WORKSHOP RESULTS
(DRAFT, APRIL 9TH 2014)

TOP-NEST
Nordic pathways for sustainable transport and energy

Nordic roadtransport and prospective value chains of renewabel energy

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Confidentiality: Public

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Content

1. Introduction

This report describes the working process and results of the workshop finding out the prospective value chains of Nordic road transport in the renewable energy context, especially dealing with biofuels, electricity and hydrogen technological platforms, The workshop was held in Espoo, in Finland in February 3rd 2014. The workshop is a part of a TOP-NEST project (http://www.topnest.no/).

The meaning of the workshop was twofold: 1) to gather information concerning the prospective value chains in co-creative process together with various stakeholders, and 2) to test the foresight method intend to help in identifying the prospective value chains. The used foresight process is developed in TOP-NEST project by VTT.

The Figure 1 describes the content of the transport and energy system how it is understood in the project.

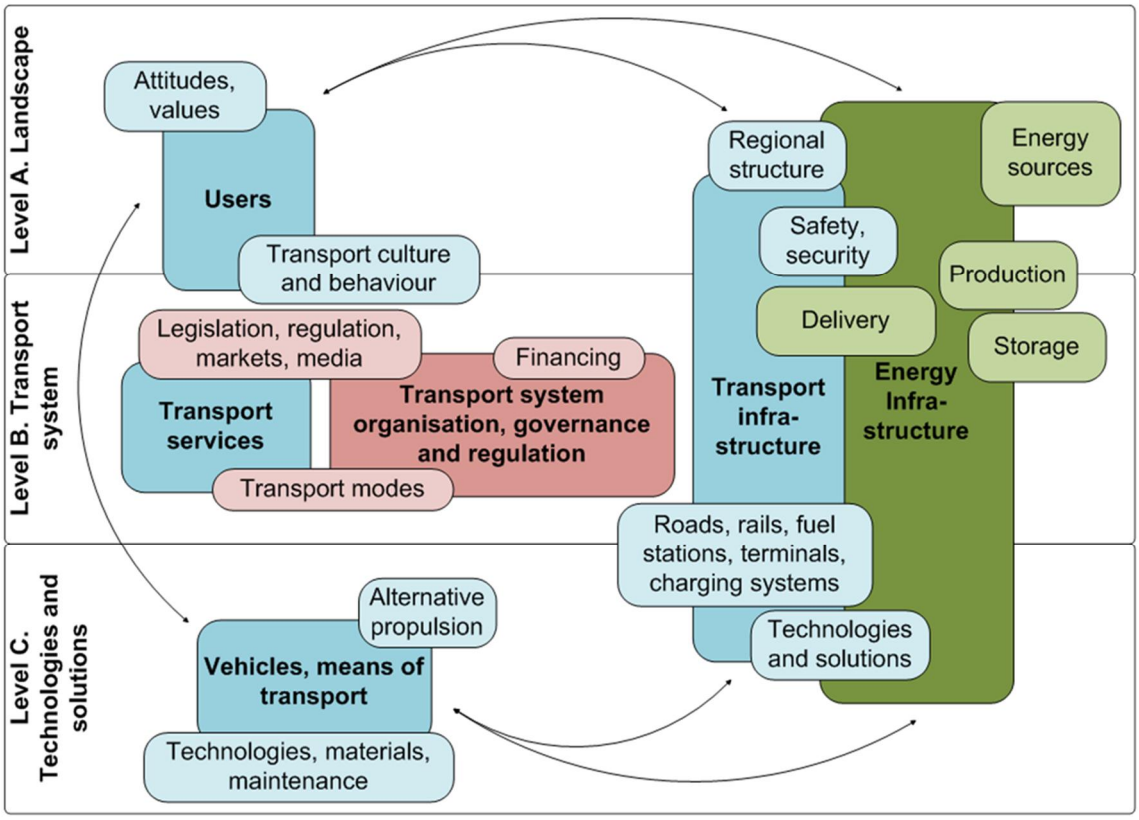

Figure 1. The integration of transport and energy system.

The workshop gathered 20 participants (listed in the attachment).

The working process in the workshop was twofold:

1) Analysis of the scenarios developed earlier in the Top-nest project (in pairs)
2) Identification of prospective value networks and value chains (in groups).

In the following the results of these pair and group works are described.

2. Scenario analysis

We have created four scenarios for describing the possible futures up tp 2050 in the Nordic transport context. Scenarios differ from each others in policies and societal structure. (see the Figure 2). The basic content of the each scenario is described in the Table 1. Scenarios are shown more detailed in the attachment.

