

Transfer of knowledge

WP8-report

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BEST deals with the introduction and market penetration of bioethanol as a vehicle fuel, and the introduction and wider use of flexible fuel vehicles and ethanol cars on the market.

Read more at www.best-europe.org

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Summary

The report shows specified and summarized activities that have been carried out in order to improve and strengthen the transfer of knowledge between partners by giving a holistic overview of the system of change and specific knowledge important to the project.

The transfer of knowledge is built on three steps;

Step 1: The local kick-offs for the BEST project have been completed at all sites.

Step 2: The Light House Tours to Sweden. The concept of study tours is explained here together with an overview of the participants and whether the visit has been the useful for the BEST partners

Step 3: The process support from BioFuel also called Road Map is running according to plan.

Specific knowledge is continuously transferred during the process within the BEST project and in this report you can find information about the general discussions among WP leaders and Site Managers and others involved in the BEST project. The report gives also a summary of the history of introducing bioethanol on the market in Sweden, Brazil and U.S. Finally we discuss what we have learned and recommendations for the future.

The results in this report are based on experiences from the WP leaders, evaluations from participants, an evaluation from Imperial College in London, written documentation and interviews with the site managers.

1. Introduction and objective

1.1. Introduction

The world is facing great challenges that are of concern to all of us. The problems are complex and embrace economic, social and environmental factors. Solutions presuppose a holistic approach in which measures that are undertaken in different areas are mutually reinforcing and in which everyone assumes responsibility. Learning is a prerequisite if mankind is to be able to meet the challenges facing the world. What people learn and how they put it into practice is crucial for whether sustainable development can be achieved. The BEST project is focusing on sustainable transports and introduction of biofuels. This is the wide context of WP 8 Transfer of knowledge with focus on ethanol and market brake through.

Within the BEST project the transfer of knowledge is one of the key factors to success while specific knowledge is continuously transferred during the work in all Work Packages.

Important questions to answer are what have been achieved during the project and what we can learn for the future to promote a successful transfer of knowledge to deal with the introduction and market penetration of bioethanols as a vehicle fuel, ethanol buses and the introduction and wider use of flexible fuel vehicles and ethanol cars on the market.

The basic source of knowledge is the Swedish work since 1980s. The long-term systematic work on the introduction of ethanol as a vehicle fuel has been carried out in Sweden. In-depth knowledge of the practical experiences from BioFuel Region (northern part of Sweden) and the city of Stockholm has been transferred with different kinds of activities. Embedded in this, are the experiences from the other countries leading the way of the bioethanols development – Brazil and the U.S.

1.1.1 BioAlcohol Fuel Foundation

The Swedish Ethanol Development Foundation was established in 1983. The main aim was to develop production techniques and usage of bio-based ethanol for the transport sector. The foundation is responsible for projects related to production, distribution and usage of bioethanol as well as knowledge and information of systems change towards sustainable transport systems based on biofuels.

An increasingly international focus inspired the name change in 1999 to the BioAlcohol Fuel Foundation, BAFF. Today, the BioAlcohol Fuel Foundation is a knowledge and information led organisation involved in projects of sustainable transport around the globe.



Figure 1 Biofuel development chain

The Swedish processes for introducing bioethanol on the market can be described in the form of a chain that represents the entire transport system (Figure 1). Every link in the chain has to be developed simultaneously.

1.1.2 BioFuel Region

BioFuel Region is the propelling force in a long-term process where regional co-operation is used to implement the development and introduction of renewable fuels, based on biomass from forests, agricultural land and recycling. For the most part, the counties of Västernorrland and Västerbotten, in the northern part of Sweden, make up the region.

The vision for BioFuel Region is to be a world-leading region in sustainable transport based on biofuels (biogas, bioethanol, DME, FT-diesel, etc.) and bio-products from renewable raw-materials.

Therefore BioFuel Region focus is on being in the forefront of

- societal change
- industrial and regional development
- increasing the availability of renewable raw materials (feedstock)

BioFuel Region's strategy is to promote and lead development by **mobilizing, committing and activating** as many potential forces as possible in each respective region. BioFuel Region was inaugurated in 2003 and at present time there are about 34 stakeholders that represent municipalities (17), universities (3), county councils (2), county administrations (2), national and regional authorities (3) and private enterprises (7).

BioFuel Region also uses a strategy that is to work with a systems approach, which is symbolized by for instance the biofuel development chain that is described in figure 2. Bio refineries and bio energy combinates is another way of describing the systems approach, i.e. meaning that bio energy input into a plant (the production link in figure 2) has to be used efficiently in order to give maximum output in the form of electricity, heat, biofuels and new bio based products, hence the name bio refinery or bioenergy combinate.



Figure 2 Biofuel developmental chain (source: BAFF)

1.1.3 Clean Vehicle, Stockholm

Since 1994, the city of Stockholm has worked with different clean technologies like ethanol, biogas, electric, electric-hybrid and fuel cells. Within the City there is a cross-party political board exclusively dealing with clean vehicles and with a clear aim to keep Stockholm as the leading clean vehicle city. Today 50 % of the vehicles within the fleet owned and operated by the city are clean vehicles. Most vehicles as well as most clean vehicles are however bought by companies. During 2005 the sales of clean vehicles exploded and the market share for 2005 was 7,5 percent. 90 percent were bought by companies. In 2007 the sales figure rose to more than 20 percent making Stockholm lead the way in Sweden and in the world when it comes to new car sales of clean vehicles.

1.2. Objectives

The overall objective of WP8 is the transfer of knowledge to the BEST-sites on the local process and strategic thinking. An underlining objective is the wise use of frontrunner-experiences from Brazil and US speeds up the introduction within the European sites.

To reach the objectives the transfer of knowledge are made in four steps:

1. Kick-Off-seminar at each site in Europe and in China
2. 'Light-House-Tour' - Study tours to Sweden
3. Road map
4. Seminar at each site (outside BEST-funding and not mandatory within the project)

Step four will not be described in this report since it is outside BEST-funding and not mandatory within the project.

2. Transfer of knowledge

2.1 Step 1 - Kick-off Seminars

The transfer of knowledge within the BEST project started with Kick-off seminars (open transfer of knowledge seminars) for a local/national audience at each site. The events were organized by the site together with the BioFuel Region. The aim was to transfer inspiration and know-how from markets that have longer experience of bioethanol development, in the first six months of the project. The focus has been on providing the total picture and singling out the parts (see Figure 1).

BioFuel Region has provided a program and lecturers from Sweden. The program has been locally adapted to suit each site. The strategic thinking based on the more than twenty years of development of the Swedish and Brazilian ethanol markets by BioAlcohol Fuel Foundation, together with the experiences from BioFuel Region from the local process have been the basic source of knowledge transferred from the BEST-project at the seminars.

