Scenario Based Learning Regarding Contested Articulations of Sustainability

The example of Hydropower and Sweden’s Energy Future

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Abstract

Providing electricity from renewable sources is of key importance both to reduce depletion of fossil fuels and reduce emissions of greenhouse gases. Many of the renewable energy technologies are not ideal for electricity networks. Reservoir hydropower is one of the most ideal renewable sources as it can store energy efficiently, and can be made quickly available in cases of peak loads.

Reservoir hydropower generation has considerable impact on the landscape. Reservoirs and dams are perhaps the most visible elements, but the effects of a regulated flow of rivers on the river ecosystem, and the ecology of the river banks, is considerable. In Sweden, hydropower has a long tradition of being an arena for environmental controversy. Historically, various river related economic interests collided, but nowadays river basin ecology and sports fisheries are important issues too. [cf. 1].

Swedish Government has high ambitions regarding climate change: it aims at becoming the first fossil free country within 40 years. Unlike the traditional image of Swedish society, there is no consensus on the hydropower issue but a fortified dissensus. Communication between the contestants is limited to regular clashes (accusations) in the media rather than sensible interaction between different stakeholders on basis of substance of the issues at stake.

This paper describes a specific approach which brings together different stakeholders in an orchestrated and supported setting so that interaction between different stakeholders can take place on basis of the content and substance of various issues that are faced. The main aim of the workshop was to facilitate interaction through which the participants could gain a more substantive insight in each other’s positions and background arguments regarding different issues at hand. The interaction was supported by specific tools: External scenarios and value based scenarios were developed for analyzing the future of (hydro-) electricity production in Sweden. We evaluate specific learning effect of the participants as a measure of productivity of our approach.

The attendance of the workshop was very good. Our post workshop evaluations show very encouraging results in terms of new insights in each other’s positions.

Keywords: learning, scenario workshops, hydropower, climate change, biodiversity
1. Introduction

Various renewable energy technologies cannot be controlled by the electricity system: they generate power when there is wind, tide or sun. Other renewable energy technologies (like many non-renewable energy technologies) have long response times making them less attractive for electricity generation. Reservoir hydropower seems to be ideal as the power output can almost be completely controlled (provided that the season brought sufficient precipitation) and it is able to respond almost instantaneously to changing demand for power. However, river ecosystems are greatly affected by hydropower. The ecological worst impacts are fragmentation of ecosystems by barriers and river regulation (changing the natural variation in water levels). Embankments are missing the spring floods and so many plants retreat from it. Many people regard the dry rivers (in periods of low energy demand) as a curse in the landscape. Since the 1970s, the environmental movement has been aiming to terminate the ‘industrialization’ of rivers. Hydropower stations have become the arena for many disputes. Increasingly, this has become a controversy of ‘the deaf’. In this paper we describe an approach, using scenario workshops, to create direct interaction between various stakeholders in order to achieve mutual learning. This could lead contestants to understand the positions of others in a better way (through the information they receive during the interaction) through which they could broaden their view and become more reflexive in their future strategic decision making.

The paper will describe the scenarios, analyze the workshop discussion, and finally reflect on its results and give options for further development.

2. Hydropower in Sweden

Hydropower has a long history in Sweden. In the beginning of the 20th century, Sweden was one of the countries that were spearheading hydropower for electricity generation, as the country hardly possessed coal to fuel its industry and railways. Until the 1960s, the expanding Swedish industry was fueled by a rapidly expanding number of hydropower stations. As the hydropower resources were most abundant in the almost uninhabited Northern part of the country, rivers in Northern direction were ‘industrialized’, harnessing them for electric power production.

In the 1960s, environmentalist started objecting to this development. Mainly to protect them from hydropower, four large rivers in Northern Sweden have been declared natural reserves in the 1980s (Vindel Älven, Pite Älv, Kalix Älv and the Swedish section of the Torne-Muonio Älv). Apart from local and global environmental impacts, the ‘industrialization’ of rivers was challenged [3, 4].

In the early 1980s, Sweden decided to introduce nuclear power, as hydropower approached its limits and energy intensive industry expanded rapidly. Expansion of nuclear power lasted until 1980, when further expansion plans were defeated in a referendum. Since the early 1980s, Sweden consumes about equal shares of hydropower and nuclear power. The fate of Swedish nuclear power is still undecided. The 1980 referendum called for a phase out in 2010 but this decision was postponed, and even options for nuclear expansion were presented at the time that we organized our workshop.