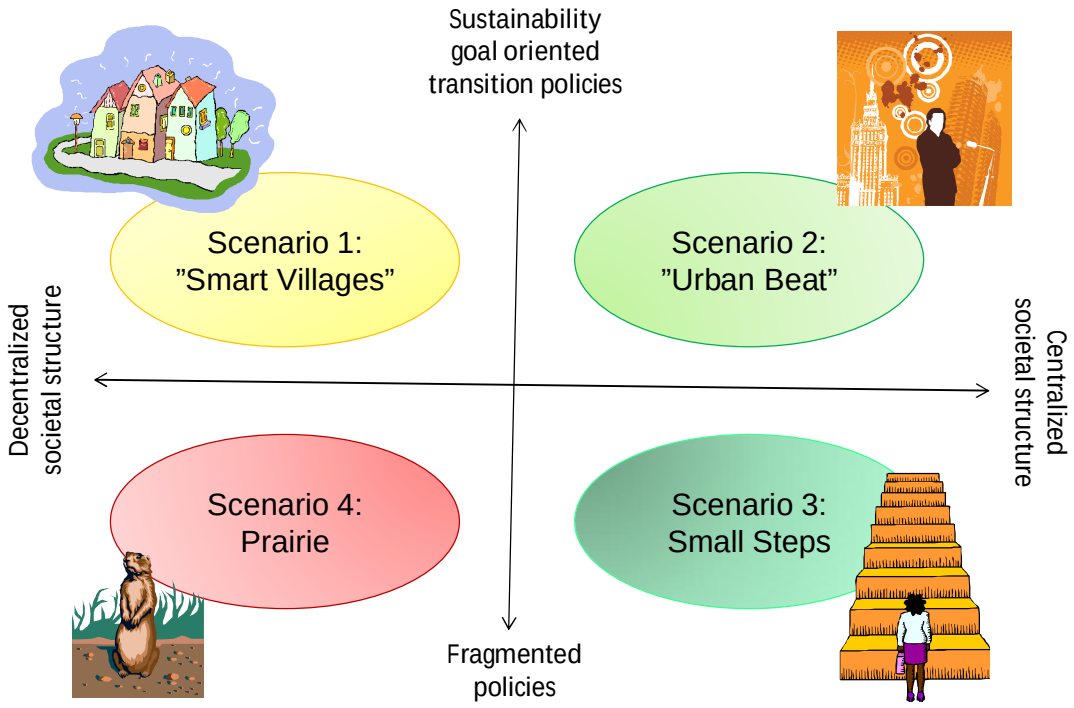

Figure 2. TOP-NEST scenarios for roadtransport up to 2050.

Table 1. The content of the scenarios.

	Smart villages	Urban beat	Small steps	Prairie
Transport system	• Road transport dominates • Smart passenger and goods transport solutions for small communities	• Rail transport and Non Motorised Transport (NMT) dominate in cities and inter-citi connections	• Road, rail and NMT in cities, no priorities • Road transport for long distance travel and goods	• Road transport dominates • Poor maintenance of infrastructure
Transportation demand	• Passenger: Slight increase • Goods: decrease	• Decrease	• Passenger: slight decrease • Goods: no change	• Decreases due to poor economy
Industry characteristics and structure	• Local distributed industries and services	• Industrial renewas, large service sector companies	• Centralized energy intensive industries	• Stagnation, economic problems, no renewal
Technology development	• Moderate	• Rapid, advanced and innovative	• Moderate	• Slow
People, values, users, policies	• Community-based thinking is strong • Tight local/regional regulations for vehicle and fuel production, distribuiton and use	• Educated, green users • Tight global and national regulations for vehicle and fuel production, distribution and use	• End-user views and needs are dispersed • Various (even conflicting) regulations	• Economic aspects dominate due to crisis • Only few poorly supervised regulations

The first task in the workshop was to discuss and analyse the scenarios together with a pair. The results of this discussion were written in the templates provided. These results are shown in the following.

2.1 Scenario comments

We had total 7 pairs (or small groups) discussing and analysing the scenarios. In the table 2 an example of the results is shown. In your results (in Norway, Sweden and Denmark), please provide us a summary of the results (see section 2.2).

Table 2. Scenario analysis, group A, an example of the results.