Target groups were mainly local stakeholders; politicians, civil servants, journalists, fleet owners, franchise owners of fuel stations, NGOs, private company representatives, key decision makers, etc.

The following kick-off seminars have been carried out:

- Somerset, 20 March 2006
- La Spezia 22-23 May 2006
- Nanyang, 7-9 June 2006
- Madrid, 14 June 2006
- Basque Country, 4 October 2006
- Rotterdam, 20 October 2006

Instead of arranging several BEST seminars and conferences, BEST chose to give presentations at important conferences and meetings. Partners have been encouraged to give presentations and a general PowerPoint presentation about the BEST-project has been developed to support this. During 2006 and 2007 BEST partners all in all presented the BEST project in at least 150 international conferences with all in all approximately 11 400 attendants.

The first step, the kick-off seminars were carried out successfully and became the intended ignition spark for each site to start the project. The schedule was delayed in time with three months. The strategy to participate in international and regional seminars has been an important transfer of knowledge and has strengthened the objectives of the BEST project.

Within step 1 not only a kick-off seminar was planned but also a training course at each site. The purpose of the training courses was to give an in-depth knowledge of the practical experiences from BioFuel Region (northern part of Sweden) and the city of Stockholm, who are spearheading the bioethanol developments in Sweden and the world. Added to this would be the experiences from the other country leading the way of the bioethanol development – Brazil.

Only a small version of the training courses has been carried out during the kick-off seminars. The small version was from thirty minutes up to two hours. The reason why the training courses could not be carried out as they were planned was mainly due to lack of time in the project. This was because step 1 took much longer to finish than expected. The idea was that step 1 was to be carried out during the spring of 2006 and the training courses during the fall of 2006. Step 1 was not finished until late fall of 2006. In some cases WP8 was involved in the planning and execution of step 1, in some cases WP8 was only involved in the planning and in one case WP8 was not involved at all in step 1. *It is hard to be responsible for the transfer of knowledge and not be involved in the planning and execution. In several cases language was also a barrier, i.e. English was not commonly accepted at the kick-off seminar, which made communication harder.*

Four training courses have been carried out during this period.

2.2 Step 2 - Light House Tours

As part of the BEST-project, BioFuel Region and the City of Stockholm arranged the so called 'Light House Tours', i.e. study visits, to Sweden. They have been carried out from September of 2006 to June of 2008. The specific concept of study visits or the light in the 'Light House Tour' is the holistic, system thinking view demonstrated through the biofuel development chain (see Figure 1) in order to improve and strengthen the transfer of knowledge.

2.2.1 Content of the Light House Tour

Each 'Light-House-Tour' consists of a well-balanced combination of site visits, presentations, lectures and meetings with the people who 'walk the talk', i.e. people with practical experience from the local, regional and/or national process.

The first two days in BioFuel Region show how regional co-operation is used to implement the development and introduction of biofuels. BioFuel Region is an example of formation for collective action in two counties with a diversity of stakeholders, which represents municipalities, universities, county councils, county administrations, federal authorities and private enterprises.

The city of Stockholm is an example of a rather large public authority and they have also the national authorities as part of their programme. The intention with the programme in Stockholm is to show both national Incentives for Clean Vehicle and Fuels and to give practical, detailed information about for example safety aspects, materials and the Stockholm experiences from communication activities to promote clean vehicles. The biofuel and clean vehicles are shown as something ordinary and that is a living proof of how the changes are possible. A new stakeholder in Sweden is now the car industry itself. They are proactive, for example they are now arranging "Sustainable Seminars" and "Mini – Light House Tours" from other countries to show the market breakthrough in Sweden.

The Tour gives an opportunity to build new networks by meeting the key people working in Sweden but also forming new networks among the other participants in order to strengthen work at each participating site.

Travelling together is also an opportunity for the participants to start discussions about new projects in their own region. Learning together increases the knowledge - for example from questions asked by other participants but also to share knowledge among the participants about the subject or the situation in their own region. BioFuel Region has transferred the knowledge about how a regional co-operation including different parts. The program has been designed to transfer knowledge to the BEST sites about all links in the chain of process (see Figure 1) as a pedagogically approach to "paint a picture" of the strategic thinking.

The choice of study visits and lectures aim to represent all stakeholders. SEKAB, an industrial member of BioFuel Region, has been an important stakeholder in the process of change.

Information provided on the Light House Tour (LHT) connected to the chain. (Figure 1)

<p>FEEDSTOCK</p>	<p>Supply of forest biomass for energy purposes</p> <p>Production of biomass in the future - forest biotechnology & plant biology</p>
<p>PRODUCTION</p> 	<p>BAFF – BioAlcohol Fuel Foundation – 20 years of experience of ethanol.</p> <p>SEKAB E-Technology - learn about the results and future plans for the Pilot Plant for 2nd generation of bioethanol from cellulose</p> <ul style="list-style-type: none"> - 2 step diluted acid process and enzym hydrolysis by forest residues - 2 tonnes DS/day (200 m3 ethanol per year) - Sekab (Svensk Etanolkemi AB) mannes the pilot plant - Investment 20 Million Euro + 18 Million / year for R&D <p>Learn about Low blends – Ethanol blends in diesel and in gasoline</p>
<p>VEHICLES</p>	<p>SAAB and Ford. Test-driving FlexiFuel cars</p> <p>Ethanol buses in Stockholm Public Transport</p> <p>Ethanol buses from Scania</p> <p>National Incentives for Clean Vehicle and Fuels in the City of Stockholm</p>
<p>DISTRIBUTION</p>	<p>Visit a FlexiFuel pump at a filling station</p> <p>Visit to an ethanol bus filling station</p> <p>Visit to Europes largest filling station for E85</p>
<p>LEGAL AND POLICY FRAMEWORK</p>	<p>Lectures by public and national authorities</p> <p>Meetings with Municipality representatives</p> <p>National Incentives for Clean Vehicles and Fuels</p> <p>Learn about “Letter of Statement” in BioFuel Region</p>
<p>MARKET DYNAMICS</p>	<p>Experiences from communication activities to promote clean vehicles</p> <p>Environmental and sustainable impact from renewable fuels – pros and cons about biofuels</p> <p>Verified Sustainable Ethanol – a cooperation between Sweden and Brazil (www.hallbaretanol.se)</p>

2.2.2 Participants

The following Light House Tours with 147 participants have been carried out:

- Brandenburg, 3-5 September 2006
- La Spezia, 13-15 November 2006
- Basque Country, 5 - 8 February 2007
- Rotterdam, 28-30 March 2007
- Madrid, 14-16 June 2007
- Open Light House Tour , 2 - 4 April 2008 (17 from Rotterdam, 3 Somerset, 2 Imperial C),
- Basque Country II, June 2008