Many of the renewable energy technologies are not ideal to feed electricity grids. In general they can only be controlled to a very limited extent (wind, PV, tidal, wave, non-reservoir hydropower). Nuclear- and coal-fired power stations are also unable to respond quickly to changes in demand. Reservoir hydropower is most ideal as it can store energy efficiently, and can be made quickly available in cases of peak electricity demand. Especially if ‘uncontrollable’ sources of electricity (wind, PV, waves) grow in importance, then hydropower (and biofuels) might become even more important to compensate the variations in electricity production of these sources. So, hydropower is not only ‘fossil free’, it might also be crucial for the success of other renewable energy sources in feeding the electricity grid.

Swedish Government has high ambitions in regard to Climate Change: it aims at becoming the first fossil free country in 2050. In many respects, Sweden is in the frontline of moving away from the carbon economy. In this development, the government considers the hydropower resources are an important asset. But the electricity market is no longer a national one. Sweden is a member of the EU and its electricity grid is integrated with neighboring countries. Swedish low electricity production costs make it attractive to sell electricity abroad. The grid balancing capacity of reservoir hydropower is of increasing value as this is in increasing demand due to the increase in wind power, both in Sweden and abroad (esp. Denmark and Northern Germany). The transition to an open European electricity market will increase pressure on the Swedish system. Growing demand by increasing electricity consumption in transport (electric vehicles), growing exports, and the political ambition regarding climate change will increase the pressure on the government to allow expanding hydropower. These developments create powerful dilemmas regarding the future of hydropower: Could it be expanded to contribute to preventing climate change or should ecological destruction be terminated and eco-restoration of river basins begin?

The societal debate on hydropower has been strongly entrenched. Unlike the traditional image of Swedish society, there is no consensus on this issue but a fortified dissensus based on different value judgments and interests. Communication on the issue is virtually absent ever since the main decisions on river protection were made around 1980. Contestants mainly fight each other’s positions in the media and in court.

2 Scenario Workshop Approach as Constructive Technology Assessment-like Procedure

Constructive Technology Assessment is an approach that aims at broadening design, development, and implementation processes of new technologies. The approach implies a modulation of ongoing technological developments, stimulating the societal embedding process of such technologies [8, 9]. In this approach, structured scenario workshop methods have been applied where learning among stakeholders was ensued [10].

In a CTA approach the root cause of the need for interaction among stakeholders is the social and institutional rearrangements that are required by the emerging character of a new technology. New alignments have to be made as novelities introduce ruptures in the existing societal order. New technology proponents promote a new actor world in which the technology will function. They seek new alignments to create this new actor world [11]. However, this takes negotiation and learning, i.e. a better understanding of perceptions and motives of other stakeholders. This might create feedback loop, making technology developers reconsider their aims. Constructive
Technology Assessment aims at initiating and facilitating this process, with a specific emphasis on understanding the dynamics of the innovation process. Insight in the dynamics of a new technology is crucial to broaden the understanding of stakeholders of the changes that might take place due to an innovation and the impact it might have at the collective level. A similar process might also be expected in this case. As CTA aims at influencing the process of shaping new technology, we aim at influencing the process of shaping new systems. The root cause of re-alignments is in the hydropower case not in the emerging character of a new technology, but in various external developments that exert pressure on the existing electricity system to adapt itself. Therefore, we chose to map the external causes for change as a starting point for a CTA workshop on hydropower.

Our experiment

Initiating a CTA process on hydropower was an experiment. The experiment aimed at creating learning among the main hydropower contestants in Sweden by means of a CTA workshop. The main aim of this workshop was to contribute to the understanding that stakeholders have of each other’s position and each other’s future world view. Scenarios try to reach clarity on the impacts of the future world views that stakeholders adhere to. Thereby the workshop did not aim at consensus, but at improving understanding each other’s world. The workshop is evaluated from this perspective.

Our approach in this experiment consisted of:

• interviewing the main actors (about 30) regarding hydropower (power companies, environmentalists, grid operators, power consumers, water governance). The aim of the interviews was to understand the hydropower world and to get information regarding the actors’ perception of problems. Moreover, the interviews also had to contribute to the interviewees’ understanding that we were seriously dealing with the problem, aiming at contributing to the quality of interaction and not interested in supporting one of the contesting parties.

