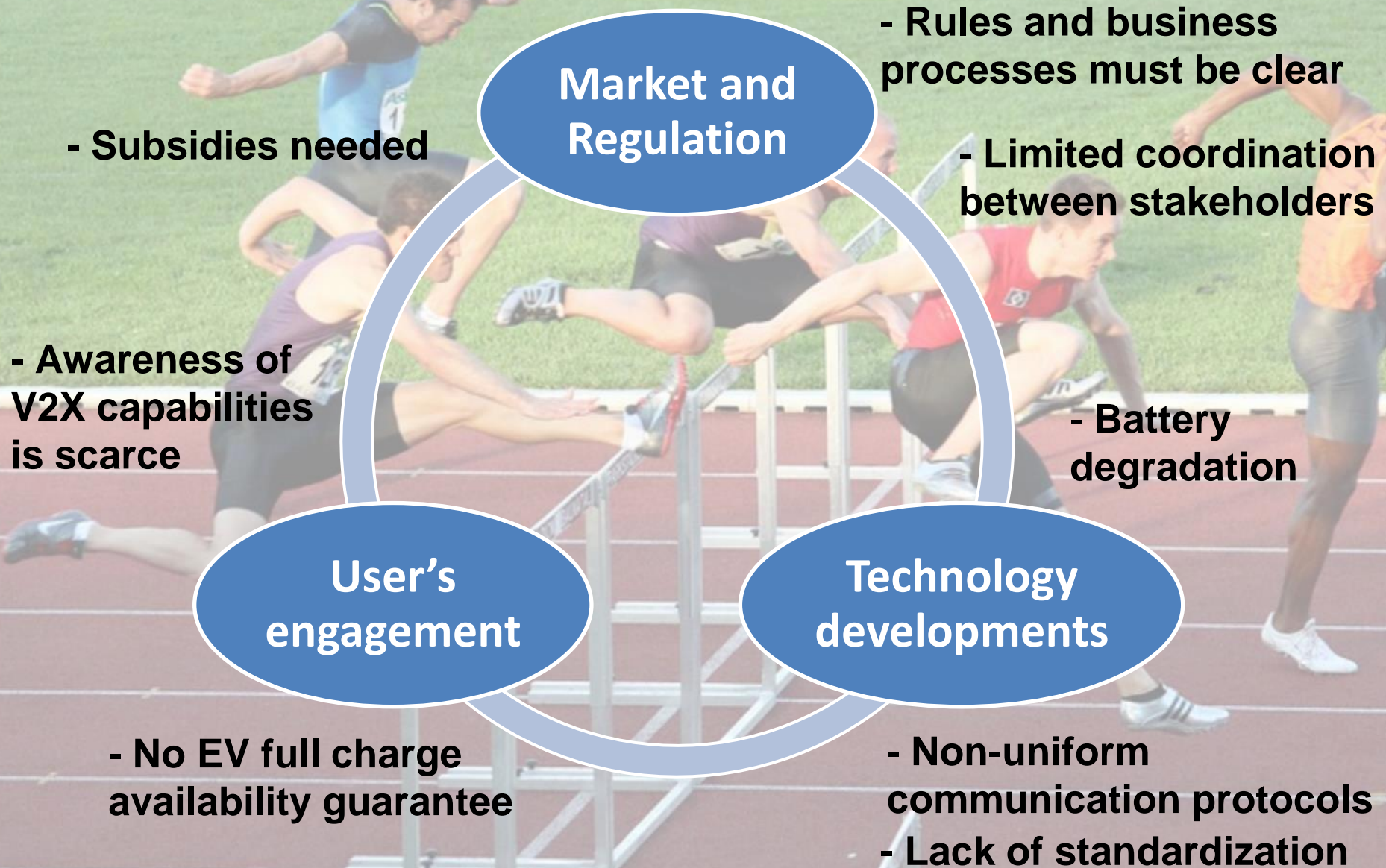
Costs and Revenue

- Earn \$1,000 at launch and \$540 at project completion in gift cards

How?

