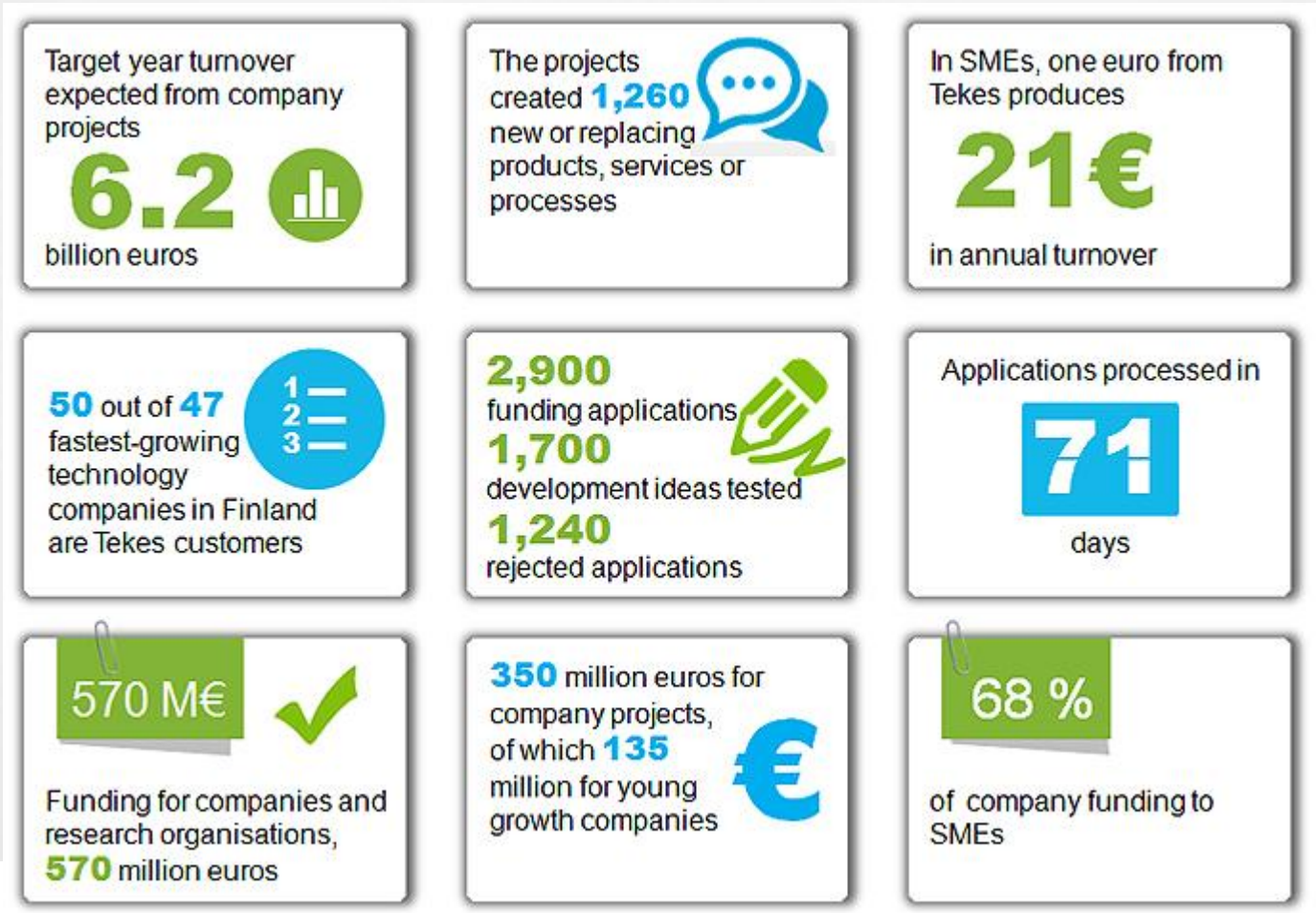
EVE – the Finnish electric vehicle programme – including a co-Nordic dimension