• identifying and analyzing the main issues that play a role in regard to the future of hydropower and dividing them into external issues (that can only be marginally influenced by any of the Swedish actors) and internal issues (issues that are to be decided upon among the actors in Sweden)

• Developing external and internal scenarios on basis of identified issues in the analysis through clustering the issues. The division between internal and external scenarios is new here compared to ordinary CTA workshops. As CTA workshops normally are based on perceptions of changes that could emerge by a new technology, there was an important difference here: The changes in this case originated from the external world that is pushing hydropower. The external pressure for change was perceived rather differently by various actors in the hydropower arena. At the other hand, the external pressure for change was quite different from the changes proposed by the various actors within the hydropower arena: the external ones were regarded as ‘facts’ to deal with by adaptations in the electricity and water management systems, while the internal ones were regarded as the stake of the fight. However, the external pushes for change were sometimes differently perceived, supporting the positions of specific stakeholders, while undermining others.

For this reason, we decided to orchestrate the workshop in such a way that interaction would take place in three parts:

1. discussing external changes (creating a need for hydropower change)
2. discussing options for changing hydropower in Sweden
3. evaluation of the scenario workshop approach.

An advantage could be that such a lay out of the workshop could create a better atmosphere if the initial discussions would not be too much of a head on confrontation. So the workshop would have two phases. In the first phase, the participants would discuss the external scenarios. Afterwards, internal scenarios describing future hydropower development in Sweden would be discussed.

3 The Scenarios

3.1. External change

From the interviews, it became clear that three main external changes might affect the future system:

1. The nuclear issue (will Sweden close down its nuclear power stations or not, or even expand nuclear power). This issue was at stake in the summer elections. The political landscape as well as Swedish society is deeply divided.
2. Growth of electricity consumption (due to economic growth and the introduction of electric vehicles) or gradual success with electricity consumption reduction programs.
3. Liberalization of the European electricity market and further integration of Sweden into that market or a growing isolationism as Sweden should first try to get its own electricity production right.

We determined that for the situation of hydropower, 1 and 2 could be combined as they both result in more/less demand for hydropower. Moreover, this would also help to keep the nuclear power issue out of the workshop. The issue was to be avoided as it is highly politicized, especially during the months in which this project was carried out (election campaign 2010). The third issue might also lead to higher demand for hydropower, as this is an ideal technology to stabilize the electricity grid, also of neighboring countries, but might lead to higher prices for Swedish electricity, electricity exchange between countries and political alienation as energy source and energy consumption are at a growing distance.

3.2. Value Based Scenario’s

For the second part of the discussion, 4 value based scenarios were made that pictured the future of the system. These were not intended to represent the viewpoints of specific actors, although some scenarios resembled pretty strong the positions of specific actors.

1. Scenario: Beautiful Sweden. The major value of this scenario is the nature in Sweden and the main goal is to preserve the natural environment. Therefore, the scenario:

   • Prevents building new hydropower stations in Sweden
   • Phases out some of the already existing stations which cause greater damage comparatively to benefits they produce
   • Remove abandoned dams
   • Introduce to the maximum mitigation measures at existing hydropower stations (such as fish ladders and minimum flow levels) in order to reduce ecological damage of hydropower.
At the same time, other renewable sources of energy should be expanded and the remaining reservoir hydropower should aim at providing the balancing power. This also means that Sweden will not aim at exporting electricity to other countries but only exchange electricity for grid balancing reasons. The efficiency of the existing hydropower stations should be increased through refurbishment. The electricity certificate system regarding hydropower (subsidies as hydropower is recognized as sustainable power) is to be abolished and the money should be transferred to:

- Energy efficiency research and measures to implement it
- Development of other renewable energy sources
- Demolition of old dams and introduction of measures to reduce the environmental damage of hydropower
- Additional taxation for electricity may be introduced in order to encourage energy efficiency improvements.

The Swedish system in which licenses to utilize hydropower last forever, will be abandoned and a thorough inspection system will be introduced. All hydropower plants should meet the requirements of the Swedish Environmental Code and the EU Water Framework Directive.

The number of rivers that are prohibited for hydropower will increase.