	**SMART VILLAGES**	**URBAN BEAT**	
Plausibility of the scenario	+++	+++	**Plausibility of the scenario**
Factors in today's society that anticipate change towards the scenario	Communication networks Distributed energy production The growing trend in farm size Local food production / local food trend	Diginatives Urbanisation Light traffic (walking and cycling) as a boom Investments on rail traffic	**Factors in today's society that anticipate change towards the scenario**
Additions to the scenario	E-commerce	Transport services	**Additions to the scenario**
	**PRAIRIE**	**SMALL STEPS**	
Plausibility of the scenario	+/-	++	**Plausibility of the scenario**
Factors in today's society that anticipate change towards the scenario	Anti-EU Global development	Political model / consensus / compromise in national and EU levels	**Factors in today's society that anticipate change towards the scenario**
Additions to the scenario			**Additions to the scenario**

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2.2 Conclusions on scenario working

Scenarios and plausibility

- Small steps is the most plausible scenario. Transition processes are slow and existing infrastructure is hindering radical changes.
- Urban beat is plausible scenario only in big city areas, like Helsinki, Stockholm, Copenhagen, Malmö, Göteborg and Oslo regions. Smart villages may be plausible in ”smaller” city areas. Prairie may also be a parallel option for people seeking for country side atmosphere.
- In Finnish political context the smart villages scenario is working well.
- Urban beat scenario is suitable for new generations, digi-natives.
- Prairie is on the other hand a worst-case scenario, but on the other hand an option for urban life. Both images have potential: worst-case scenario gives ideas on what should be done in order to avoid this kind of development and prairie creates new business potential.
- Prairie scenario is unrealistic, because in bad times people are creative.
- Urban beat scenario is utopian.

Additions to the scenarios

- All scenarios miss the industrial and service business aspects.
- Different transport modes and different transport needs exist parallel.

3. Prospective value chains of biofuels

Prospective value chains of biofuels were identified in two groups. The first group chose to find out value chains in Small steps scenario and the other group in Smart villages scenario. In the following the results of these groups are shown.

3.1 Biofuels in Small steps scenario (group 1)

The group created the value network for biofuels in Small steps scenario, and it is shown in the Figure 3. Based on this network the group identified three value chains, which are shown in the tables 9-11 (notice that these value chains are created in the unique workshop, the content may differ in other workshops depending on the participants).