Markku Antikainen
Coordinator
EVE – Electric Vehicle Systems

Tekes

EVE

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

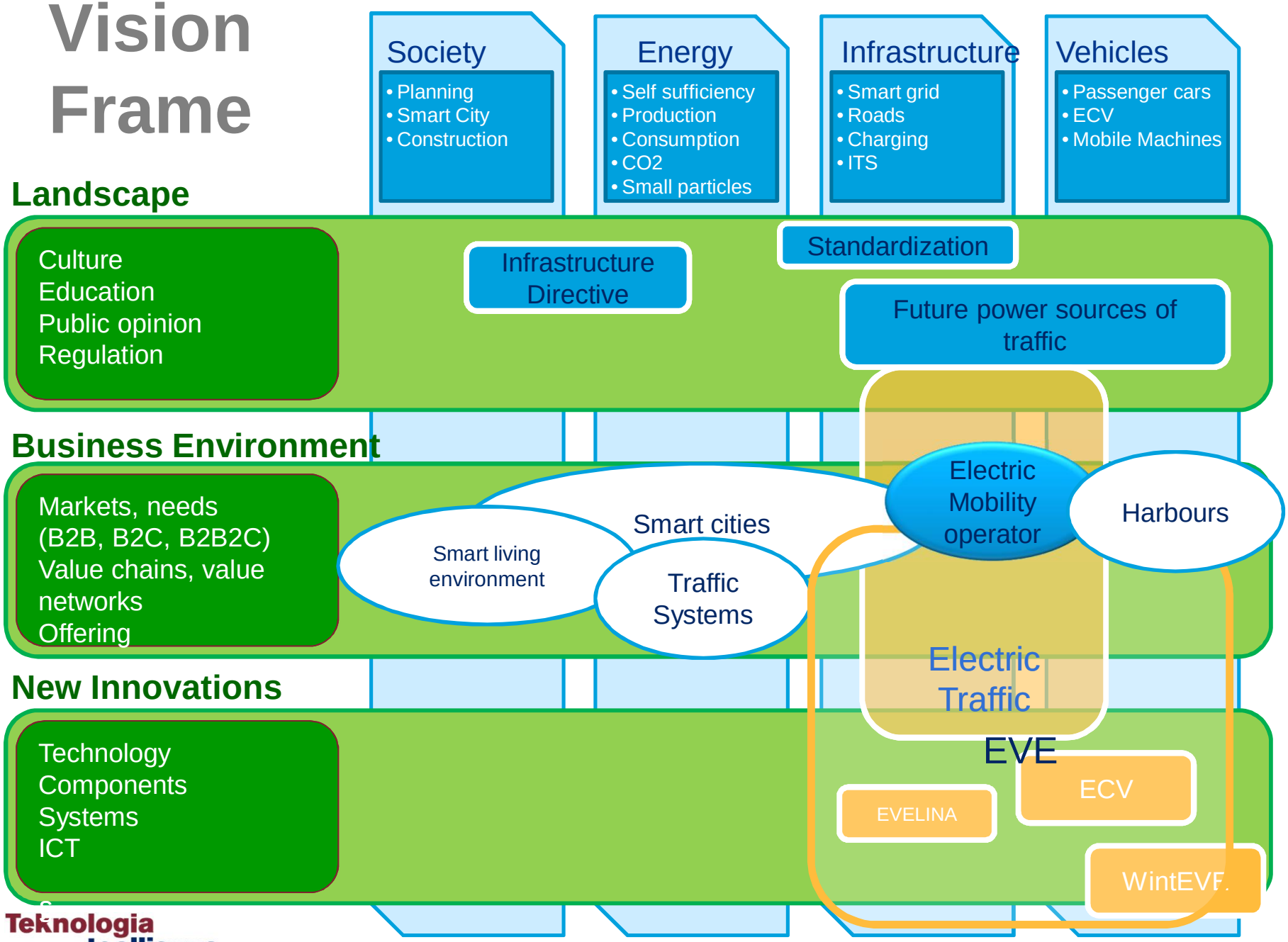
EVE

- *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

Tekes

EVE

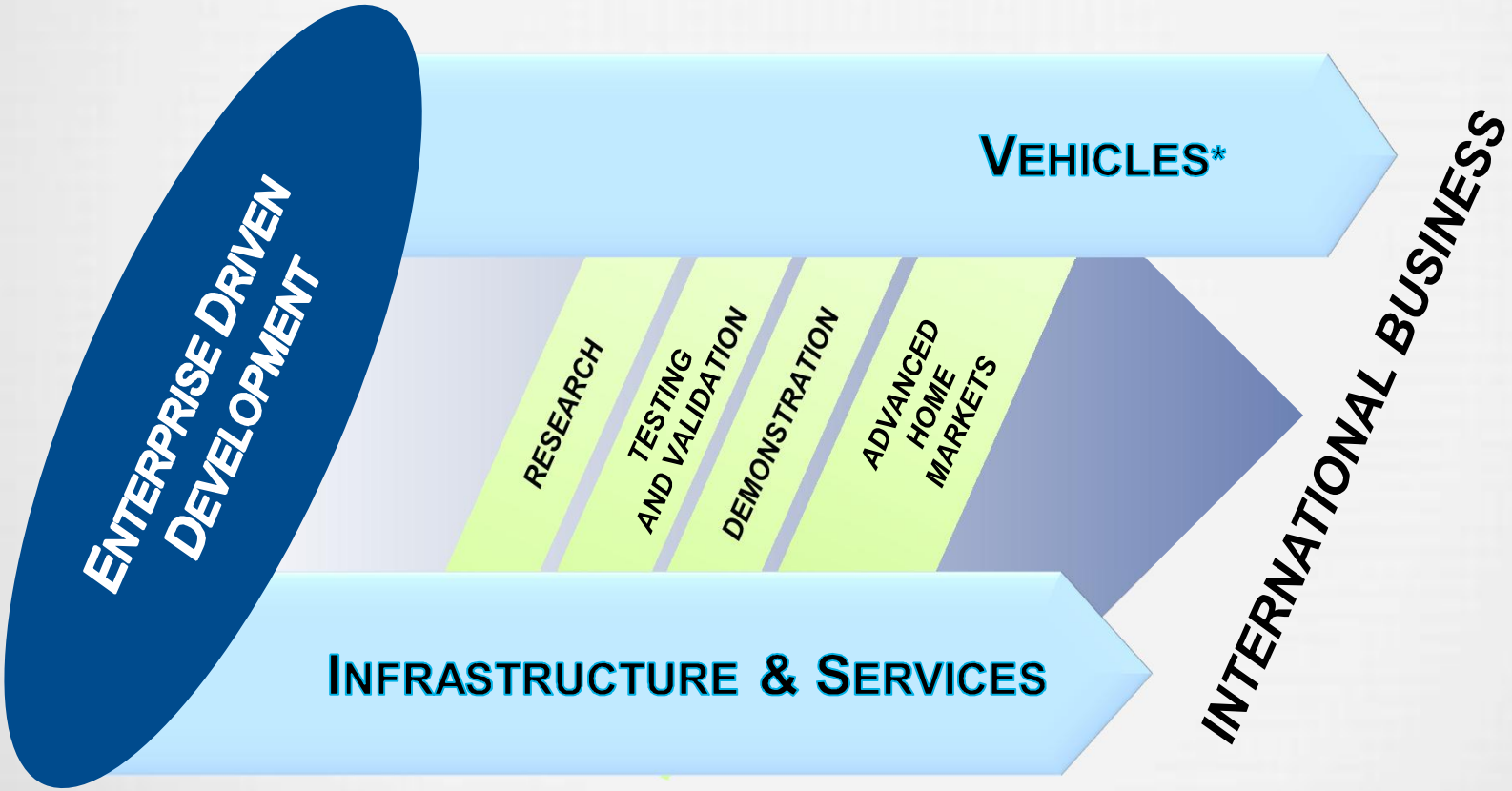
Vision Frame



Teknologia teollisuus

Source: Technology Industries

EVE – from Research through Testing and Demostration to Business



* Vehicles: Light and passenger vehicles and heavy machinery included

Tekes

EVE

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 condititions works elsewhere