2. Scenario: Economic opportunities. The major value is to utilize economic opportunities of hydropower, which can affect in a positive way the GDP and the welfare of the country. The development of hydropower in Sweden will be expanded in order to be able to export to other European countries. This is economically feasible since the energy prices in Sweden are lower than in Europe. Export of renewable balancing power is probably commercially interesting. Besides the growing economic opportunities for Sweden that would bring some other benefits:

- It will help to combat climate change in Europe
- It would generate money for investments in other renewable energy sources which are not developed enough at the moment to produce energy at a commercial scale, such as wave energy and geothermal energy.

To achieve this goal the electric power industry needs to:

- Increase the public acceptance of hydropower in Sweden
- Facilitate the process of getting the permission for refurbishment without the risk of losing the existing license
- Keep the electricity certificate system

In order to increase the public acceptance some environmental friendly measures might be implemented but without significant compromising the electricity production level. Some of these measures have already been implemented. In addition, further research in this field is needed, trying to find win-win projects which would be beneficial both for the environment and for the energy production.

Depending on the demand for energy in Sweden and Europe in future, it could be necessary to reconsider some areas that are thus far prohibited for hydropower, as is stated in the Swedish Environmental Code. The industry acknowledges the need to preserve the unharvested rivers. The law should be more flexible with respect to new hydropower which doesn’t increase the burden on the environment.

3. Scenario: Availability and accessibility of energy. The major value is availability and accessibility of energy in Sweden, which implies a low price and a good transmission system within the country. The main challenges for that are to keep the capacity of the existing hydropower plants, develop new hydropower plants, and reinforcement of the existing transmission lines.

Before Sweden will build external transmission lines to other European countries, it will have to cope with its internal transmission system problems. For example, there are bottlenecks in the middle part of Sweden which hamper the energy transmission from the Northern part, where most hydropower is produced, to the Southern Part, where the consumption is concentrated. Another aspect is that low electricity prices are in the interest of local consumers but will also make the Swedish electricity producers more competitive on the global market. In turn, this will bring economic and social benefits for the country. Thus hydropower production has to be preserved and developed as well as other forms of energy. Electricity exports have no priority.

4. Scenario: Local for local. The main value is the possibility of small-scale energy producers to contribute to local renewable energy production, and thereby to national renewable energy production. The damage caused by small-scale hydropower (SSH), which is claimed to be larger than damage from the large-scale plants (per unit of energy produced), may be reduced by the implementation of environmental measures. At the same time comparatively to large-scale hydropower plants, SSH does not affect the flow pattern of rivers as much as large scale hydropower does.

Producing energy at the same spot as its consumption is important for local commitment. It becomes more important with the future division of Sweden into three energy price areas. SSH may contribute to fossil free energy production, especially in the South of Sweden where there are still opportunities for building new SSH and refurbishment of old plants.

Furthermore, all SSH may play a more important role in the local energy system in order to support energy security and make power supply less vulnerable for breakdowns, terrorist attacks and natural catastrophes.

The electricity certificate system should be kept, and the public acceptance of SSH should be increased by using local commitment.

4 Dynamics of Interactions during the Scenario Workshop

The scenario workshop took place on May 5th 2010 at the department of Industrial Ecology at KTH Stockholm and lasted from 13.00 to 16.30. All major stakeholders (including electricity companies, environmentalists, sports fishermen, government agencies, small scale hydropower producers, the electricity grid operator, water management organization) were represented (at senior level) in the workshop and most participants were actively taking part in the discussions. Hydropower electricity companies and grid operator generally represented similar views while sport fishermen and environmentalists also often agreed. The discussion was constructive which contributed to a very friendly and respectful atmosphere where stakeholders could openly elaborate their arguments for specific issues.
4.1. External Scenario phase

During the first phase of the workshop, the external scenarios were presented by Olga Petrik.

In the discussions on the external scenarios, all participants agreed that Sweden could not have an independent electricity policy from Europe. Integration was a fact and would probably only be strengthened in the future. However, later in the discussion, it became clear that various participants required from the government that it should not just aim at optimizing national economic benefits by stimulating electricity exports. Sweden should demand stricter climate change policies from other nations in return for Sweden’s hydropower resources. National isolation was no option. Participants had different views to what degree Sweden should use its bargaining power if it would export renewable energy or the balancing capacity of its hydropower.

During this phase participants engaged in probing each other’s realities. For example, the representative of an environmental organization asked the representative from the national electricity grid organization, “What is that present rate of integration; would you say low or high?” Some of the participants remarked that the external scenarios were simple for understanding and interesting for them to consider.