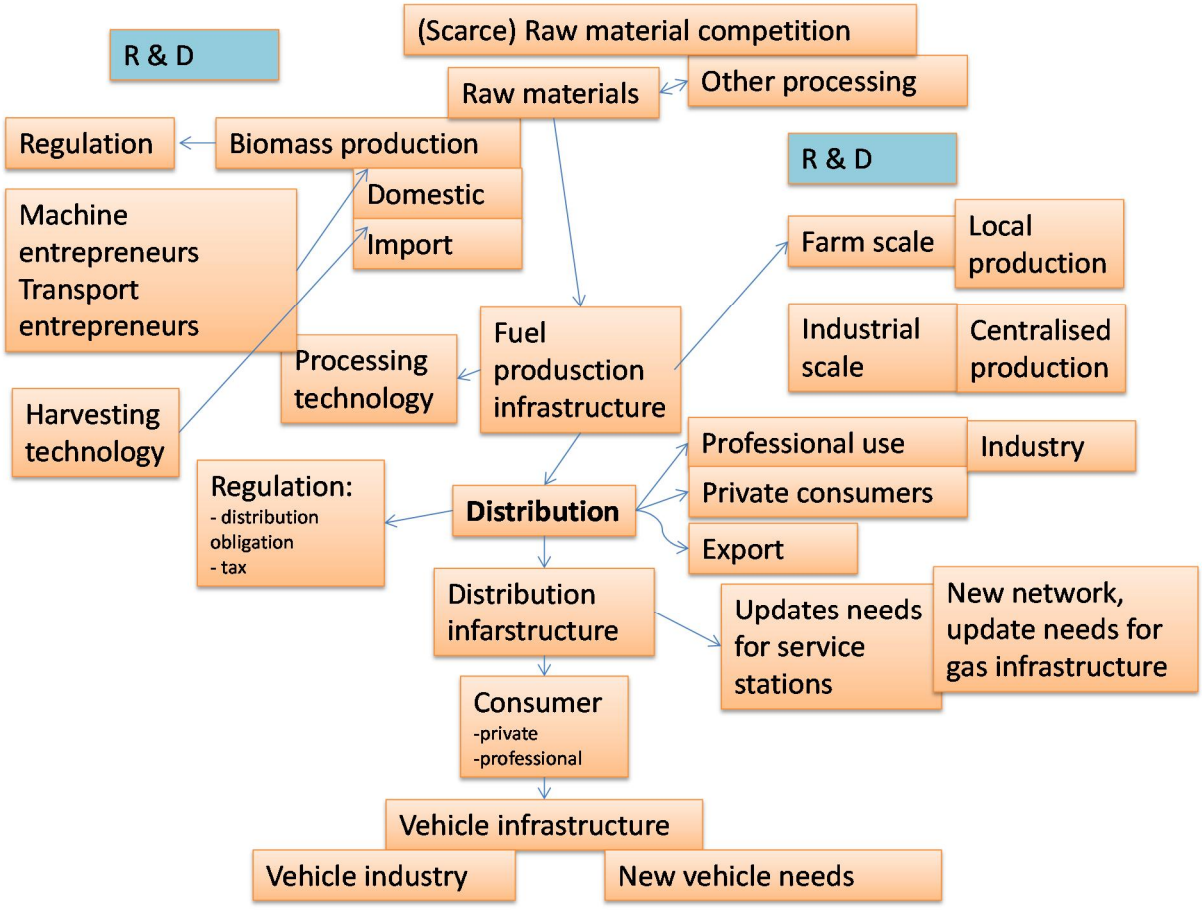

Figure 3. The value network for biofuels in Small steps scenario.

Table 9. "Drop-in"-biofuel value chain.

Actors	**Value generation (What?)**	**Prerequisites for value generation (By what means?)**	**Supporting activities**
Consumer	Transport km	Existing vehicles	
Vehicle manufacturer	Existing vehicles (diesel)	Existing vehicles	
Distributor	Distribution	Mixing fuel	Mixing fuel commitment
Tax model			
Logistics	Existing	Existing	
Biorefinery	Production	Mixing fuel commitment, or other subsidy	BtL investment subsidy
R&D subsidy			
Logistics	Timber logistics	Existing	Infrastructure

Table 10. "FlexiFuel"-biofuel value chain.

Actors	**Value generation (What?)**	**Prerequisites for value generation (By what means?)**	**Supporting activities**
Consumer	Transport km	Suitable vehicles 100% ethanol cars consume more fuel than "fossil" cars (10 l / 100 km)	Support: transport km cannot be too expensive
Vehicle manufacturer	FFV-vehicles	Manufacturing FFV vehicles should be profitable	EU subsidies needed (today car manufacturers do not get benefit from bioenergy cars)
Distributor	Distribution	Service stations should have biofuel suitable equipments (e.g. packings)	Service station updates (100 % biofuels)
Logistics	Distribution	Own tanks for 100 % biofuel	
Industrial waste flows	Waste refining (biorefinery)	Industrial waste	Neutral regulation (markets decide how "waste" is utilised)
Other industrial manufacturing	"Main product"	Enough production, volume	

Table 11. Biogas biofuel value chain.

Actors	**Value generation (What?)**	**Prerequisites for value generation (By what means?)**	**Supporting activities**
Fleet consumer	Transport km	Existing vehicles	Support
Vehicle manufacturer	Gas vehicles	Existing	
Pit	Distribution	Existing	Existing
Logistics	Distribution	Local gas production + pipeline	
Gas production	Production	Existing	

1.1.1 Biofuel value chains in other scenarios (analysis made by the group 1)

- The additional costs are smallest in Drop-in biofuel option in all scenarios.
- Biogas value chain has good local prerequisites for biogas production in Smart villages and Prairie scenarios, but in Prairie there is no money for gas infrastructure and technology development.
- Smart villages scenario provides good poprtunities for flexi-fuel value chain bio-ethanol production.

All in all, the group assessed that the development is slow in all scenarios, because transport is heavily stock and infrastructure intensive development. Big changes are not going to happen up to the 2050, because the changes in stock and infrastructure is so slow; the vehicles, which are under the designing process at the moment are still in use in the year 2050.

Biofuels in Smart villages scenario (group 2)

In the Figure 4 the biofuel value network in Smart villages scenario is shown. The value chain related to this network is shown in the Table 12 (only one value chain was identified in the workshop).

