

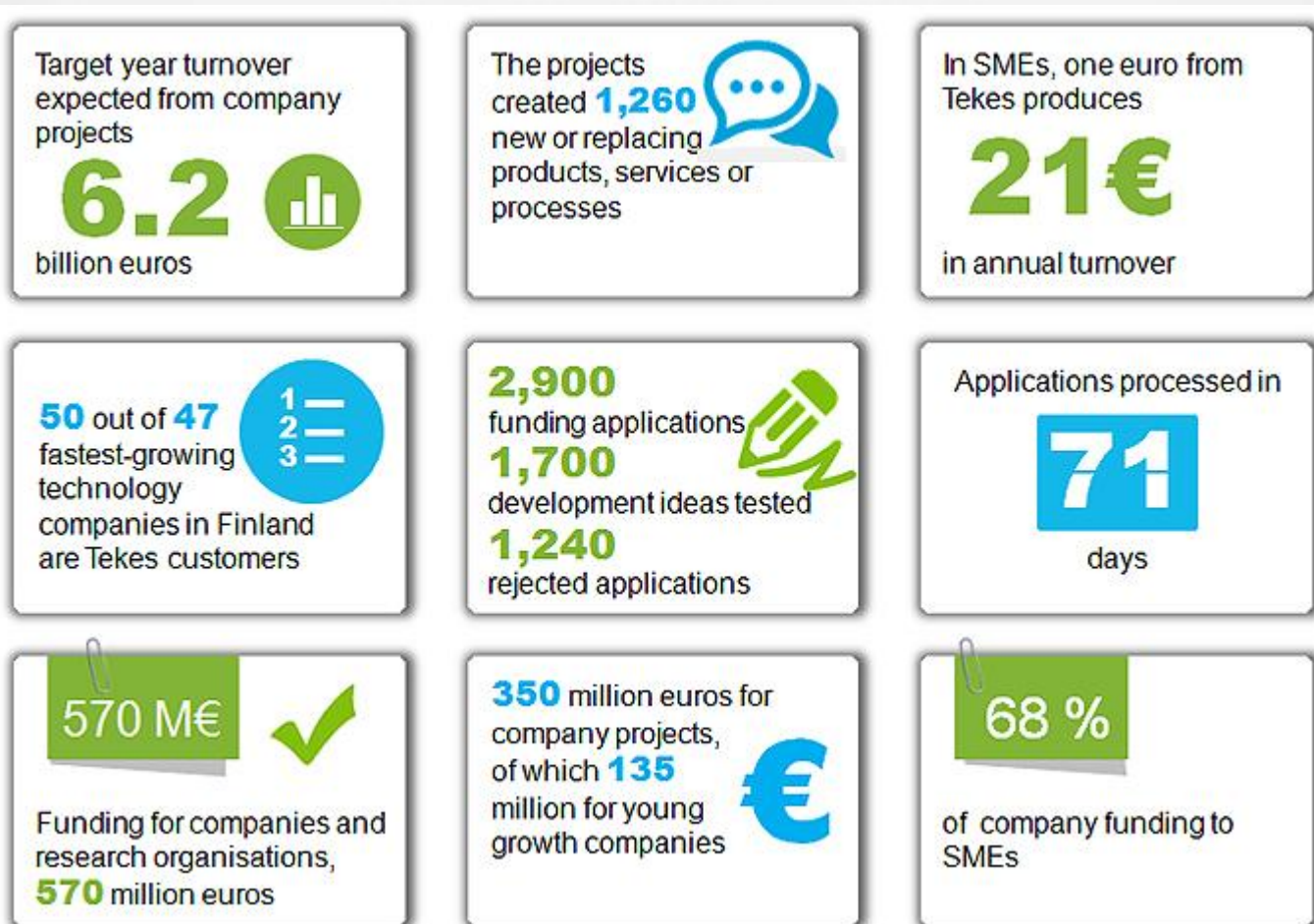
EVE – the Finnish electric vehicle programme – including a co-Nordic dimension

Markku Antikainen

Coordinator

EVE – Electric Vehicle Systems

Tekes – the Finnish Funding Agency for Technology and Innovation



Starting point

- Strong international trend towards eMobility
- Several national and international synergic programmes ongoing
- Small domestic automotive industry
- Strong mobile machine industry already utilizing electrification
- Grid ready for electric mobility
- 1,5 M (with slight modifications) ready charging poles
- Requiring arctic conditions
- Long driving distances (especially to summer cottages)
- High level of technology, especially in ICT and electronics
- Government not willing to flag for any specific sustainable power source