- PG&E contacts the BMW server and requests **load drop** (up to 100 kW total)
- BMW i selects vehicles for delayed charging of up to one hour
- Smart meters installed by PG&E verify that total desired load drop is achieved

MAIN V2X DETECTED BARRIERS



CONCLUSIONS

Task 28

- Key barriers preventing the roll out of V2X technologies have been identified
- Task 28 running until end 2018

Outputs

- V2X Roadmap to be published end 2017

CONCLUSIONS

Task 28

- Key barriers preventing the roll out of V2X technologies have been identified
- Task 28 running until end 2018

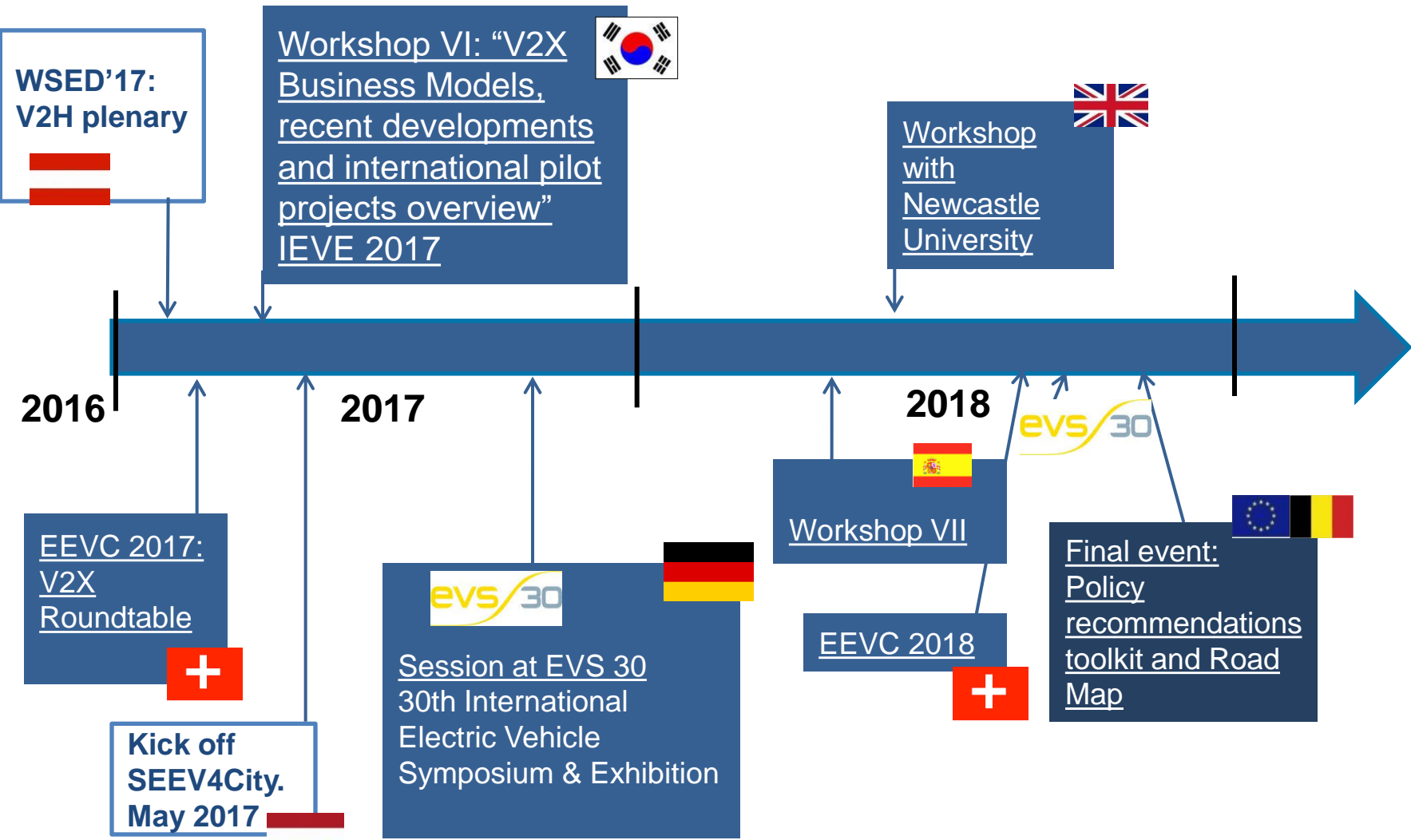
Outputs

- V2X Roadmap to be published summer 2017

V2X R&D

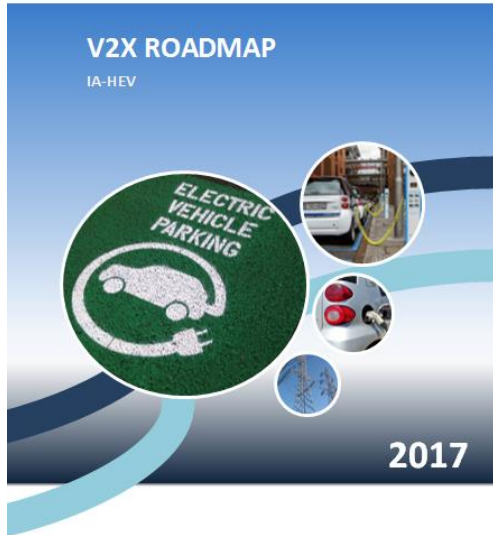
- Pilot in DK validated technology and the full chain of V2G services
- Lab research shows that V2G system is capable to follow erratic variations of the power set points with short periods of time
- Nowadays, OEMs and utilities are starting the implementation of V2G market solutions worldwide.
- Business models adapted to the different regulatory frameworks are still needed.
- Further development on standards and protocols would help for the massive roll out.