4.2 Value Based Scenario Phase

During the first phase of the workshop, four participants had been invited to present a specific scenario. The presenters and scenarios were selected in such a way that the correlation between the scenario and what we expected to be the value system of the presenter would be minimal. Our idea was that presenting arguments of others would contribute to an open discussion on arguments. The participants had received the scenarios in advance. They were all willing to perform this task, and did it quite well (see Table).

Table 1 Scenario’s and their presenters

<table>
<thead>
<tr>
<th>Scenario's and their presenters</th>
<th>Representing main interest of:</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local for Local”</td>
<td>Small Scale Hydropower</td>
<td>Environmentalist</td>
</tr>
<tr>
<td>“Availability and Accessibility of Energy”</td>
<td>Electricity Consumers</td>
<td>Electricity Producer</td>
</tr>
<tr>
<td>“Economic Opportunities”</td>
<td>Electricity Industry</td>
<td>Environmentalist</td>
</tr>
<tr>
<td>“Beautiful Sweden”</td>
<td>Environmentalist</td>
<td>Electricity Producer</td>
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</table>

However, the presenters requested that there would not be any recordings of the workshop, as recordings could embarrass them if these recording would show up in the media. This denotes an important feature of the workshop: that it created a ‘protected’ space for discussion (i.e. protected from the pressure to firmly defend the position of the organization of the participant without regard for argumentation). The participants appreciated this opportunity to have a respectful discussion without media pressure. This point was repeatedly made, also in the evaluation afterwards.

Each of the scenario presentations was followed by 10-15 minutes discussion.

The Local for Local scenario was presented by an environmentalist. The discussion was not very active since both of the representatives of small-scale hydropower (SSH) agreed with the environmentalists that there is a need for introduction of environmental friendly measures at the SSH plants, such as fish ways and environmental flow. They asked the environmentalists to respect local traditions and local heritage. Local communities living along the rivers would be opposed to demolishing dams and demolishing could lead to a local social catastrophe. “You should not forget that there is a cultural system established around hydropower.” This point was acknowledged by the environmentalist. Therefore, there was surprisingly little debate between SSH producers and environmentalists, while they had often been engaged in public confrontations. However, the electricity certificate dilemma (hydropower ‘green’ energy or not) ignited a debate. The participants provided or elucidated their positions by bringing their specific arguments to the table. One of the participants (SSH producer and university professor) said, “I want to say something about the energy prices as a professor…” and then “I want to say something about the electricity certificate system as a practitioner.” This relativism, elaborating a problem from more than one perspective signified openness in the debate.

During this discussion the participants started anticipating the next scenarios, for example, they started positioning the energy consumers, as only demanding low electricity prices. This means that the scenario was provoking and stimulated the discussion. Especially the discussions following the last two scenarios were very active and the participants opened up many issues:

The “Economic Opportunities” scenario was more or less the “dream” scenario of the electricity producers. Discussions started from the last statement of the presented scenario, which was “But the law should be more flexible with respect to those hydropower stations that do not increase the ecological burden.” Government representatives started defending the law “But the law is flexible”. The energy producers gave examples showing that the law was not flexible in their opinion. This interaction was important from a learning point of view, since the participants had never socialized with each other before and here was an opportunity to articulate their positions and arguments regarding environmental law issues.

During the discussion of the “Beautiful Sweden” scenario the participants returned to the discussion on the green electricity certificate system in Sweden. The environmentalists’ representative said, “The electricity certificate system artificially changes the balance between economic gains and the environment for the good of energy production.” The counter arguments from energy producers and distributors were, “But hydropower is also a part of renewable energy, which has to be promoted in order to reach energy policy goals and cope with climate change, and the electricity certificate system is an economic incentive which meets this challenge”. Another argument was that, “Fossil fuels and nuclear power do not cover their external costs, so these costs are not reflected in market prices of these conventional sources of energy. The electricity certificate system plays a role as a balancing instrument for renewable energy to make it competitive on a fair basis.”