EVE – Electric Vehicle Systems

Need

- Innovation of new business in the growing field of electric mobility
- Creation of international partnerships for electric mobility business

Solution

- EVE programme with different research and demonstration areas

Benefits

- Well established high quality development environment
- Really demanding testing conditions for all purposes

Users

- Enterprises, universities and research institutes
- Public authorities developing electric mobility infrastructure

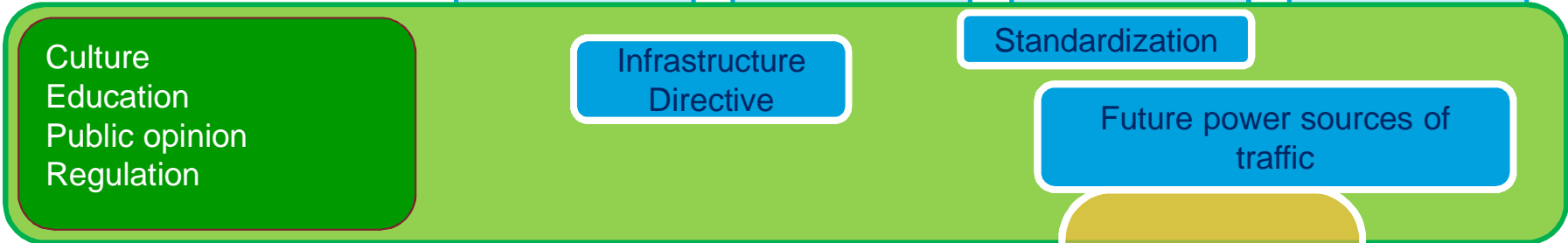


EVE

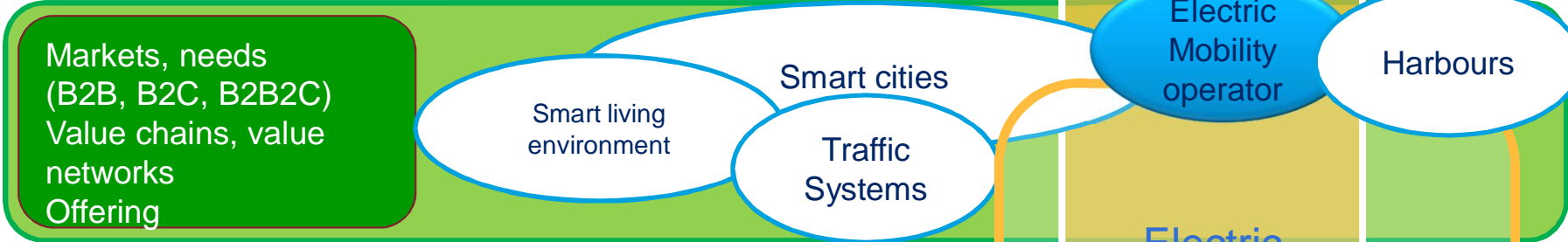
- *Electric Vehicle Systems programme 2011-2015*
- *Budget 100 MEUR*
- *100 + participants*
- *68 projects ongoing*
- *Part of Smart Living focus area of Tekes*
- *Strategic partnership possibilities for technology and service developers*
- www.tekes.fi/programmes/EVE