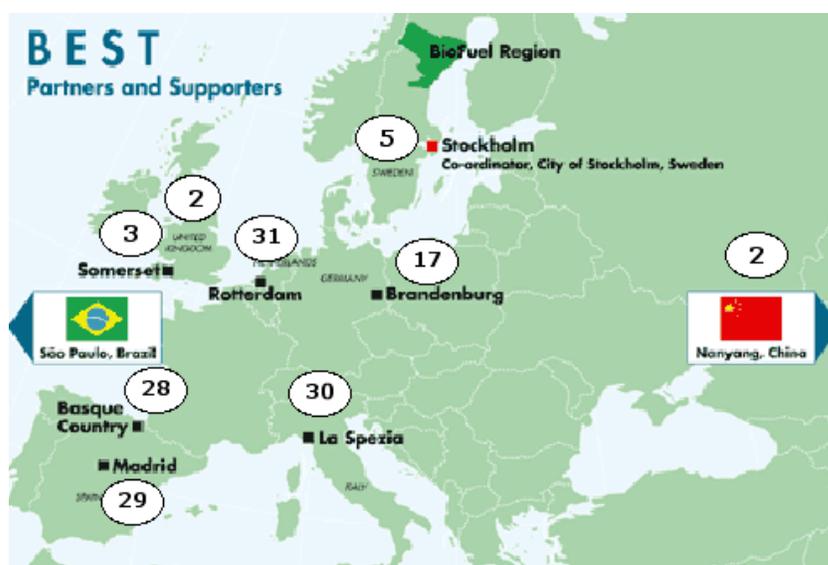


Figure 3 Number of participants on Light House Tours from BEST region/sites (2006-2008):

Brandenburg came on a visit before the official Light House Tours were launched. The purpose was to become a BEST Friend but after two days in BioFuel Region they were invited to apply to become a BEST Partner. They are now a BEST-partner and their visit in September of 2006 is considered a Light House Tour within the BEST-project. Together with the Coordination (Sthlm) the decision was taken that **Nanyang** (the Chinese partner) only will participate at one meeting per year in Europe. This resulted in the fact that Nanyang did not participate in the LHT at all. They have had their kick-off seminar in June of 2006 and step 2 and 3 they have not taken part in. However, two representatives from Nanyang visited the Pilot Plant for 2nd generation ethanol production from cellulose in Örnsköldsvik in June 2005. **Madrid** made a study tour to BioFuel Region 2007 and Stockholm. Organizer was Volvo (car manufacturer in Sweden). The two day tour is considered a Light House Tour. **Stockholm** visited Umeå and Örnsköldsvik 2006 at a Light House Tour.

Our goal in WP8 to attract participants representing all the different links in the biofuel development chain below; vehicles, distribution, legal framework and market dynamics have been reached. All sites have received know-how on how to produce bioethanol cheaper and more energy efficient (ethanol production from 1st generation in Brazil, 2nd generation production using cellulose and through bio refineries or bioenergy combinates).



Feedstock (0)	Production (7)	Vehicles (22)	Distribution (11)	Legal Framework (63)	Market Dynamics (44)
	Ethanol producer, Biorefinery	Car Companies Car Leasing Co Public Transport Co Ass. of enterprises (taxi, trp)	Gas Distribution Co Filling Station	Politicians and civil servants from national, regional and local level	High schools Graduate Students Education Centres Consultants Journalists

Figure 4 Distribution of the no. of participants linked to the biofuel chain of development (above).

Participants at Light House Tour in relation to the different links in numbers/Participants split into the different links of the chain (below in Figure 5).

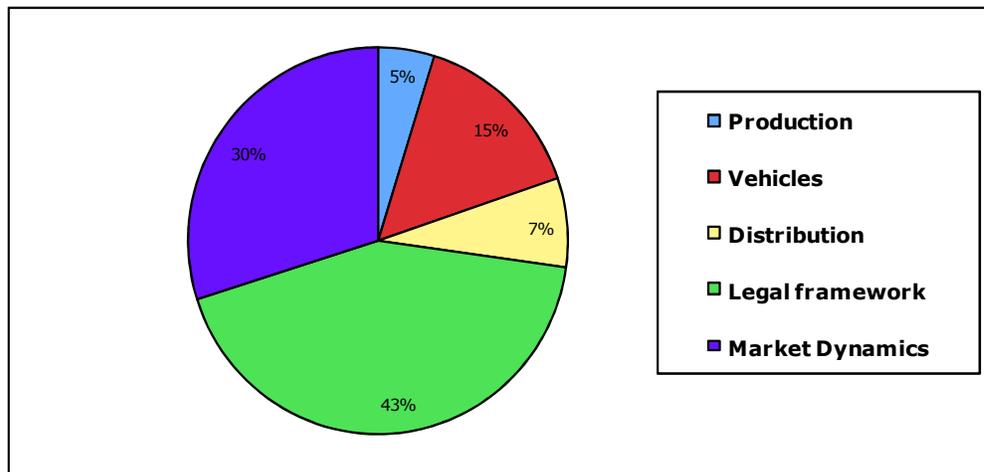


Figure 5. Participants representing different areas of the biofuel development chain (in percent).

Open Light House Tour

The Open Light House Tour had three participants who had seen the invitation sent out to the Best Friends network. Neste Oil / Research & Technology, Finland, Malaysian Palm Oil Board, UK, AGRANA Bioethanol GmbH (bioethanol producer), Austria.

2.2.3 Evaluation

The purpose of the “Light-House-Tour” has been to improve and strengthen the transfer of knowledge between partners by giving a holistic overview of the system of change. The evaluations carried out in 2007 and 2008 show that the participants agree that the concept of Light House Tours gives this overview.

“How valuable was the study tour for you in the coming work in the field of bioethanol/clean vehicles in your country?” 62 out of 71 participants have answered the question above and 95 % find it valuable or very valuable. (See figure 6 below)

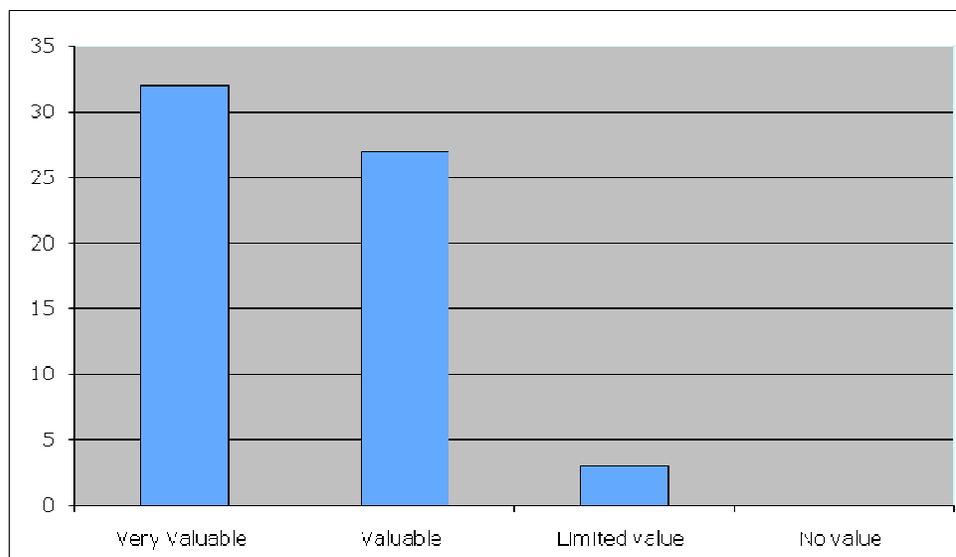


Figure 6 Result from evaluation

Loss analysis

A question about result was not included until 2007. The initial evaluations focused on the actual tour.