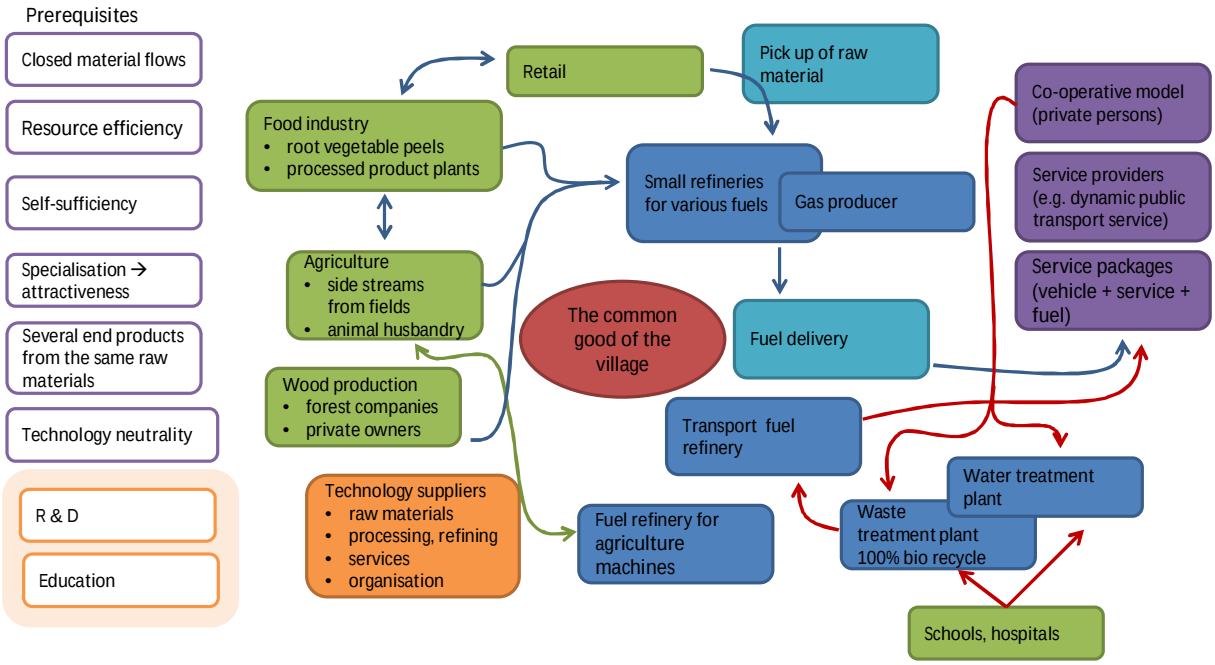

Figure 4. Biofuel value network in Small steps scenario.

Table 12. Value chain of biofuels in Smart villages scenario.

Actors	**Value generation (What?)**	**Prerequisites for value generation (By what means?)**	**Supporting activities**
Food industry • root debarking • further processing	Waste→ Raw material	Enough waste for raw material	
Agriculture • field side streams • livestock	Side streams→Raw material	Enough side streams for raw material	
Wood production • forest industry companies • private forest owners	Wood	Raw material availability (volume and quality)	
Technology providers • raw material • processing • services • organising	Technology needed in the whole chain	Working markets for technology providers	R & D, start-up assistance
Trade	Waste→ Raw material	Waste→ Raw material	
Transport company	Raw material collecting	Suitable stock and enough raw material to transport	
Small refineries	Raw material processing	Enough raw material and demand for te end product	
Distribution company	Fuel transport and distribution	Suitable stock and distribution logistics	
Consumers	Fuel to the vehicle	Suitable vehicles in reasonable price	Vehicles and fuel in reasonable price (taxes)
Service providers	Total service (fuel as a part of total service)	Working service business	

The group assessed that the value chain described in the Table 12 might have good operating conditions also in Small steps scenario.

4. Prospective value chains of electricity and hydrogen (group 3)

One group was creating a value network for electricity and hydrogen. This group chose to look at the future in the Smart villages scenario. A central actor in this network is distribution, because it integrates the electricity and hydrogen platforms. The value network of electricity and hydrogen is shown in the figure 5. Two value chains identified based on this network is described in the Tables 13-14.