Vision Frame

Landscape



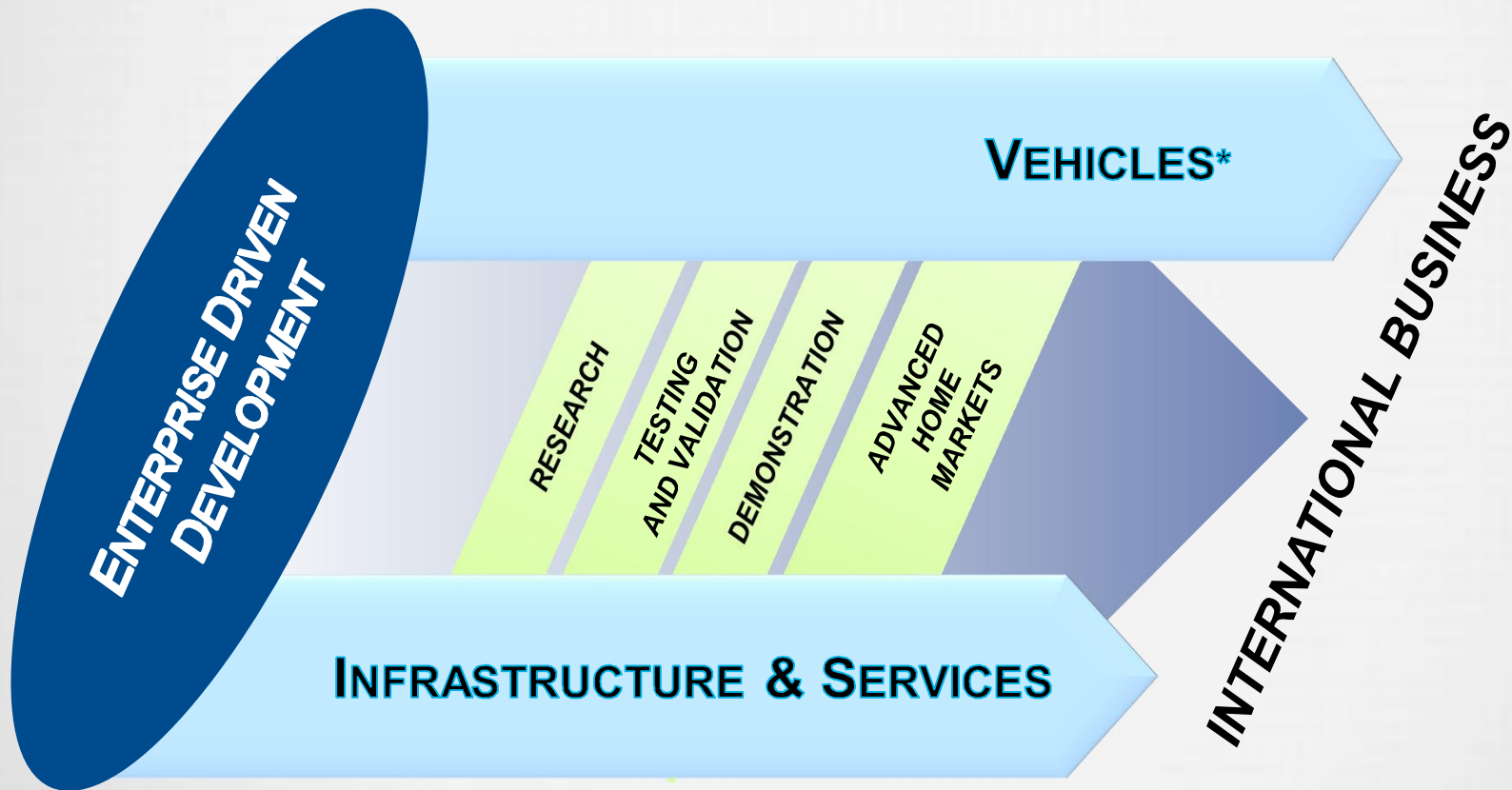
Business Environment



New Innovations



EVE – from Research through Testing and Demonstration to Business



* Vehicles: Light and passenger vehicles and heavy machinery included

Vehicles

- Battery capacity growing slowly, no quantum leap to be awaited soon
 - PHEV premium models pave the road to electrification?
 - More range with more money
 - Reduction of cost and enhancing of efficiency (50/200 by 2020?)
- Safety and reliability issues
 - In arctic conditions range easily half of normal
- Public transport solutions under development
 - Optimized electricity utilization in public transport
- Price
 - Governmental support and incentives needed
 - Financing alternatives and support
 - Lower total cost of ownership

eStorage2–Aalto University

Need

- To understand better the characteristics of a battery cell and module
- To make drivecycle simulations of EVs and non-road mobile machinery
- To design a full battery system for a dedicated vehicular application

Solution

- Experimental cell testing to reveal aging and thermal characteristics
- Experimental module testing for modeling purposes and BMS research
- Experimental pack testing to validate the battery model

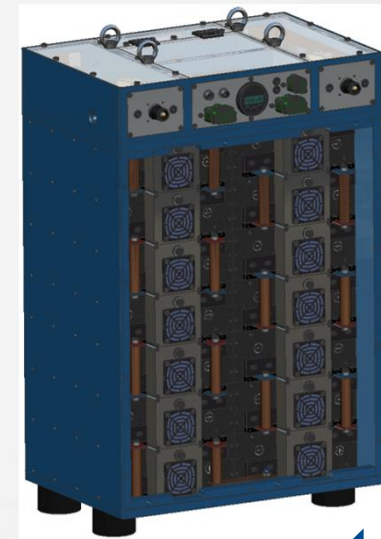
Benefits

- Knowledge about aging characteristics at various temperature and rate
- Impedance plots and thermal characteristics for thermal design
- A validated battery model for cell-, module-, and pack-level

Users

- Designers of vehicles and their battery systems
- BMS developers

<http://www.ecv.fi/estorage2/>



WintEVE – EV's in Winter Conditions

Need

- Testing and demonstration solutions for arctic conditions

Solution

- Testing ecosystem based on collaboration between Arctic Research Center and testing service providers in Lapland