The Tour for Madrid was organized by best Volvo and the 29 participants did not use the questionnaire about Light House Tour.

The loss of questionnaires (15) is the amount of participants who had to leave in a hurry to flights. The constant improvement has resulted in a better evaluation form and the routines of have constantly been improved. We scheduled time for filling them in before they left the country. The interpreter translated the questions to the participants.

Evaluations from site managers

In June 2007 a special questionnaire and a follow up interview with the site managers from Brandenburg, La Spezia, Basque Country and Rotterdam was carried out.

According to the evaluations, made by site managers from four sites, we have been fulfilling the purpose to explain the process of system-change by showing all aspects/link, but the “chain” could be even more repeated connected to the detailed knowledge transferred during the Tour.

The main lesson from **Rotterdam** is the insight that another system must replace our use of fossil fuel system and they have learned about important factors in this system of change. The awareness of the necessity of change has improved.

Taking part in the Tour has helped the participants to understand their own process they are dealing with. After the Tour there has been follow-up-meetings organized in Rotterdam. *“More people walk the talk now”*. The follow-up meetings have been organized by the participants (the City of Rotterdam did not have to be a driving force in making it happen), which is a result of the networking of the Tour. They used the Light House Tour as a way to intensify their network. This helped them a lot in reaching their goals. They also used the Light House Tour to get more acceptance of their work within their own management and community.

Effects after the tour are the network and that they now have better contact with the ministries. Also the learning process is recognized in the situation of change and contact and efforts has been made towards high schools. They have also initiated studies for example to establish a definition of market break through in the Netherlands.

Brandenburg made the Tour before the Light House Tour concept was ready and they weren't at the time partners. *“We have managed to become your partners, also by your help, that was the most important effect!”*

Brandenburg is stating that they have learnt a lot about the background and the motivation to act. But they would like to have more information about the practical work in school and study circles as well as our strategies to get the administration on board and on track. A lesson learned was although the importance of working with schools and they have now started similar activities.

Specific information about the different Work Packages in the best Project wasn't part of the Tour because they came before the concept was ready.

The time the Mayor of Örnköldsvik spent with the politicians from Brandenburg was appreciated. Brandenburg would like to go further with the relations between their universities and the region.

A suggestion for coming Tour is to initiate a process of change among our guests during the visit. The result from this proposal is the workshop among participants that was introduced in 2008.

For **La Spezia** a very important outcome is that the successful Swedish experience demonstrates that there is a need of clear national policies to have the development of an ethanol market. La Spezia has experienced that *“Seeing is believing”*.

All links were explored but additional information would be the availability of resources, the sustainability of their production, more details regarding the production costs and the energy balance in the production process. Another important issue is the one related to the emission reduction for vehicles running on bioethanols.

The Tour gave the possibility to pose questions to the key-people in the conversion process from fossil fuels to bioethanols. The group has experienced the same, all together, and this has contributed *“to have the same vision and goals”*.

The tour was an excellent occasion to make contacts and to build up networks, but in the case of La Spezia their Tour was organized in a too short time (in one month) and they could not get all the key persons to come. They keep in contact with the participants and have had occasions to collaborate with some of them.

Benefits with the Tour are that they have seen what kind of mistakes should be avoided and they have got some ideas on how they could overcome some obstacles. All the partners and the people from the region have learned a lot and they came back with a great enthusiasm. Having shared the Swedish experience have made them stronger in promoting bioethanols as a fuel for transport.

Evaluation from Imperial College

Imperial College that participated on the Open Light House Tour in April 2008 has made a special evaluation and here follows their conclusion:

“The agenda for the three days is quite comprehensive and demanding for both organisers and participants. This is well balanced with some social activities at lunch and dinner times which facilitate networking among the participants.

The overall tour is highly useful and some additional suggestions are as follows:

- To link some of the social and economic benefits that the BFR has brought to the inhabitants (e.g. job creation, economic development). This is particularly important for decision-makers to see the benefits and sustainability links of biofuels.
- To visit one of the forest industries participant in the region and link it to the feedstock needed for the production. This is also remarkably important for the sustainability issues on the biofuels debate.
- To engage participants in a follow up activity such as newsletters”

Examples of constant improvements

Here follows a list of the Light House Tour has been developed after suggestions from participants:

- Evaluation form and the routines around how they were carried out have constantly been improved. We scheduled time for filling them in before the participants left the country. The interpreter translated the questions for the participants.
- Quality of content. The presentations from the different lecturers were reviewed and the obvious repetitions of pictures were reduced.
- In order to encourage the sites to start the work at home we have introduced a session for reflection and a workshop with the participants during the last two tours. Individual commitments and discussions in groups about what they can do at home took place.
- Our message to transfer the knowledge of the process of change has been more emphasized during the project. Encouraging the participants to find what they can use at home regardless of different prerequisites and basic conditions in different countries.

2.3. Step 3 - Road Map

Within WP8 BioFuel Region and BAFF will offer each site individual support in the process towards market breakthrough and this work is till ongoing. The road maps will be individually tailored for each site. . They may include 1-2 training courses for each site, workshops, speeches, transferring of good examples, etc. This started 2008 and will continue until the spring of 2009. The individual Road Maps was planned to start as soon as the sites had completed the kick-offs and the Light House Tours and evaluated these. The evaluation and the experiences from each site together with experiences from Sweden and Brazil will form the platform for the individual Road Maps for each site, with the purpose of reaching the market breakthrough.

Rotterdam and Cottbus/Brandenburg have declared that they want process support from BioFuel Region. Somerset has also shown some interest but mainly for one or two activities. The Basque Country has declared that they are in no need of process support from BioFuel Region. No response has come from the other sites.

The first planning meeting and the first support activity have also been held with Rotterdam. It included a speech from the process leader in BioFuel Region at a conference organized by the City of Rotterdam and the Port of Rotterdam “Bio Brandstoffen Barbecue” in June 2008. One support activity has also been carried out in Somerset and that is also speaking at a conference.