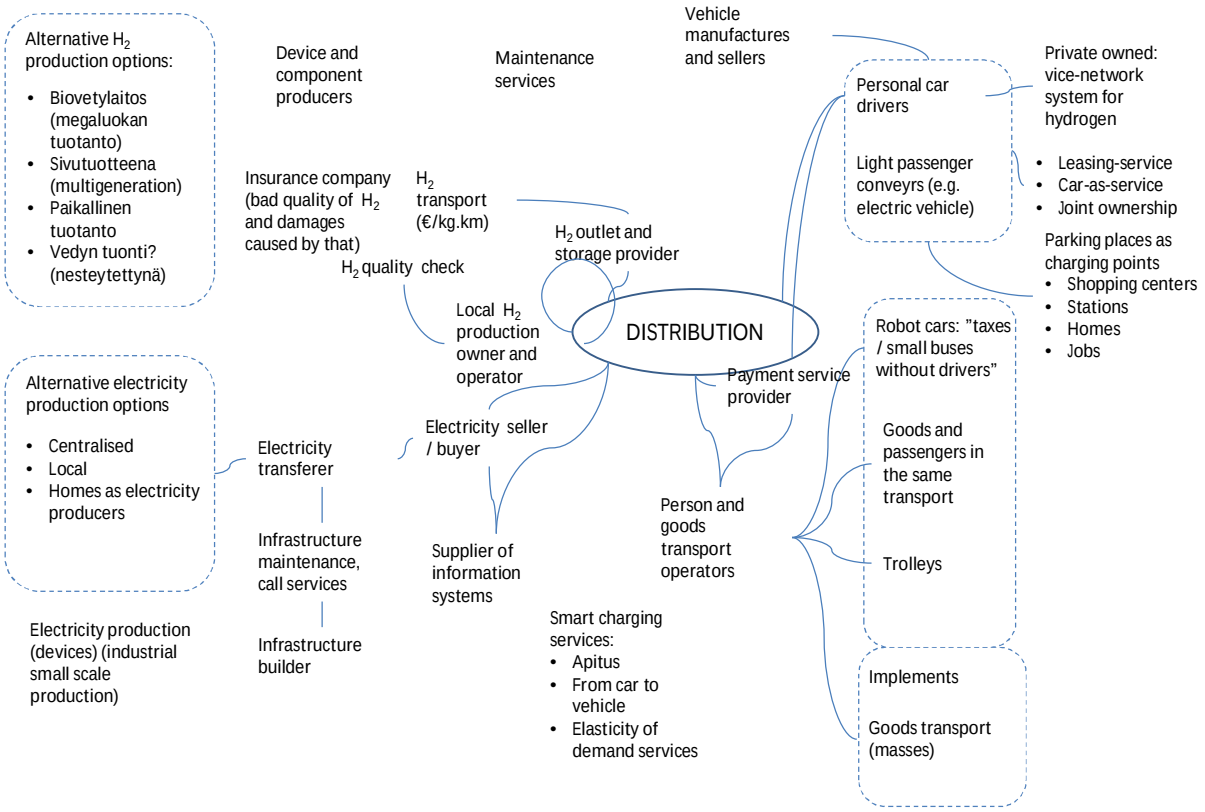

Figure 5. Electricity and hydrogen value network.

Table 13. Hydrogen value chain based on local production.

Actors	**Value generation (What?)**	**Prerequisites for value generation (By what means?)**	**Supporting activities**
Distribution station owner	Real estate for rent	Operator exists	Financing, risk management
Station operator	Fuel and service sales	Potential to integrate the business to other businesses Enough growth potential	Safety services, insurances Payment and ICT systems
Refueling infrastructure provider • refuelling point • hydrogen storage	Machine and device sales, maintenance, leasing	Enough distribution stations Remote control and maintenance	Sertification services
Local hydrogen producer • electrolysis • biogas	Fuel production and selling Heat selling Control power selling	Enough volum Affordable maintenace (remote control) Biogas option	Electricity brokers
Quality controller	Laboratory services	Need	
Reserve hydrogen provider	Fuel selling / standby service	Enough customers	Outside transport contractor
Electricity seller and distributer	Electricity selling Transfer services + infrastructure building	Need Control and reserve power, enough consuming	Outside contractors
Safety services • devices	Safety services and sertications	Need	

The group assessed that the value chain shown in the table 13 is works in all scenarios. The challenges are in profitability in the early phase as well as in political preferences and possible subventions.

Table 24. Hydrogen value chain based on centralised production.

Actors	**Value generation (What?)**	**Prerequisites for value generation (By what means?)**	**Supporting activities**
Energy producer / Owner of the energy production plant	Sold electricity (capacity)	Energy source (solid, gas, renewable)	Consumption prognosis Weather forecasts Production prognosis
Electricity markets	Transaction fees	Working markets & ICT systems	ICT systems
Network actor	Transition capacity sale	Working distribution networks Measuring of the energy transition	ICT systems
Energy buyer	Retail to the end users / distributor	Enough customers	ICT systems
Vehicle owner	”Clean” transport Flexibility (energy storage also)	Financing	Right tax policy Insurances

Group assessed the value chain described in the table 16 is possible also in the Smalla steps scenario. The challenge however will be the lack of end users, because of conservative attitudes. Urban beat and Prairie scenarios hardly creates enough demand for such a services as required in this value chain. In Urban beat the developed public transportation system and light traffic (pedestrians and cyclists) dominates the system and in the Prairie there is lack of paying capacity.