Benefits

- Combination of world class testing environment and experience
- Technology tested in arctic conditions works elsewhere

Users

- EV manufacturers, OEM's
- Suppliers of charging technology and end user services, utilities etc.

www.centria.fi

www.winteve.fi



eSled – Electric Snowmobiles' Demo Fleet

Need

- Tourists to experience the nature in it's purest form
- Environment friendly solution for snowmobile safaris

Solution

- Battery electric snowmobile
- Zero emission application

Benefits

- Low operating costs
- Silent operation
- Zero emission

Users

- Ski resorts
- Safari operators
- Tourists

www.esled.fi

www.ecv.fi/esled



eBUS – Testbed for Development

Need

- Things to take into account when planning electric bus operations
- EV-component manufacturers need experience of real life solutions.

Solution

- Test mule bus for component testing and references
- Field tests on actual bus line in Espoo (line 11)
- Laboratory tests for efficiencies and driving cycle dependence

Benefits

- Unique set of tools and facilities for overall comparison of electric buses and their sub systems
- Knowledge to be used as a basis for electric bus development and procurement and for planning the future electric bus systems

Users

- Bus and component manufacturers, cities, public authorities, research institutes

www.ecv.fi/ebus



Infrastructure and Services

- [Ecosystem research and development](#)
- [Identification, testing and supporting of new business models and services](#)
- [Community level demonstrations](#), living labs including electric traffic as an essential means of transport
- [International collaboration](#), benchmarking, information exchange of best practices
- International collaboration in standardization
- Education, communication, marketing

Public Low Carbon City Facilitation

Need

- Identifying the role of the public policy and the societal prerequisites for EV proliferation

Solution

- Mapping patterns of governance and management models
- Actor and process analysis on the emerging cooperation forming the institutional infrastructure for the EV platforms

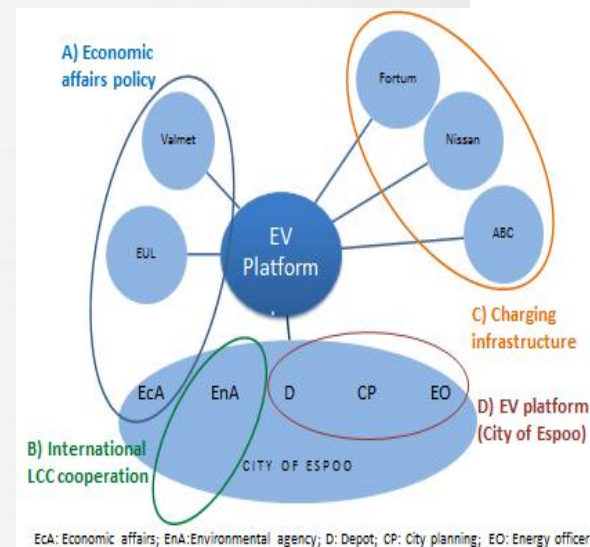
Benefits

- Benchmarking of success stories on high profile EV-projects, experiences of mainstream cities with moderate policies.
- Comparison between a well resourced vanguard (Shenzhen, China) and a newcomer (Espoo)

Users

- Enterprises, cities and researchers developing EV platforms and having an interest in the societal prerequisites of their success

<http://ytk.aalto.fi/en/>



Case Espoo:

Networks influencing the EV proliferation

- A & B influence the landscape of the socio-technical mobility system and generate policy pressure for EV promotion. A also builds up the EV business ecosystem.
- C & D create changes in the present mobility regime

eSINi – Electric Vehicle Charging Infrastructure for Urban Environments

Need

- Enabling introduction of electric vehicles in Finland
- Sustainable solutions for electric mobility

Solution

- Test bed to support finding holistic and sustainable solutions and creating viable charging and service network for electric mobility

Benefits

- Well studied and tested infrastructure and service solutions
- Integration of charging infrastructure and power grid