A planning meeting has been held with Cottbus/Brandenburg and in June 2008 there were three support activities. The first was process support on the strategy for bioethanol in Cottbus/Brandenburg and the second was the second activity was a work-shop with proactive stakeholders from the Brandenburg/Berlin region. The third activity was to share the Swedish experience on introducing bioethanol with a working group of experts in the field of biofuels. The third activity took place in Berlin but stakeholders came from all over Germany. **BioFuel Region will work with the sites that have shown interest.**

The reasons why not all sites involved in the BEST-project has shown interest in process support have not been stated. Here are some thoughts:

- Lack of resources (time and money) to engage in long distance planning and strategic work and/or process support was not put into the budget at the beginning of the BEST-project
- A strategy at the site that can not see the benefit of process support
- Key persons at the site have not been to the “Light House Tour” and therefore they find it difficult to understand the benefit of process support
- The distance to the site is too great and therefore the cost in time and money will be high for process support (China and Brazil)
- Since rules and regulations differs from country to country it could be hard for sites to see the benefit of learning from Swedish incentives

In conjunction with the SGM (Steering Group Meeting) held in Vindeln, Sweden 23-24th of September of 2008 a common model for stakeholder analysis was introduced as a result of the Light House Tour and the work on the Road Map with the city of Rotterdam.

After identifying/describing the stakeholders we have used the theory behind process of change used in BioFuel Region (see figure 7 below). The Four Rooms of Change is a theory created by the Swedish psychologist Claes Jansen. PH.D. It deals with change and with what happens to people and organizations in change, stress and transition. The tool make it possible to measure the climate of change and it creates a common language for addressing change within organizations and it has been used to support development strategies.

The Four Rooms of Change is one of the components in the stakeholder analysis; the second one being the biofuel chain (see Figure 1), which again implies that the transfer of knowledge has made an impact on the participants and subsequently at the sites.

A model for stakeholder analysis

- Who are the stakeholders?
- Place the stakeholders in what “room” they find themselves in the process of change.
- Place the stakeholders in the chain (See Figure 7)

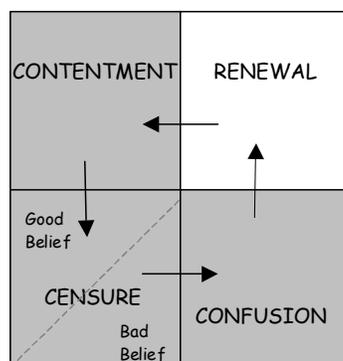


Figure 7 The four rooms of change according to Claes Jansen

2.4 Training courses in Biofuel Region

The experience from BioFuel Region is that education / information needs to be applied on two levels at the same time – the citizens (bottom-up perspective) and the decision-makers (top-down perspective). BioFuel Region has devoted more time to citizens than decision-makers in the past. The difficulty to reach decision-makers in the public sector has led the BioFuel Region to initiate a training course only for politicians during 2008/2009. These courses will be open for all politicians, last for half a day and be offered twice a year in different places in the region. Other training courses directed at other target groups will follow.

Another training is directed at particular administrations within a municipality that is defined as a large user of transports. This could, for instance, be the technical administration that is responsible for maintenance and service of the whole organization (schools, buildings, streets, waste management, etc.). This responsibility means a lot of transports. A pilot training has been conducted in one municipality in the BioFuel Region during the spring of 2009. The target group was decision-makers within a technical administration in a municipality with about 6.000 employees; the group where about 30 people and a mixture of politicians and civil servants participated. Two half days with the first concentrating on sustainability, renewable energy and sustainable transports while the second half day focused on an action programme for the technical administration using systems perspective together with the steering documents of the municipality regarding environment, sustainability and energy. The turn-out was 95% and the evaluation was

Information and educational efforts aimed at citizens and key decision-makers have been described in the BFR process in terms of why, what and how.

Why include arguments for transitioning the transport system to renewable fuels: climate changes, peak oil and the BFR's good potential for increased growth and jobs.

What refers in part to the biofuel chain and in part to the strategies for a sustainable transport system, making transports more efficient, driving less and increasing the use of biofuels.

How involves involvement and commitment in the BFR. One of the regional process managers refers to five key words as a necessary platform for mobilising and involving people, which are expected to lead to more activity. (In no particular order):

- Insight into the problem (understand that it really is a problem)
- Ability to act (each individual has a different possibility to take action)
- Responsibility (in a society each individual has a responsibility for societal changes)
- Courage (a process of change is not always popular, but needs individuals with courage)
- Knowledge (to be credible in a process of change it needs to be built on knowledge)

3. Frontrunner experience

3.1 The Swedish process for introducing bioethanol on the market



Figure 8 Biofuel developmental chain

It is important to state that since the 1980s long-term systematic work on the introduction of ethanol as a vehicle fuel has been carried out in Sweden. The main places involved are the City of Stockholm and Örnsköldsvik Municipality, though a large number of other municipalities in Sweden have been involved and have supported the development through the purchase of FlexiFuel cars, ethanol-operated buses and so on. Focusing on the chain (see figure 1), BAFF (BioAlcohol Fuel Foundation) and BFR (BioFuel Region) have worked to develop all the links in the chain. It is a systematic approach that has proven successful. The production side has developed and the second generation of biofuels is now under way. The production has also played an important role on the road to market breakthrough. The start-up of a new ethanol factory in Norrköping in 2000 resulted in as from 2001 most of the 95-octane petrol distributed in Stockholm, Södertälje and Norrköping contains 4-5% ethanol. The City of Stockholm before this, tried hard to introduce E10 but when it was prohibited one oil company (OKQ8) started with E5. This has helped the user-side of the chain, that is, the introduction of vehicles and the build out of the infrastructure.

A large number of vehicle experiments involving cars, buses and fuel tests have shown that it is an environmentally friendly alternative with excellent properties. In 2008 the sales of clean vehicles was nearly 40% of the total new car sales in Stockholm. The figure for the whole of Sweden was in 2008 approx. 30%.

