Integrating transport energy supply with the energy system of the future

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MOBILITY: TECHNOLOGY PRIORITIES AND STRATEGIC URBAN PLANNING

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Of the Future and Forecasting
What is the Future?

- **The Future is**, according to the linear concept of time, the *portion of the timeline that has not yet happened*

- The portion that has already taken place is called *the Past*

- The phase that in on-going at the moment is called *the Present*
Why Do We Have Interest in the Future?

- Our interest in the Future is often linked with:
  - *Desire to plan and prepare for the changes* in the operating environment that may threaten your business or activity and its continuum
  - *Find new, arising possibilities* that may support growth or development of new business.
How Can We Forecast the Future?

- **Forecasting** is presenting an estimate of the Future, based on the interpretation of the omens that convey future trends.

- We cannot predict the future, but it is possible to explore it with a systematic method, and to present alternative images of the future called Visions.

- Visions arise from the construction of time-phased and logically progressive development paths called Scenarios.
In the Past...
"Listen to the Visioneers"

"Many parts of the future are already here now, but in an embryonic state"

Carlos Ghosn
Chairman, CEO Renault-Nissan

FISITA World Automotive Congress 1998
What Ultimately Determines the Future?

- There is *not one, Deterministic Future* that we need to predict!

- *The Future is determined by the choices, decisions, and actions We take*

- It is not only necessary to prepare for the future, but *we may also actively contribute* in order to:
  - Avert the looming threats, or
  - *Create new opportunities*

- *Interactively we can contribute to the development paths that will result in different futures!*

What Makes the Prediction Difficult...
Traditional Pathway of Fossil Fuels in Transport Energy Use

Domination for some 100 years
”The Race is On”
Pathways of Gas in Transport Applications
In pure technical terms the options are numerous, but not all are competitive!
Pathway analysis – Well-to-Wheels (WTW)

Energiaketju - “lähteestä pyöriin”

- Raw Material Extraction
- Primary energy
- Fuel production
- Electricity production
- Distribution, Refuelling, Recharging
- On-board fuel
- Electricity On-Board
- Energy conversion
Critical Issues
*Kriittiset tekijät*

Any one of these can set the limit!

Abundance
*Saatavuus*

Refuelling infrastructure
*Polttoainejakelu*

Compatible engines & vehicles
*Yhteensopiva kalusto*
KEY DRIVERS IN THE OPERATIONAL ENVIRONMENT

- Raw materials (Abundance, costs)
- Legislation (exhaust emissions, fuels, taxes)
- Vehicles (compatibility, performance)
- Fuel Distribution (compatibility, coverage)

COSTS
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COSTS

TECHNOLOGY

POLITICS

ECONOMY
What Helps us out in Our Predictions...
Use the Right Tools
Using Transition Pathway Analysis to Identify Prospective New Value Chains In the Energy System of the Future
Present-day Value Chains of Cars & Fuels

- Crude extraction
- Supply
- Refining
- Distribution
- Marketing & Sales

Product Planning
Sourcing Components
Assembly
Distribution
Marketing & Sales

Dialogue Only via Fuel Standards Co-Development!

Well-Established and Long-Term Co-Existence, but No Cross-Ownership!
Opportunities
With the Introduction of Electricity as "Fuel", a New Value Chain Can Emerge

- Electricity generation is much more diversified and localised than present-day transportation fuel supply
  - Security of supply is inherently quite high
- Power grid is relatively widespread
  - Must only concentrate to the "last five meters"
- Quality is not an issue - "one size fits all"
  - No need to segregate "transportation-quality" electricity
- Also many fairly large, multi-national companies
  - Ability to invest, if new market is foreseen

- But: Grid balance must be secured
  - Generation capacity must be exploited wisely: "Smart Grid"
CHALLENGES OF INTRODUCING NEW VALUE CHAINS FOR TRANSPORTATION SECTOR
Nº 1 - STAGNANT AND SLOW-CHANGING BUSINESS

- Status Quo for the sector is quite stagnant, because:
  - Very large global companies are overruling both stages
  - Huge incumbent investments
  - Long history and legacy, some companies over 100 years old
  - High degree of technology with emphasis on quality vs. price
- Strong competition between companies, but simultaneously strong and united opposition against newcomers
 Nº 2 - “THE GATEKEEPERS”