Users

- EV users: private and public organizations, consumers
- Organizations and authorities developing electric mobility

www.esini.fi

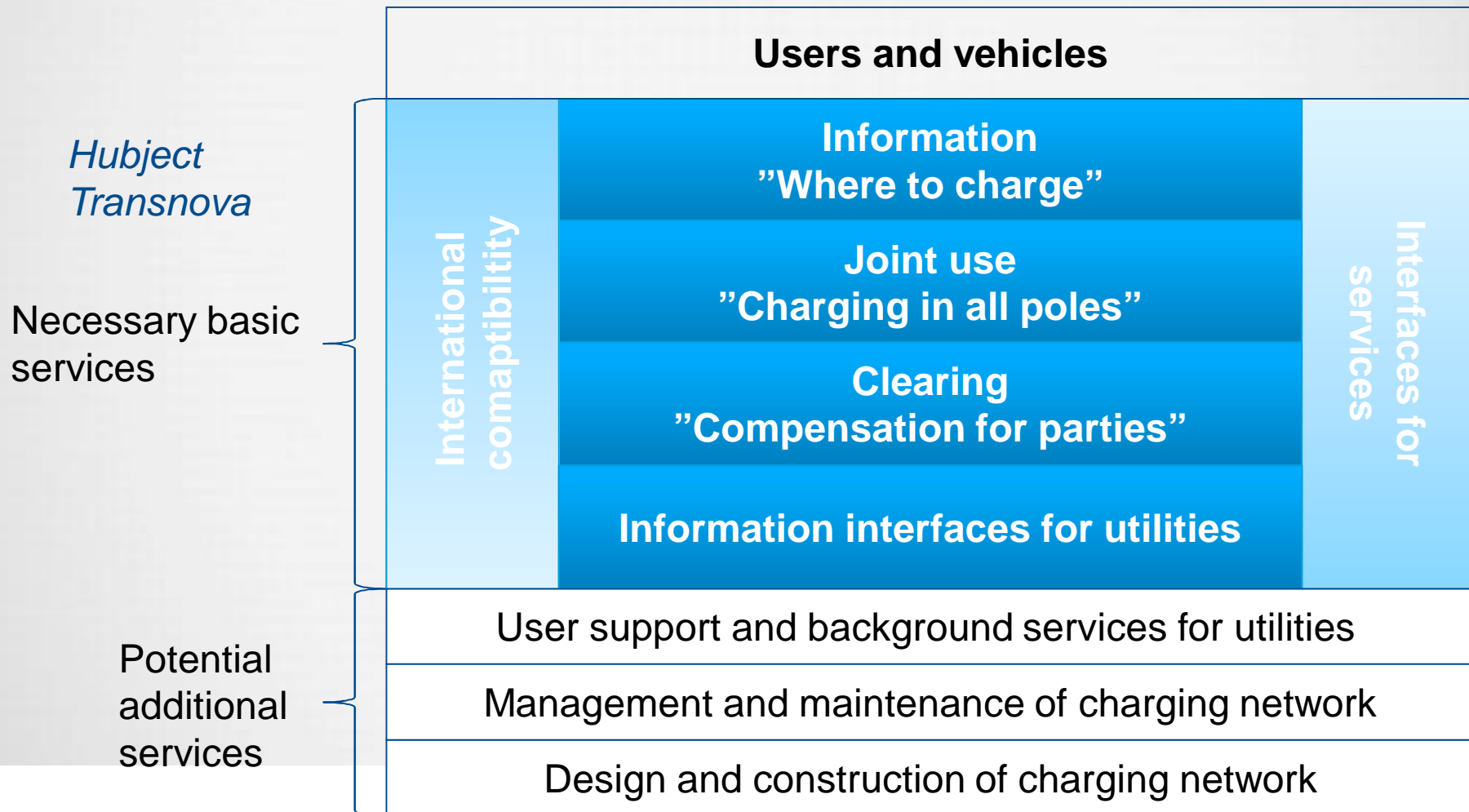


eSINi

- 2011 – 2013 (option 2014)
- Budget 1,18 M€
- BIT Research Centre
- Department of Electrical Engineering
- Department of Civil and Environmental Engineering
- Department of Chemistry
- Department of Design



EMO – Electric Mobility Operator, Platform And Operator Interfaces



Helsinki EV Platform by electrictraffic.fi

▪ User in focus

- User centric design emphasized in the infrastructure and services

▪ Open platform open interfaces

- IT platform enables sharing of information and provides channel for traffic related SW and app development

▪ Ecosystem model

- Multi ecosystem based structure and business model enabled

▪ Advanced electricity networks

- Low CO2 generation using hydro and sustainable energy as primary energy sources
- High adaptation rate of SG 2.0