Users

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

www.centria.fi

www.winteve.fi

WintEVE
Winter operability for Electric Vehicles

Tekes

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

YTK/Aalto University

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

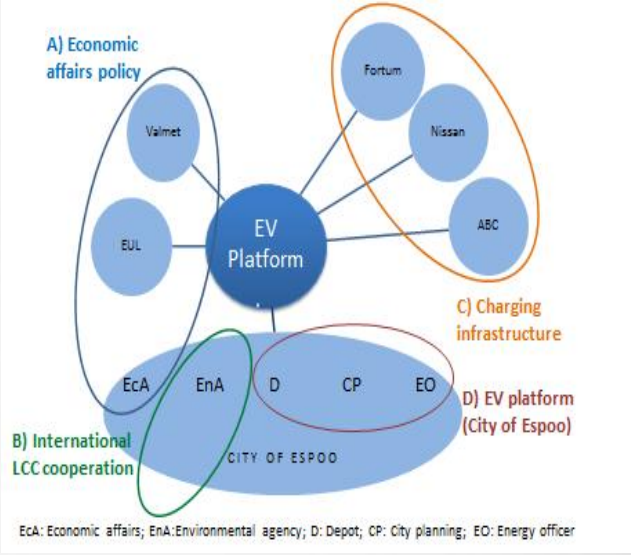
Benefits

- 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 Infrasructure 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

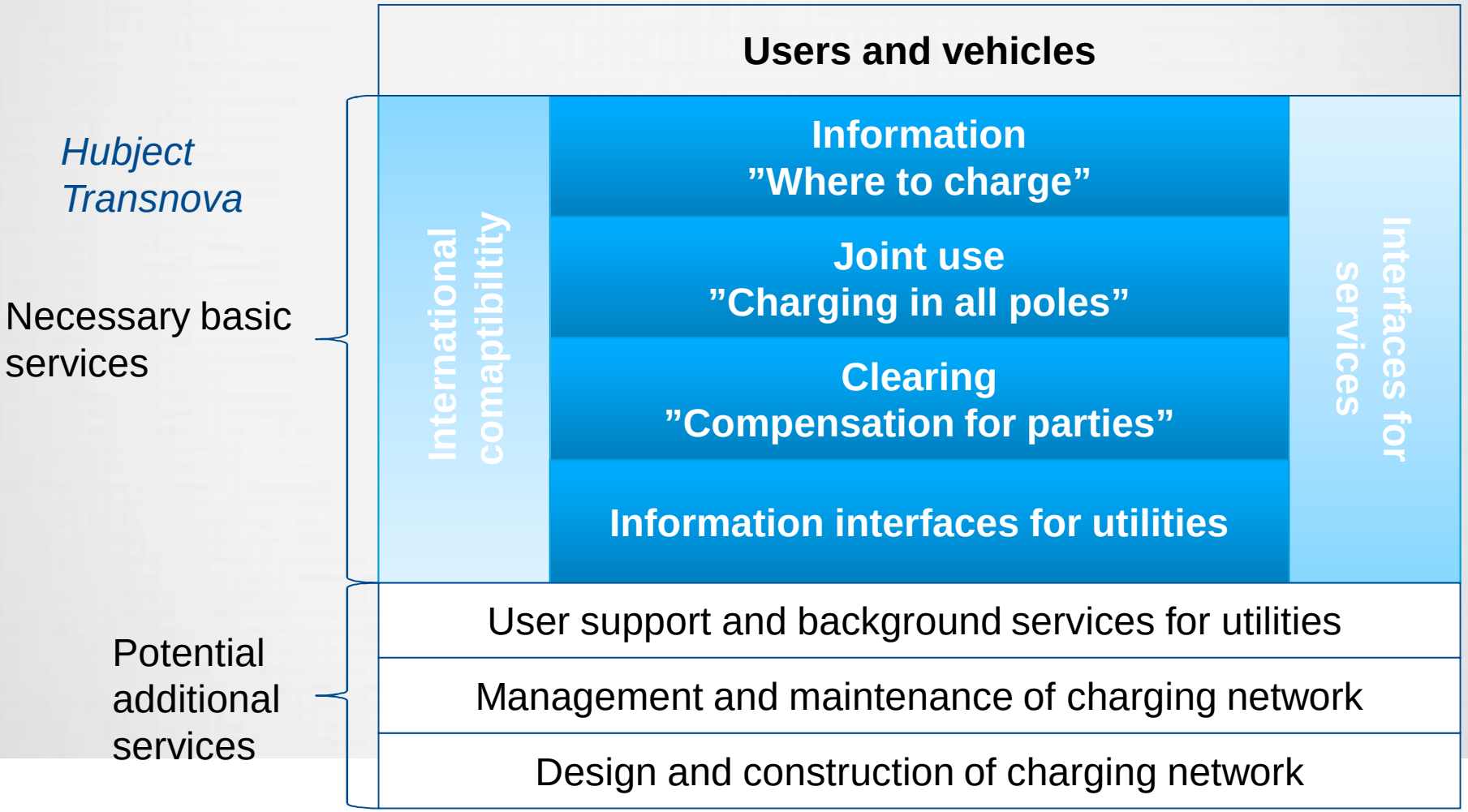
- EV users: private and public organizations, consumers
- Organizations and authorities developing electric mobility