5. Summary of comments and development suggestions

Comments on value chains and scenarios:

- The most interesting part of this prospective value chain exercise is to figure out the cross points of energy and transport systems; these points show where the common interests of these two systems are. The new value chains can be created into these points.
- New ideas are needed in de-centralised energy production; in Finland the energy production is rather centralised.
- Scenarios are too regulation oriented. It is good to consider regulation, but scenarios should also consider the markets and their prerequisites.
- Global development paths should be regocnised in the scenarios; e.g. the deveopment in Germany

- There is strong path dependency in value chains:
    - Biofuel infrastructure and actors already almost exist as they may be also in 2050
    - Electricity production infrastructure and actors may also be almost the same as today in 2050 (long investment periods)
    - Technology development in general is slow: vehicles under the design process at the moment may be in still in use in 2050.
- Crucial in transport sector energy development is how the sector (system) can integrate itself to other sectors (systems). For instance the hydrogen production may develop better for the transport sector purposes, if hydrogen production will benefit also other sectors than just transport sector; the use of hydrogen in transport will grow slowly, which means few users (customers) at the beginning. For instance a Finnish firm Woikoski Ltd. (specialised in industrial gas production) is following this strategy. It is not wise to build a separate hydrogen production and distribution system just for transport purposes. The value creation must be diversified.
- Industrial side flows may cover 5-10 % of the transport biofuel raw material resource needs. Side flow is also always bound to the main production line, hence, dependent on the demand of the main product. The whole biofuel production cannot rely totally on industrial side flows.
- Centralised electricity production is business-as-usual; it does not matter how the electricity is used, transport use does not make a difference. The diversified electricity production is growing; the question is how diversified and centralised electricity production can be integrated in the system. For instance quality and reliability are critical issues, also regulation must be changed in order to integrate diversified production into the system. The use of the electricity must be smarter: charging of the vehicles when renewable energy is available (hydro, wind, solar). Energy services may have a crucial role in this integration process.
- Value chains based on hydrogen and electricity were, as expected, more future oriented than biofuel value chains. Hydrogen and diversified electricity production are radical options, only centralised electricity production has path dependency. Challenges are for instance related to quality of the fuel and safety.

Comments on the foresight method and the workshop:

- The workshop was rewarding especially because it allowed and created interesting discussion among the participants. New ideas were not emerged, at least not within the strict time frame, but maybe afterwards due to the discussions.
- The creation of value chains was challenging, especially if the person is not familiar with value chain theory and practice. Value chain table was also seen a bit rigid method; network kind of outline felt more feasible. There could be an example of a value chain to show to the participants in the beginning of the task.
- Different scenarios do shape the discussion and the creation of a value chain. This was shown in the workshop: Smart villages scenario shaped the discussion to the direction of industrial side flows (smart action), while in Small steps scenario group the side flows were not discussed at all, but the value chains were created based on forest raw material and distribution actor.

6. Attachments

6.1 Participants in the workshop

Companies:	Mika P. A. Anttonen, St1
	Timo Huhtisaari, NEOT
	Juha Matikainen, Fortum
	Seppo Mikkonen, Neste Oil
	Jussi Vainikka, Gasum
Associations:	Tage Fredrikson, Bioenergia ry
	Jari Harju, Suomen Kuljetus ja Logistiikka ry (SKAL)
	Petteri Haveri, Energiateollisuus ry
	Hannu Kauppinen, Suomen Kaasuyhdistys
	Outi Nietola, Metsäteollisuus ry
	Helena Vänskä, Öljyalan keskusliitto
Ministries and agencies:	Maria Rautavirta, Liikenneministeriö
	Veli-Pekka Reskola, Maa- ja metsätalousministeriö
	Jussi Salminen, Trafi
Research organisations:	Juha Honkatukia, VATT
	Jari Ihonen, VTT
	Lauri Kujanpää, VTT
	Juhani Laurikko, VTT
	Nils-Olof Nylund, VTT
	Jussi Solin, VTT
Fasilitators	Anna Leinonen, VTT
	Anu Tuominen, VTT
	Nina Wessberg, VTT

6.2 Scenario descriptions

These descriptions were sent to the participants beforehand and they were asked to study these before the workshop.