EVE

Northern Collaboration 23.5.2013

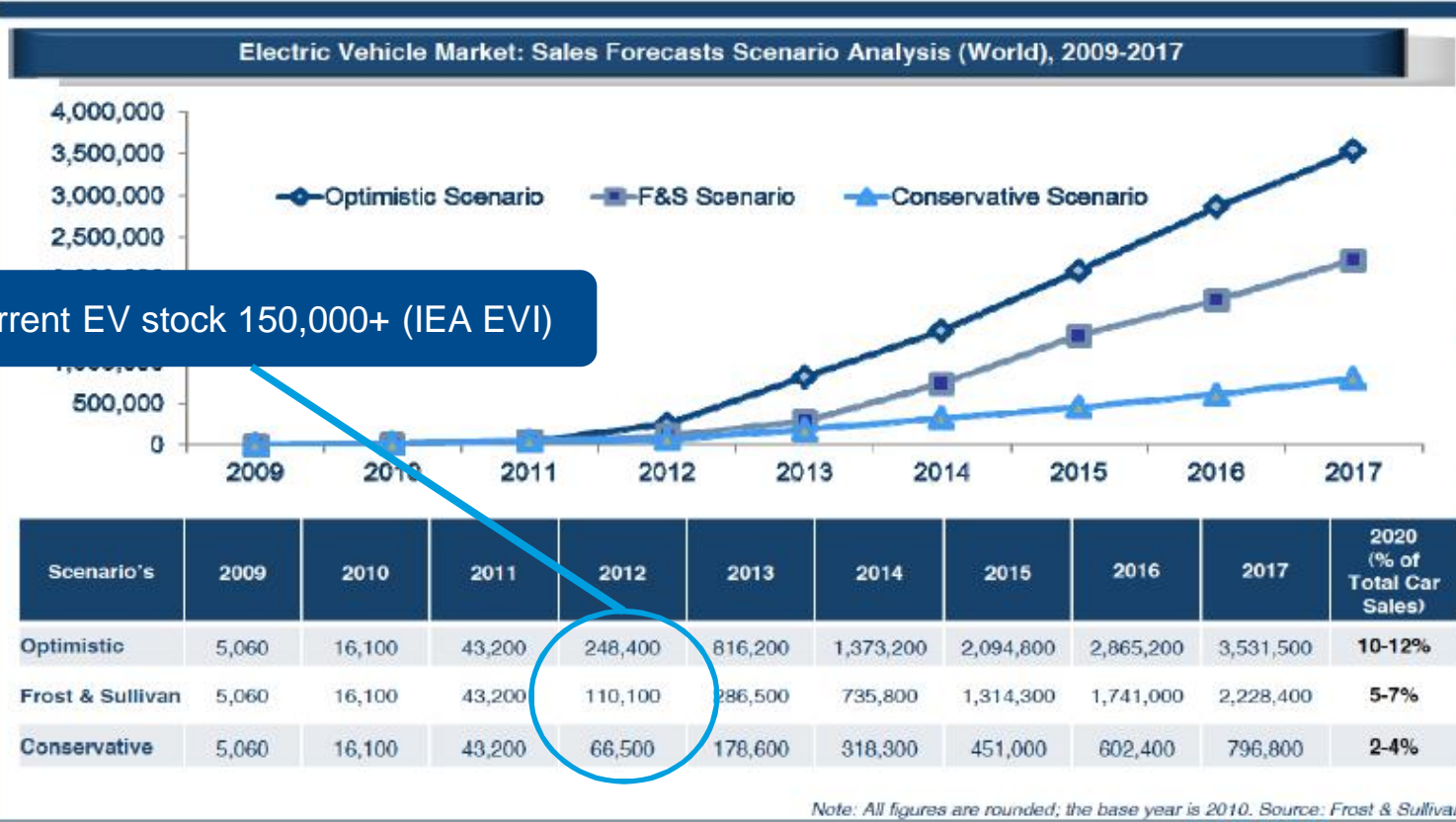
Ilmarinen Building, Porkkalankatu 1, Helsinki

9:30	Registration and coffee	
10:00	Opening words	Raine Hermans
10:10	Introduction of Electromobility – National approach	
	Estonian experience in creating electric vehicle ecosystem	Jarmo Tuisk
	Icelandic approach	Jón Björn Skúlason
	The Norwegian EV success - how and the way forward	Asbjørn Johnsen
	Swedish approach	Anders Lewald
12:00	Lunch	
13:00	Introduction of Electromobility – Business approach	
	Electromobile Estonia - a business view	Eero Elenurm
	Business Approach to Electric Mobility Operator	Elias Pöyry
	Why are thousands of Norwegians buying EVs? Lessons learned from the Norwegian marketplace	Ole Henrik Hannisdahl
	Electromobility – the option for new business models	Jens Christian Lodberg Høj
14:30	Coffee	
15:00	Panel discussion: Collaboration in practice, benefits and barriers	Piia Pasanen
15.45	Closing words	Martti Korhikoski
16.00	Networking	
17.00	End of session	



The Market – When?