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

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 Korkiakoski
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

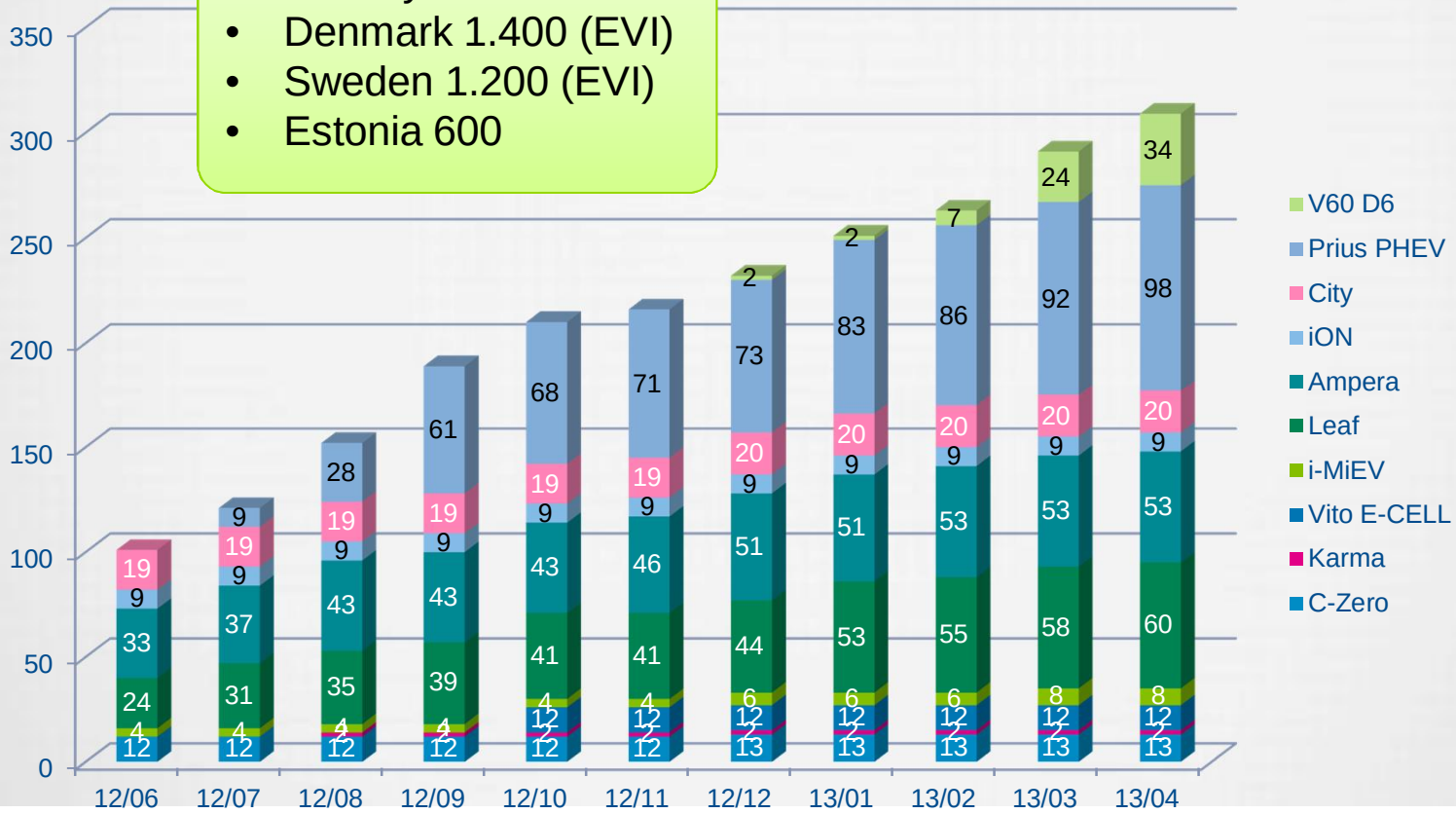
Current EV stock 150,000+ (IEA EVI)