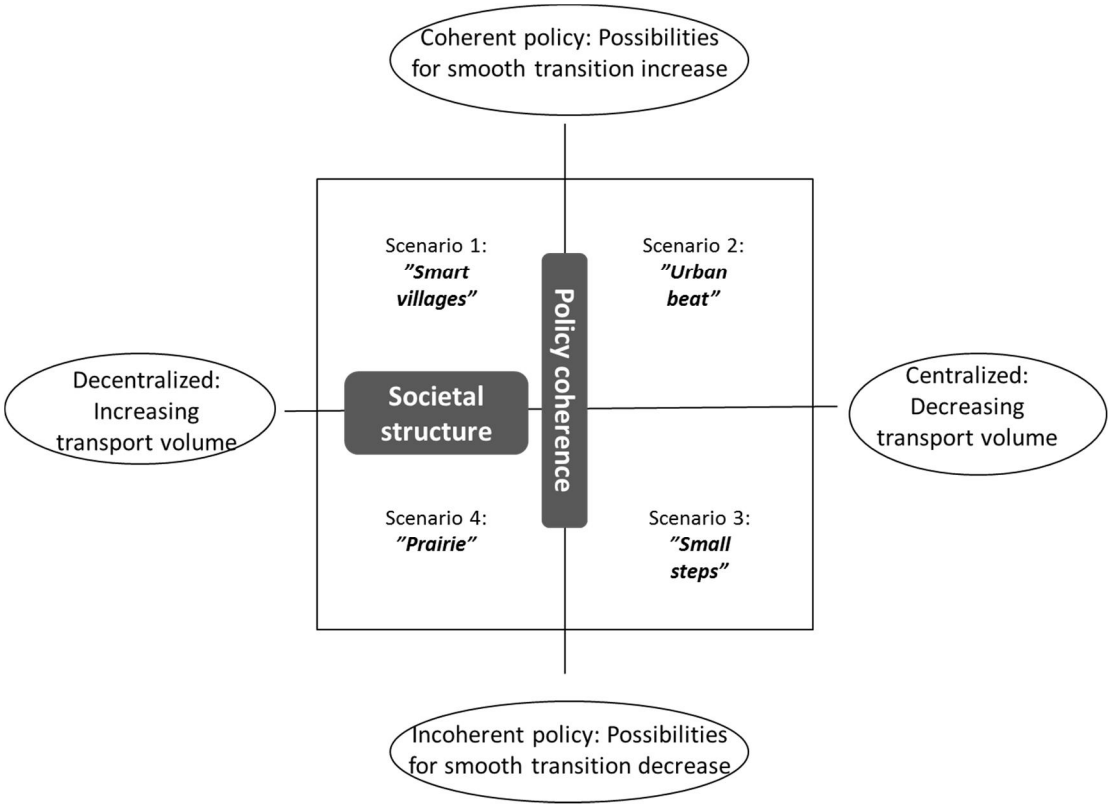

Figure. The principle of scenario creation and the four transport scenarios formulated for 2050.

i. SMART VILLAGES - Decentralized community structure and energy system & coherent policies

Road transport is a dominant mode for both passenger and goods transport. Smart, low carbon public and goods transport solutions for small communities are deployed and attracting more users. Community based thinking and acting is strong, but it does not prevent generation of private passenger transport. Slight increase in passenger transport demand has taken place, but the demand for transportation of goods has decreased. Technological development is on a moderate level. Industries and services are mainly locally based. Public, private and research organisations have built up strong local or regional clusters for co-operation and decision making. Powerful local, regional and national regulations and incentives steer vehicle and fuel production, distribution and use.

ii. URBAN BEAT - Centralized community structure and energy system & coherent policies

Due to the centralised community and energy system structures, rail transport and non-motorised transport (cycling, walking) dominate in cities. For long distance travel and transportation of goods, high-speed rails are the main transport mode. Urban regions have seamless, just-in-time, public transport and urban logistics services. Transport system end-users consider green, renewable energy production and transport as a fundamental value of

the society. Substantial decrease in transport demand has taken place. Technological development is fast and large service sector companies have reconstructed the industrial structure. Public, private and research organisations at national and Nordic levels have built up strong urban clusters for co-operation and decision making. In addition, powerful, complementing global and EU regulations and incentives steer vehicle and fuel production, distribution and use.

iii. SMALL STEPS - Centralized community structure and energy system & incoherent policies

Various modes of transport, such as road, rail and NMT are used in cities without clear priorities. Road transport dominates long distance travel and transportation of goods. Both private and public transports are supported, but no clear decision on preference has been taken. End-user views and needs towards energy and transport are dispersed. Passenger transport demand has decreased slightly, but in transportation of goods, there is no evident change. Centralised energy intensive industries form the industrial back bone. Technological development is moderate due to lacking coordination of R&D activities and cooperation between public and private research organisations. Various (even conflicting) regulations, incentives on fuels and vehicles, their production and distribution have been prepared and realised.

iv. PRAIRIE - Decentralized community structure and energy system & incoherent policies

Due to the decentralised community and energy system structures, road transport is the dominant mode for both passenger and goods transport. However, the development and maintenance of road network is poor. In the absence of common vision and co-operation networks, public transport is slowly fading away. The overall economic situation is bad, travelling and transportation of goods is expensive and hence transport demand decreases. The state of energy intensive industries is poor, because no renewal has taken place. Also, technological development is slow. Public, private and research organisations have very little cooperation. Each organisation tries to survive individually. Only few poorly supervised regulations and incentives on vehicle and fuel production, distribution and use have been carried into effect.