Global Electric Vehicle Demand Analysis – Potential Sales of 2.2 M in F&S Scenario by 2017

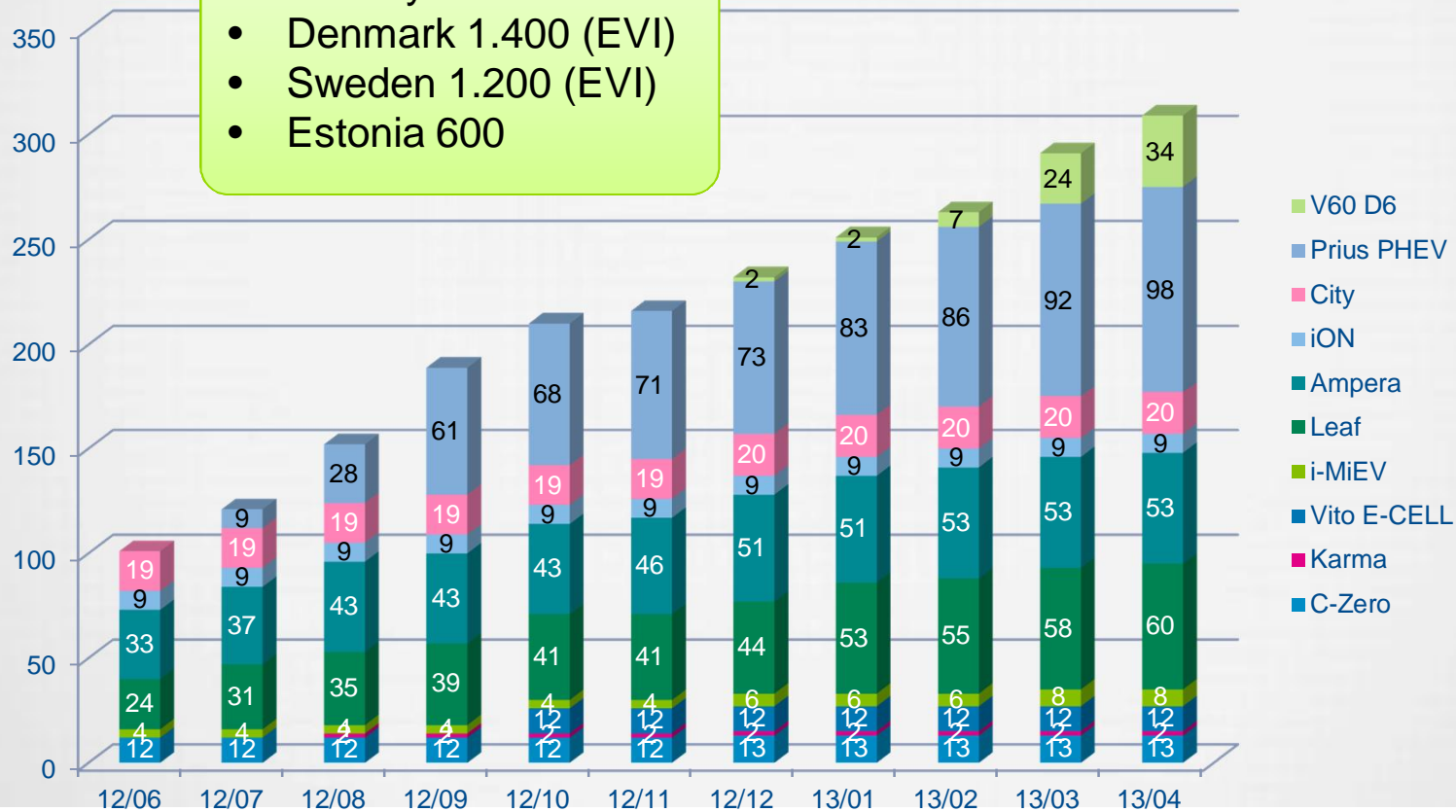


Current EV stock 150,000+ (IEA EVI)

EV Stock in Finland: BEV 122, PHEV 187

2012

- Norway 10.000
- Denmark 1.400 (EVI)
- Sweden 1.200 (EVI)
- Estonia 600



Support and Incentives

- Norway
 - Apr 2013 number of EV's 12,000
 - No taxes
 - In Oslo, usage of the bus lane, free parking in city spaces.
 - 4,000 charging posts and 130 fast-charging stations.
- Denmark
 - No registration tax
 - Free parking in Copenhagen
- Sweden and Finland
 - Support for demonstration projects
- Estonia
 - Maximum 50% support of purchase price depending on battery capacity
 - 165 fast charging stations



Vision of Business Potential 2020

1600

1400

1200

1000

800

600

400

200

0

2013

2020

Enterprise driven development needs

Research

TESTING AND VALIDATION

PASSENGER CARS AND SERVICES

COMPONENTS AND SOFTWARE

MOBILE MACHINERY

NET SALES
2000 - 3000 M€

Tekes



ECV – Tubridi

Need

- Energy efficient mobile working machines; reduced fuel consumption, reduced emissions

Solution

- Virtual simulation of mobile working machines with Hardware-In-Loop (HIL) testing possibility of power transmission components
- Answers to questions like:
 - “What is the load cycle like of that special working machine?”
 - “How much is fuel consumption reduced by hybridisation?”
 - “What size of energy storage should I choose?”