Scenario's	2009	2010	2011	2012	2013	2014	2015	2016	2017	2020 (% of Total Car Sales)
Optimistic	5,060	16,100	43,200	248,400	816,200	1,373,200	2,094,800	2,865,200	3,531,500	10-12%
Frost & Sullivan	5,060	16,100	43,200	110,100	286,500	735,800	1,314,300	1,741,000	2,228,400	5-7%
Conservative	5,060	16,100	43,200	66,500	178,600	318,300	451,000	602,400	796,800	2-4%

Note: All figures are rounded; the base year is 2010. Source: Frost & Sullivan

EV Stock in Finland: BEV 122, PHEV 187

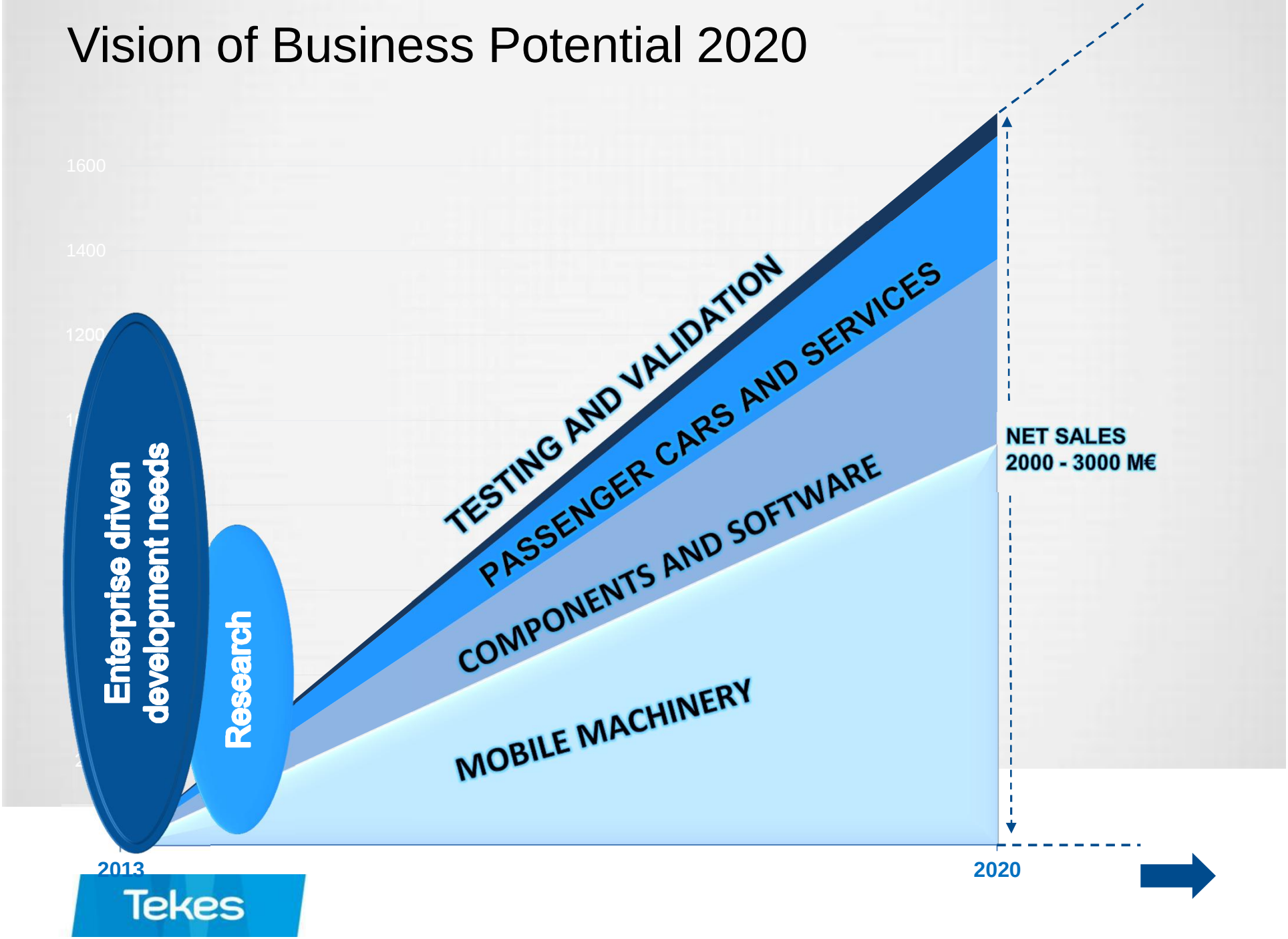
2012
- Norway 10.000
- Denmark 1.400 (EVI)
- Sweden 1.200 (EVI)
- Estonia 600