- to be able to introduce a new fuel or energy carrier you must seek consent with the “Gatekeepers”
- Why?
- Because each one has his own key, and you need all of them:
  - **Auto industry** controls vehicle and engine technology
  - **Oil industry** controls the fuel and distribution infrastructure
  - **Financial sector** controls capital for new investments needed
AUTO INDUSTRY’s KEY

- you must agree with the auto industry, because…
  - if the new energy product needs new storage and conversion devices on-board, like electricity or hydrogen, new cars are needed
  - considerable lead-time needed, if new technology is needed, as the auto industry has a legacy of safeguarding high quality and “crashproofness” of their products
you must agree with the oil industry, because…

- if the new product is suitable for blending with the existing fuels, it can be distributed via the existing infrastructure
- however, lead-time needed here also to ensure compatibility of the new product with the existing and future vehicle park
- if it does not fit in with the existing standards, must develop new
FINANCIAL SECTOR’s KEY

- you must agree with the financial sector, because…
  - if your product is non-compatible with the existing fuels, and there is no existing infrastructure for it, you must build one
  - Building new system will require heavy long-term investments, where growth of revenue and pay-back times will be very long
  - New fuel or energy need to be offered quite widely before consumers can commit themselves, unless bimodal cars are used
Nº 3 - ATTITUDE

“WE WELCOME YOUR NEW IDEAS, INVENTIONS AND INNOVATIONS WITH GREAT ENTHUSIASM!”
Are We in a Dead-end?
IS THE CURRENT BUSINESS MODEL THE ONLY WAY TO SUCCESS?
WHAT IF IKEA WOULD START SELLING CARS...

CERTAINLY IT WOULD COME WITH ONE OF THESE...
WHAT IF APPLE WOULD START SELLING CARS…

Introducing the iCar

Apple

LIKELY IT WOULD RUN JUST WITH THIS!
WHAT IF APPLE WOULD START SELLING CARS…

Introducing the iCar

Apple

…PROBABLY YOU WOULD ALSO STEER IT BY WAVING YOUR HANDS!
CAN WE REALLY SEE THE GAME TO CHANGE?
YEAH, SOME REFRESHING NEW IDEAS, BUT…
Who is the Scapegoat?

Scapegoat
The Secret To Success Is Knowing Who To Blame
Show-stopper № 1 – ”Battery Technology Sucks!”

Insufficient Capacity + High Costs + High Risks (lifetime?) = Stay Away From It!
“Take A Detour Instead”
"FUEL OF CHOICE” by the Auto Industry

CHEERS:

- Even Higher Potential for Use of Renewable Energy Resources
- Decent Range with One Fill, and Fill-up Time Like with Petroleum Fuels
- High Efficiency of the Electric Drivetrain
- Fossil (Methane Reformate) Option Offers Nearly-decent Entry-level Cost per MJ

JEERS:

- Must Find Capital & Partners to Create Distribution Infrastructure
New automotive alliances have been formed for FCEV commercialization **in January 2013**

**Timeline for Introduction**

- "Toyota FC → BMW"
- "Mercedes → Nissan+Ford"
"We Are Ready to Roll-Out"

Production > 100k by 2015
Integrated Energy System of the Future

Graph by Jussi Solin, VTT
Integrated Energy System of the Future

Power-to-Gas (P2G) - Concept: Interconnection with Mobility

German “Power to Gas” concept by Michael Specht, ZSW. see http://www.powertogas.info/
Parallell, Co-working ”Energy Circles” with Binding, Two-way Nodes
What is the Critical Piece of the Puzzle?
The Last Necessary Piece is...

“Lots of Lazy Capital”
CONCLUSIONS

- The Future cannot be predicted, but we can influence it
  - It is based on our decisions and actions, not “God Given”
- The basis of the Future lies in today, mostly linear change
  - So far, no strong disruptive game-changers
- Automotive/transportation sector is slow to change
  - Huge, incumbent investments
  - Longish product cycle and vehicle lifetime
CONCLUSIONS

- **Future challenges cannot be met with just one energy carrier**
  - Several co-existing fuels/energies and conversion technologies
  - However, future carriers are non-specific to transport use

- **Lately, revolution has gotten more attention than evolution**
  - Strong battery-electric car hype, but poor industry support
  - Hydrogen fuel cell is seen more viable by the Auto industry

- **Strong, incumbent actors rule the stage and slow-down change**
  - New and innovative value chains are difficult to create, even if lucrative

- **Furthermore, we must always keep in mind**
  - “Affordability”, market-acceptance and trust of the consumers
  - You cannot mandate vehicle sales!
The End

Questions & Discussion

- Thank you for your attention!