It is difficult, though not impossible, to determine exactly which incentive will lead to a market breakthrough. As has been established, there are many underlying reasons why the market breakthrough for ethanol came in 2006 in Sweden, e.g.:

- A population with a high level of environmental awareness
- Insight into climate change and the dependency on oil, on a national, regional and local level
- Financial incentives (car duties, free parking, lower fringe benefit value etc.)
- A long-term systematic approach
- Ethanol's availability, i.e. the infrastructure is relatively well developed with about 1200 fuel stations out of approx. 4000 that provides bioethanol (95%) or biogas (5%) since 2008
- Big petrol-powered vehicle fleet (approx. 70%)
- Legislation on expansion of pump availability 1st January 2006 (see Chapter 8)
- A Swedish FlexiFuel model (SAAB) having been introduced on the market
- National carbon taxation since 1991

The following is an overview of incentives that have played an important role in the market breakthrough for ethanol in Sweden:

- Carbon (CO₂) taxation since 1991
- The large nation-wide public procurement competition of FFVs (1998 to 2000) led to more than 3000 FFV were introduced on the market
- Project support (tax deduction) for the first ethanol factory
- Public support for ethanol-powered vehicles (buses in Stockholm, ordering of FFVs, government authorities – have to have at least 75% clean vehicles, etc.)
- Good support from some oil companies (e.g. OKQ8)
- Strong support for ethanol buses from SL (Stockholm Transport)
- Long-term tax exemption for transport biofuels (until 2008, with probable extension to 2013)
- Low-level blending of ethanol in 95 octane about 4-5% since 2001
- Low-level blending expands market
- Statutory requirement for filling stations to offer biofuels
- Free parking for clean vehicles
- Exemption from congestion charges in the City of Stockholm
- Government subsidy for clean vehicles
- 20-40% lower 'fringe benefit value' for company cars that are clean vehicles
- Differentiated vehicle tax for efficient and inefficient vehicles
- Early pilot projects demonstrating that the technique works for cars (FFVs), buses and pumps (E85)
- SAAB's introduction of the 9'5 BioPower in 2005
- The EU BioFuel Directive from 2003

An important initiative for the process is that the Swedish environmental technology company SEKAB has in July 2008 signed an agreement for the supply of bio-ethanol verified for its sustainability with LDC Bioenergia, a Brazilian ethanol and sugar industry leader and part of the French group Louis Dreyfus.

Verified Sustainable Ethanol Initiative is an effort to physically guarantee Swedish consumers that they are filling up with good ethanol and to increase the offering of verified sustainable ethanol in close collaboration with the Brazilian sugar industry.

Transferable to other countries would be, on a national level, the legislation on expansion of pump availability and the national carbon taxation. Something that is missing in all three countries (Sweden, the US and Brazil) is a flexible mechanism for the fuel price at the pump, i.e. the price for biofuels/bioethanol should have a stable margin towards the gasoline/diesel price. In other words, the consumer at the pump should not have to worry if the oil price fluctuates and is instable, biofuels/bioethanol should always remain at least a breakeven price.

3.2 The ethanol market development in US

Market conditions and policy incentives have contributed to an unprecedented expansion of the U.S. ethanol industry during the last couple of years. There are a total of 128 ethanol plants in the U.S., most of them located in the Midwest and 77 new plants are under construction. A few companies operate more than half of U.S. production capacity, while farmers' cooperatives also play an important role in the growth of the industry

The federal renewable fuels standard (RFS) fuelled a rapid expansion of the U.S. ethanol industry by setting goals for production of renewable fuels made from U.S. agricultural resources. Seven states have also enacted renewable fuels standards that require the use of ethanol-blended fuel. Corn is the dominating feedstock for ethanol production. Because of a combination of higher corn prices and lower ethanol prices, there has been a halt to expansion during the second half of 2007. In November 2008 the ethanol fuel production was 842,2 MGall (668,000 bbl/d) and the ethanol fuel use was 864 MGall (683,000 bbl/d).

The ethanol industry is expanding at a fast pace.

Both market conditions and policy incentives contribute to development. One of the goals of the U.S. Department of Energy's biomass program is to make ethanol from cellulosic feedstock cost competitive by 2012. No commercial cellulosic ethanol bio refineries currently exist. In March 2007, the U.S. Department of Energy announced that it would award \$385 million in grants to support development of six commercial-scale, integrated bio refineries. The public-private projects will collectively produce up to 130 million gallons of cellulosic ethanol annually by 2012. Feed stocks include agriculture residues such as corn stover, wheat and rice straw; wood residues, wood based energy crops; and landfill organic wastes. Incentives have not been decisive for the investment in new ethanol facilities.

United States (Federal) Incentives and Laws

Incentives

- Advanced Technology Vehicle (ATV) Manufacturing Incentives
- Alternative Fuel Excise Tax Credit
- Alternative Fuel Infrastructure Tax Credit
- Biobased Transportation Research Funding
- Biodiesel Income Tax Credit
- Biodiesel Mixture Excise Tax Credit
- Biomass Research and Development Initiative
- Fuel Cell Motor Vehicle Tax Credit
- Heavy-Duty Hybrid Electric Vehicle (HEV) Tax Credit
- Improved Energy Technology Loans
- Light-Duty Hybrid Electric Vehicle (HEV) and Advanced Lean Burn Vehicle Tax Credit
- Qualified Alternative Fuel Motor Vehicle (QAFMV) Tax Credit
- Qualified Plug-In Electric Drive Motor Vehicle Tax Credit
- Renewable Energy Systems and Energy Efficiency Improvements Grant
- Small Agri-Biodiesel Producer Tax Credit
- Small Ethanol Producer Tax Credit
- Value-Added Producer Grants (VAPG)
- Volumetric Ethanol Excise Tax Credit (VEETC)

Laws and Regulations

- Aftermarket Alternative Fuel Vehicle (AFV) Conversions
- Alternative Fuel Definition
- Alternative Fuel Definition - Internal Revenue Code
- Alternative Fuel Tax Exemption
- Clean Air Act Amendments of 1990
- Corporate Average Fuel Economy (CAFE)
- High Occupancy Vehicle (HOV) Lane Exemption
- Idle Reduction Equipment Excise Tax Exemption
- Idle Reduction Facilities Regulation
- Import Duty for Fuel Ethanol
- Renewable Fuel Standard (RFS) Program
- Tier 2 Vehicle and Gasoline Sulfur Program
- Updated Fuel Economy Test Procedures and Labeling
- Vehicle Acquisition and Fuel Use Requirements for Federal Fleets
- Vehicle Acquisition and Fuel Use Requirements for Private and Local Government Fleets
- Vehicle Acquisition and Fuel Use Requirements for State and Alternative Fuel Provider Fleets
- Vehicle Incremental Cost Allocation

Programs

- Air Pollution Control Program
- Alternative Transportation in Parks and Public Lands Program
- Biobased Products and Bioenergy Program
- Clean Agriculture USA
- Clean Cities
- Clean Construction USA
- Clean Fuel Fleet Program (CFFP)
- Clean Fuels Grant Program
- Clean Ports USA
- Clean School Bus USA
- Congestion Mitigation and Air Quality (CMAQ) Improvement Program
- National Clean Diesel Campaign (NCDC)
- National Fuel Cell Bus Technology Development Program (NFCBP)
- Pollution Prevention Grants Program
- SmartWay Transport Partnership
- State Energy Program (SEP) Funding
- Voluntary Airport Low Emission (VALE) Program

3.3 The Brazilian Sugarcane Ethanol Experience

The most prominent biofuel in Brazil is ethanol from sugarcane. In order to use ethanol as a fuel substitute for gasoline, the Brazilian National Alcohol Program (*PROALCOOL*) was established in 1975. This successful programme was initiated 1975 partially in response to the oil shock of 1973, and as a possibility to promote self-sufficiency. The ethanol program also has been one strategy to mitigate the environmental effects of rapid urbanization.