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



ECV – Tubridi

Need

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

Solution

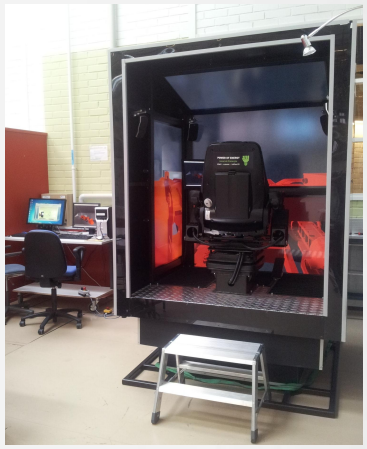
- Virtual simulation of mobile working machines with Hardware-In-Loop (HIL) testing possibility of power transmission components
- Answers to questions like:
  - "What is the load cycle like of that special working machine?"
  - "How much is fuel consumption reduced by hybridisation?"
  - "What size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

Tekes

EVE

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/

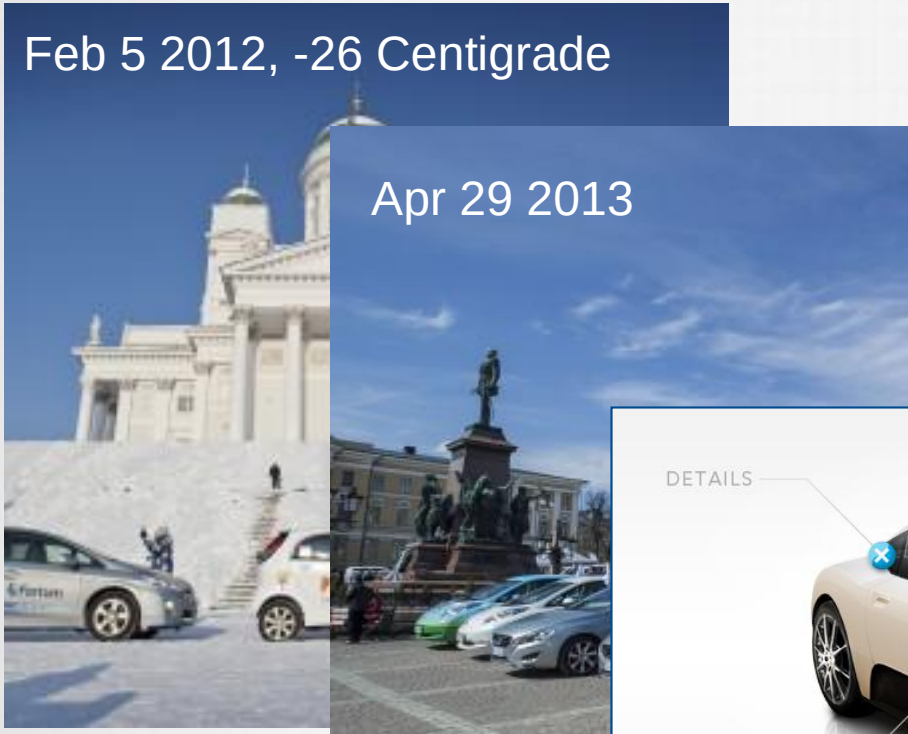
General Information (optional)

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

Tekes

EVE

Arousing Public (and Media) Interest



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