Benefits

- Load cycle generated without measurements, basis for hybridization
- Sizing of the components (energy storages, electric motors, ...) fast and easy by simulation tests
- Faster product development with less prototypes (huge and expensive)

Users

- Product development of mobile working machines and power transmission lines.



HIL-simulator

- *Model of working machine*
- *Model of environment*
- *Movement platform*
- *Testing of real components*
 - *Electric motors*
 - *Frequency converters*
 - *Energy storages*

Contact:

- lasse.laurila@lut.fi
- juha.pyrhonen@lut.fi

www.ecv.fi/tubridi/



ECV – eStorage2

User need

- Understanding advanced battery technology for different applications
- Identifying the feasibility and limitations of current battery technology
- Design and optimization of traction battery systems for specific applications

Solution

- State-of-the-art research facilities for advanced battery technology
- Bridging the gap between fundamental and industrial R&D
- Linked to industrial projects and development platforms to verify technology

Benefits

- Choice of technologies by benchmarking, validation and comparison
- Development of optimized components by demonstrations
- Cost savings and risk management through right technology choices

Users

- Enterprises developing electric vehicles and mobile machinery
- Stakeholders developing electric mobility infrastructure
- Open cross-cutting competence centre for electrochemical energy storage

www-address: <http://www.ecv.fi/estorage2/>



General Information (optional)

- 2 research parties
- 8 industrial parties
- Research facilities for battery cells, modules and packs
- Planned overall budget 2.4 MEUR (4 years)

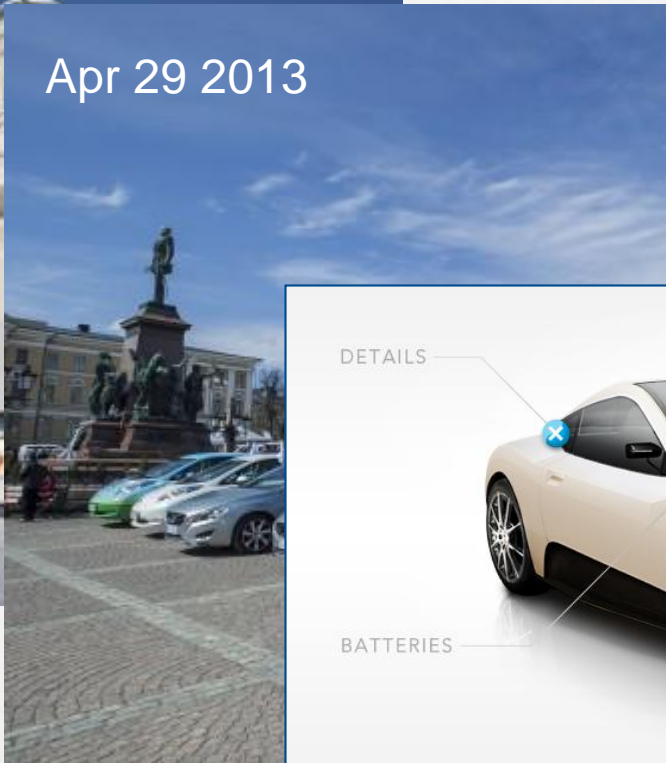


Arousing Public (and Media) Interest

Feb 5 2012, -26 Centigrade



Apr 29 2013



ERA, Electric Raceabout by Metropolia

Acceleration 0-100 km/h 6 sec.

Operation range 200 km

Energy consumption is equivalent to fuel consumption as 2,35/100 km

Top speed 200 km/h



Thank You!

- Programme web pages <http://www.tekes.fi/programmes/EVE>
- Consortia web pages
 - <http://sahkoinenliikenne.fi/>
 - <http://www.eco-urbanliving.com/>
 - <http://www.evelina.fi/>
 - <http://ecv.fi>
 - <http://winteve.fi>
- LinkedIn group
 - http://www.linkedin.com/groups/Tekes-Electric-Vehicle-Systems-4069395?gid=4069395&trk=hb_side_g