NEXT TASK 28 EVENTS

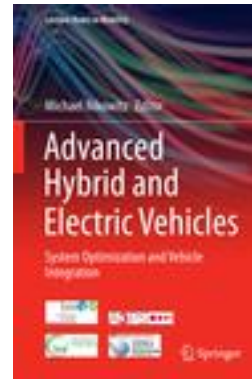


TASK 28 OUTPUTS

V2X Roadmap



Scientific Book



V2X Projects Catalogue

Project name	Topic	Budget	Country	Lead organization	Partnering	Starting date	Duration
Los Angeles Air Force Base Vehicle to Grid Pilot Project	The project will assess both the technical challenge of V2G participation and the potential financial benefits.		US	Lawrence Berkeley National Laboratory		July 15	2 years
Cotevos	Concepts capabilities and methods for testing EV systems and their interoperability within the Smart Grid.	1,2M	ES	Terma	Hyundai/Kia	Jan 15	2 years
Nikola Project	Nikola is a Danish research and demonstration project with a focus on the synergies between the electric vehicle (EV) and the power system.	2M	DK	Energy Research Centre of DTU		1	2015
Grid on Wheels	Vehicle to grid demonstration?		US			7	2015
EnergyLab Nordhavn	The project utilizes Copenhagen's Nordhavn as a full-scale smart city energy lab and demonstrates how electricity and heating, energy efficient buildings and electric transport can be integrated into an intelligent, flexible and green energy system.	500 million (DKK)	DK	Østfold Energi	Østfold Energi	10	2015
Canadian V2X project	The e-DASH project aims at the harmonization of electricity demand in Smart Grids for sustainable integration of electric vehicles.		CA	Hydro-Québec		7	2015
e-DASH	The e-DASH project aims at the harmonization of electricity demand in Smart Grids for sustainable integration of electric vehicles.	100,000,000 (€)	FR	EDF		10	2015
PlanGridEV	Distribution grid planning and operational principles for EV mass roll-out while enabling DER integration.	1,000,000 (€)	BE	Elia		10	2015
SEEV4 City	SEEV4 City supports the transition to a low-carbon economy in Europe's Cities, combining electric transport, renewable energy and smart energy management.		ES	Red Eléctrica de España		11	2015
Parker	Seeks to prove that smart produced electric vehicles, as part of an operational fleet, can support the Danish power system through power and information.	1,500M	DK	Østfold Energi		5	2015
V2G EV School bus	Move EV school buses toward full, unsubsidized commercial availability by demonstrating vehicle-to-grid as the "missing link" of economic competitiveness. Build and deploy six V2G-enabled type C school buses.		US				
Smart V2G	Its major target is the connection of electric vehicles to the grid by enabling controlled flow of energy and power through cable, precise, energy efficient and convenient transfer of electricity and data.		ES	Red Eléctrica de España		7	2015
Vehicle2Grid	This pilot will help move toward the large scale implementation of electric vehicles, the use of solar energy and the energetic independence of households.		ES			5	2015
EDISON	The EDISON project has utilized Danish and international competences to develop optimal system solutions for EV system integration including network issues, market solutions, and optimal interaction between different energy technologies.		DK	Energy Research Centre of DTU		7	2015
SPIDERS JCTD	The SPIDERS program focuses on the use of Smart Grid technologies, integration of renewable power generation, and energy storage, demand-side management, reducing power back-up, and protection from cyber threats to sustain mission-critical loads. The design for Phase II also includes an interface to an Electric Vehicle Supply Equipment (EVSE) solution.		US			10	
ZEMALL	200 vehículos eléctricos Mitsubishi i-MiEV que se alquilan a particulares e empresas, junto con una base de recarga, un smartphone y una unidad de comunicación a bordo (OBU) por una cuota de alquiler de 300 euros al mes, con un kilometraje anual limitado.		ES	ENEL		10	2015
Smart Grid V2X Energy & Mobility Project MERGE	The project aims at the harmonization of electricity demand in Smart Grids for sustainable integration of electric vehicles.		ES	Red Eléctrica de España		7	2015

Final report: Review of Roadmap and pilot project experiences

2017

2018

Thank you!

Any questions?

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<http://www.ieahev.org/tasks/home-grids-and-v2x-technologies-task-28/>