Currently, about one million people are working in the sugar-alcohol sector, with 300.000 jobs in 350 private industrial companies and 50.000 cane farmers. São Paulo itself has 500.000 workers at more than 130 plants. The sugar cane production reached 320 million tons during the 2000/2001 harvesting season. Production rose to 18 million tons of sugar and 14 milliard litres of alcohol. The estimated sugar cane plantation area in Brazil is 3,9 million hectares.¹ Creating more productive sugar cane plants is continuously advancing, with average yields increasing since 1990 from 129 to 143 kg of sugar per ton of green sugarcane owing to the growing of new selected plant varieties. Although no significant technological advances have been observed, the use of the ‘best practices’ in the factories has increased the average conversion efficiency to nearly 50 percent.²

Since 1995 the Brazilian fleet of alcohol-based vehicles has dropped to 4 million units, less than 40 percent of the total fleet. New alcohol vehicles represent less than 1 percent, after reaching a peak of 80 percent during the 1980’s. In 2003 the Volkswagen Group of Brazil announced first plans that aimed for a conversion of the entire fleet’s engine from conventional to flexible-fuel (Flexible Fuel Vehicles – FFV). Today also Fiat, Ford, General Motors, Honda, Peugeot, Renault and Toyota offer a broad variety of Flex Fuel Vehicles. During 2007 production figures of FFVs reached a total of 1.716.716 units while the production of regular gasoline vehicles (E25 gasohol) constantly decreased to 646.291 units. In 2008, of the new car sales, 87% was FFVs and the rest is vehicles that run on a 20-25% blend in of ethanol (depending on availability). In other words a shift has taken place since 2003, where FFVs now are leading the way in Brazil.

In June 2007 a voluntary scheme - the so called “Agro-environmental Protocol” - was introduced within the framework of the São Paulo State Green Ethanol Program. Signed by the State Governor, the Secretaries of Environment and Agriculture and the Head of the Sugarcane Producers Union – UNICA, the protocol is to promote sustainability in the ethanol sector.

An important initiative for the process is that the Swedish environmental technology company SEKAB has in July 2008 signed an agreement for the supply of bio-ethanol verified for its sustainability with LDC Bioenergia, a Brazilian ethanol and sugar industry leader and part of the French group Louis Dreyfus.

Verified Sustainable Ethanol Initiative is an effort to physically guarantee Swedish consumers that they are filling up with good ethanol and to increase the offering of verified sustainable ethanol in close collaboration with the Brazilian sugar industry.

¹ WEC 2002.

² Sims 2002.

4. Conclusions

To reach the objectives the method to transfer knowledge has been made in four steps:

1. Kick-Off-seminar at each site in Europe and in China
2. 'Light-House-Tour' - Study tours to Sweden
3. Road map
4. Seminar at each site (outside BEST-funding and not mandatory within the project)

Step four will not be described in this report since it is outside BEST-funding and not mandatory within the project.

The method in WP8 to use step 1-3 have resulted in:

- The kick – off seminars were carried out successfully and became in many cases the intended ignition spark for each site to start and/or involve important stakeholders in the BEST-project in their region/city.
- The strategy to participate in international and regional seminars has been an important transfer of knowledge and has strengthened the objectives of the BEST project and transferred knowledge to and from Sweden and in some cases also from Brazil.
- The LHT have been able to reach different target groups important to the process and that all sites have received know-how on how to produce bioethanol cheaper and more energy efficient.
- The “light”, the shining examples at the Light House Tours, have been the essence of a successful process of change – to involve all stakeholders in the biofuel development chain and at the same time work with a bottom-up perspective that tries to involve a Triple Helix constellation (university, industry and society) in all activities and projects.
- “Seeing is believing”, i.e. it is important to see the actual clean vehicles, buses and E85/FlexiFuel pumps in operation, as was the case on the Light House Tours
- The results from the written evaluations state that 95 % of the participants found the Light House Tour very valuable or valuable for the coming work in the field of bioethanol/clean vehicles in their country.
- A new network among the participants from Holland / Rotterdam started as a result of the Light House Tour and has had several meetings after the study visit.
- A proactive consensus decision in the Parliament of the Basque Country concerning biofuels was taken as a result of the Light House Tour.
- The Basque Country planned an organized two strategic trips to Sweden. The first Light House Tour they attended was with representatives from the Parliament and the second one with high-ranking civil servants.
- The distinction between the short-sighted time horizon of the BEST-project and the long-term strategy for the actual region/site becomes clear when comparing the results of the transfer of knowledge. The planned trips with designated target groups put into a long term strategy seems to have a better effect on the process
- Another factor is of course the resources available at each site and the possibility of getting the key stakeholders to go on the Light House Tour
- The BEST-sites that have formed a group from a site/region to come, sometimes on short notice and with a , has been a time consuming process for all involved parties and strengthens the individual participant but has a lesser effect on the larger process.

- Process support (Road Map) has been offered from BioFuel Region to all the sites and the process work is still ongoing with Rotterdam and Brandenburg.
- From BioFuel Region several activities and methodologies have been transferred as a result of the Light House Tour and process support (Road Map). Some examples are;

Activities:

- Strategy and work with high schools (see BEST-report “Informational and educational activities in the BioFuel Region”, D5.03 and D5.11)
- Discussions and meetings with the aim of forming a mutual platform around biofuels between BioFuel Region and Brandenburg including private sector together the universities and high-schools
- Speeches at conferences and workshops in Brandenburg, Rotterdam and Somerset
- Educational material from BioFuel Region has been translated from Swedish into English and German

Methodology work:

- In depth work with the biofuel development chain and the Four Rooms of Change (a model for the process of change – see figure 7)
- Educational material has been translated
- “Letter of Statement” (see BEST-report “Informational and educational activities in the BioFuel Region”, D5.11)

It can be concluded that there is a need for process support when it comes to understanding that the long term process is connected to training/educating key persons (increasing knowledge of biofuels) in order to create policy shifts in favour of biofuels. A variety of tools are needed such as; study visits (LHT), trainings, information material, network building, stakeholder analysis, etc.

The overall objective of WP8 is the transfer of knowledge to the BEST-sites on the local process and strategic thinking. An underlining objective is the wise use of frontrunner-experiences from Brazil and US speeds up the introduction within the European sites. The conclusion is that the objectives have been met. All sites have received knowledge on the local processes (BioFuel Region and Stockholm) and strategic thinking (system approach through among other things the biofuel development chain, communication plan and different incentives). **Frontrunner experiences** have mainly been from Sweden and Brazil. Interesting to note is that the experiences with hydrous bioethanol from Brazil have been transferred to Holland and is being tested within WP3 Low Blends, i.e. 15% low blend of hydrous ethanol in gasoline (HE15) as opposed to the anhydrous ethanol being used in Sweden and the other EC countries offering E85 (85% ethanol with a 15% gasoline blend).

Another conclusion from the transfer of knowledge is that the **systems approach** (the biofuel development chain in Figure 1) is an important tool to work with for all sites. The key is to work with all the links at the same time and by doing so the process will move forward.

This is stated by the evaluations from the Light House Tours but also by the fact that the missing link, feedstock, has been an important subject during the internal meetings within the BEST project (WP-meetings and SGM). The feedstock being important is due to the global media focus on biofuels being sustainable or not, which relates primarily back to the biofuel feedstock (sugar cane, corn, wheat, rape seed, palm oil, etc.) with questions raised such as (arable) land use, food vs fuel, energy input/energy output, fossil fuel input needed to obtain a certain amount of biofuel, etc.

In order to create a long term commitment from the target groups, **knowledge through education** (training) is an important ingredient. From the report “Decision makers attitudes towards flexifuel vehicles”(D1.03) it is concluded that since the majority of decision makers do not understand the broader concept of sustainability it is harder to implement an environmental policy on a “lower” level / within a thematic area such as for instance public procurement of clean vehicles.

An important lesson learned from BioFuel Region is that education (training) should be a natural ingredient in a **communication plan**, as a part of a long-term strategy. The educational (training) efforts/actions will differ depending on where the target group is in their process of change (market stair). It is hard to get people with a high educational degree and a high position in society to take part in trainings. This complicates the process of change since these people also are policy makers, either directly or indirectly. The speed of the process of change is measured by the speed which policies are decided upon and implemented. On a national level in Sweden the incentives have been in favour of biofuels in general and ethanol in particular, but this is not the case on a local or regional level.

A paradox in Sweden is that the sale of clean vehicles (>90% are FlexiFuel vehicles that run on E85) together with the E85-sales for the consumer market has increased in Sweden parallel in time with the “bad ethanol” debate.

This can be an indication of the knowledge and awareness of the Swedish people and why they have not been influenced by the media debate against ethanol. The politicians on a local level, however, are less in favour, which is a paradox, since they should have better access to knowledge and hence know more.

It can be concluded that WP8 has not succeeded in its effort to encourage and support for more trainings for key stakeholders at the different BEST-sites. The reason for this being on the one hand what is noted above, it is hard to get decision makers to take part in trainings. On the other hand it doesn't seem to be an ingredient of the long-term strategy or communication plan at the different sites either.

A barrier to the transfer of knowledge **has been the language**. A lot of the Swedish experience is only published in Swedish. Also the lack of English language skills in the area of biofuels in many European sites and in China complicates training courses and shows the importance of skilled interpreters.

A lesson learned is that transferring the 20-year ethanol processes of Sweden and Brazil is a complex mission and more emphasis should have been placed on transferring knowledge of the systems approach with for example the biofuel development chain and also the process of change together with consumer behaviour. This should have been done before cars, buses and pumps were set up in order to form a better communication plan/strategy. It is therefore important that each site put effort into training its key persons so that they can stand for and secure the long-term supply of knowledge.

The conclusion is that the progress towards market breakthrough would have been speeded up at all sites (including BioFuel Region) if training courses had been planned and carried out in step 1. The experiences made in the BioFuel Region indicate that it is extremely important to educate early in the process and on two levels at the same time – decision-makers and citizens.

Finally, it can be concluded that the Swedish experience shows that it takes time to reach market breakthrough and that establishing biofuels is a longer and harder process than the BEST project period. There is a need for each country to establish a lobby organization like BAFF (BioAlcohol Fuel Foundation) that works with biofuels on a national and international level. In connection with this there is also a need for one or more regions/cities to lead the way and become the “test bed”, thus creating the momentum for a systems shift. BioFuel Region and Stockholm could be seen as these leaders in the Swedish ethanol development.

5. Recommendations

The ethanol debate has shown that there is a need for future projects (after BEST) to put more emphasis on issues related to consumer behaviour and behaviour of key decision makers. The strongest recommendation to all levels – local, regional, national and European – is to prioritize and demand a more in depth transfer of knowledge to all involved sites before the "hard ware" (in this case vehicles, pumps and buses) are put in place. It is hard to stand up and argue for a paradigm shift from oil to biofuels and ethanol if the individual and/or organization does not have a deeper understanding of the whole system. In this case the systems perspective is represented by the biofuel development chain (see Figure 8 below).



Figure 8 Biofuel developmental chains

To understand the implications of one link in relation to the others, and to see the system and its links as interdependent, is crucial to be able to handle the ongoing "bad" ethanol debate. It is the best way to lift the debate from details to seeing the whole, i.e. understanding that a systems shift is large and complex task.

The systems perspective works for all systems, for instance the building system (planning, building, managing, legal framework and market).

Recommendations in connection with the three steps:

Kick-off

Knowledge needs to be in place before the vehicles and infrastructure is set in place, i.e. soft issues before and/or together with hard issues.

Study visits

- More emphasis should be put on the study visits (resources – long time planning and stakeholder analysis will get the important stakeholders to go on study visit)
- Find out what is transferable and not between countries and regions. Develop the analysis during the journey of the project.
- Develop industrial tourism. More than 300 study visits at the pilot plant for ligno-cellulosic bioethanol in Örnsköldsvik shows that there is a potential for industrial tourism. The challenge is to get competent guides and not having to use technical personnel, thus taking away valuable production time.
- Work hard to find very skilled interpreters who can give the participants a good picture of the complex and new area of knowledge.

Road map (long-term strategy)

Vision, long-term strategy and communication plan need to be in place. Success factors for a process of change are to have a clear vision in connection with a long-term strategy. The missing link in order to achieve a change in consumer behaviour and/or key-decision maker behaviour is to plan how to communicate with each target group in a communication plan.

It can be concluded that there is a need for process support when it comes to understanding that the long term process is connected to training/educating key persons (increasing knowledge of biofuels) in order to create policy shifts in favour of biofuels. A variety of tools are needed such as; study visits (LHT), trainings, information material, network building, stakeholder analysis, etc.

National level

Transferable to other countries would be, on a national level, the legislation on expansion of pump availability and the national carbon taxation. Something that is missing in all three countries (Sweden, the US and Brazil) is a flexible mechanism for the fuel price at the pump, i.e. the price for biofuels/bioethanol should have a stable margin towards the gasoline/diesel price. In other words, the consumer at the pump, should not have to worry if the oil price fluctuates and is instable, biofuels/bioethanol should always remain at least a breakeven price.

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