One of the main points of the environmentalists was that the “climate change issue is kidnapped from the ecological agenda and is used by the energy producers to promote and increase their production”. But “there is a wide range of problems, such as the problem of biodiversity loss; all of these problems is a should be solved”. Thus the participant articulated the term sustainability, when he emphasized that the biodiversity issue is also an element of it. Ecological issues were rejected by the energy producers as being local and less important as the sustainability, when he emphasized that the biodiversity issue is also an element of it.
disagreed with this “global environment vs. local environment” dilemma, since they argued that biodiversity was not just a local issue. In line with this the environmentalists argued that “Sweden should not export its renewable energy if it is compromising the biodiversity and the good state of its local ecosystems”. The counter arguments from the energy producers and distributors’ was that “Sweden is a part of the European Union and it is definitely not a desirable scenario if Sweden has a good environmental situation, while the other countries around keep polluting the environment and worsen climate change” and even that “the environmentalists’ idea regarding the hydropower issues is a totalitarian way of handling the problem”. And here the energy producers and distributors switched from a defending position: “Following the EU directive we have to move away from general marketing instruments.” To this the environmentalist said, “So what is your solution?” The answer was that, “When you produce and use hydropower, as a result you reduce the incentive for building coal plants through maintaining renewable energy.” Another energy producers agreed, “Yes, that is a strong argument, hydropower reduces the price of renewable energy.” As a counter argument, the environmentalists proposed to imagine that Sweden had harnessed the four nationally protected rivers to help Europe fight climate change. “What can these additional 30TWh of renewable energy change if the whole of Europe consumes thousands of TWh generated by coal-fired plants?” he asked. The counter arguments to this from the energy producers’ side were, “These 30TWh could balance a large amount of renewable energy from other sources”, “Every contribution is important”, “It is not a good approach to decide not to do any improvements, if they only lead to a small contribution” and “We should not look at the problem from the nationalistic prospective”, “We can be a positive model for the world and we cannot sit back while the rest of the world is living unsustainable”, “We have to make small steps to reach the goal and since there is so much complexity involved we cannot fix the problem at once, as you propose, but we need a transition period.” The environmentalist’s answer to that was, “We acknowledge that renewable energy production should grow. Coal based electricity production should be reduced and the Swedish hydropower would not help to achieve this. If we add even 30TWh of our hydropower to the European market, we will just help Europe to maintain its present unreasonable high consumption of electricity”, “Yes, we can export, but under the terms and conditions of forcing Europe also to change their energy production pattern.” The energy producers asked the environmentalists “But what are the mechanisms to realize your view?”

There was also a discussion on the assumed climate change effect that more precipitation in Sweden will increase hydropower production. The environmentalists saw this as an opportunity for additional ecological measures but the hydropower producers feared that they would run into legal problems if they would do so. A few times during the dispute the participants tried to shape a way to consensus, for example, one of them said, “I have the feeling that we are opposing each other in a destructive way. And I think we should be more flexible.” He also said to the most active environmentalist, “I am observing that you put pressure on the hydropower representatives, but I think you have to work together.” To this the environmentalists’ representative repeated that “he acknowledged the importance of renewable energy and hydropower as a part of it, but he still emphasized that its promotion should be done together with energy efficiency improvement and that climate change should not be considered apart from the biodiversity loss problem.”

Thus, he repeatedly broadened the assessment criteria for renewable energy. Another remark from the energy producers regarding the possible consensus was: “If we speak about consensus, we would like to reach it, we would like to collaborate with the environmentalists, and we would accept measures in order to reach this consensus. But we would like to see that the environmentalists also listen to our arguments and make steps towards consensus and towards us, since it is not really collaboration if we are the only ones to give in and go unheard.”

In conclusion, in the debates triggered by value based scenarios considerable learning could be observed. Participants were:

- Probing each other’s worlds (for example checking how local and global motives played a role in each other’s vision)
- Developing more reflexive articulations [9] e.g. that including others’ objectives in their plans would make them far more acceptable.
- Improving their understanding of dynamics at the collective level (e.g. regarding relations between the European grid development and electricity policies and the options for resolving the hydropower issue in Sweden)

4.3. Concluding Phase.

During the third phase the participants were invited to advise their opponents how they should act in order to achieve their own dream scenarios. That question was planned as an additional opportunity to probe the other actors’ world. However, it did not work out as planned as the participants remained in their own role. Another task for the participants during this part was to assess the learning effect of the workshop. To avoid socially desirable answers, the participants were invited to explain learning effects in detail. This led to various evaluative replies:

**The energy producers and distributors:**
- “We should work together and develop a future which would be acceptable for both sides”
- “We have to manage the conflict. We agree that we have to respect the local concerns, but we have to find a balance between the global and local environmental challenges”
- “We have a conflict, and we have to try to solve it and avoid confrontation”
- “This workshop has shown to me that we can discuss our dilemmas better than I expected, we can discuss them in a constructive way”
- “I think the discussion was good because it helped us to realize that we need to be more flexible and take more options into account”
- “The scenarios were provoking”
- “It was an open and frank discussion. I have not learned anything new, but it was important for me to listen to the discussion because we are depending on the other parties’ opinions and activities and so it was interesting to meet different parties and good to hear their arguments.”
- “I appreciate the discussion because it was open and constructive, and I realize that we have different arguments”

**The environmentalists:**
- “I would recommend to the energy producers to apply a more holistic view of the problem”
- “We would suggest to include into the conditions for getting these certificates a requirement for the
benefit of the environment in order to avoid our opposition against the electricity certificate system”

- “I have heard a lot of new facts about the energy issues”
- “I have not heard many new arguments, but still it was worth to have this interactive discussion”

5 Learning

The learning effects of the scenario workshop were evaluated by observation and by short interviews. Short interviews with the participants were conducted after the workshop. Three questions were posed:

- What have you learnt? Have you improved your understanding of the others’ positions?
- Were the external and internal scenarios prepared and presented during the workshop well for moving the discussion forward and getting better insight in the present and possible future situation?
- Do you think that it is possible to organize another workshop which may lead to consensus among the stakeholders?

The following answers were obtained during these short interviews:

What have you learnt? Have you understood better the others’ positions?

The environmentalists:

- “I have not heard many new arguments, but it was interesting to meet each other face to face and have a kind of decent discussion. We have different positions because of our different values. The companies want to make profit on hydropower and we want to preserve the environment, so it is natural that we have different positions. However, I think it was worthy to attend the workshop and participate in the discussion.”
- “We need these meetings more often!”
- “It was interesting to participate in the workshop, since I could listen to the arguments of the energy producers even if these arguments were the ones that I expected.”

The energy producers and distributors:

- “I have not heard much new information. But my general impression is that the workshop was very valuable since it connected people with different points of view and gave them an opportunity to discuss these points and exchange their knowledge and information. We would like to understand the position of the environmentalists and other parties and the workshop helps to do that. So for me not the content, since the content was mostly what I already knew, but the communication was very valuable.”
- “Yes, I think it was really useful for me. I have never actually met our opponents before, so it was interesting and useful”
- “The discussion was as expected, but still interesting to listen to.”

Were the external and internal scenarios that were presented during the workshop good for moving the discussion forward and getting better insight in the present and possible future situation?

The environmentalists:

- “I think they were good, it was interesting and it contained some new information for me, since I was not that familiar about the situation within the energy sector in Europe.”

The energy producers and distributors:

- “The scenarios were interesting and valuable. And, of course, you can always discuss scenarios so it was good for the discussion. However, I would recommend doing the scenarios more simplified. The set of scenario always risks being complicated. And as you are approaching different stakeholders, they perceive the scenarios in a different way based on their interests and values. That is why I think it would be better to simplify the set of scenarios to make a better basis for the discussion. Maybe you lose the scientific accuracy but you win on the communication.”
- “I think the scenarios were interesting and very clear, so they provided a good basis for the discussion”

Do you think that it is possible to organize another workshop which may lead to consensus among the stakeholders?

The environmentalists:

- “Yes, we could cooperate more. For example, if you use some of the rivers which are overexploited and it is impossible to restore the ecosystem of these rivers, you can have some less strict requirements regarding the environmental measures for these few rivers, which are the most important for the hydropower production. But you have to fulfill the environmental requirements for the other rivers, which are less important for the hydropower, in order to restore and preserve the ecosystems of these rivers. Another example is an electricity certificate system. We could reach a compromise if we include the environmental requirements into this system which must be fulfilled in order to get the subsidies.”
- “I do not think consensus is possible. But I still think the workshop was worthy and interesting to attend.”

The energy producers and distributors:

- “I do not think consensus is possible in the nearest future, but it is worth to try it anyway. If you do not try, you will never reach it. This kind of events should take place, because we need to go forward. It was worth to attend this workshop.”
- “I do not expect that we can reach consensus, but it is good to have such kind of discussion anyway. I also think it is good for the society that different parties with different points of view exist and balance each other.”
- “Yes, I think it is possible in the future and we have to try to reach it.”

The general atmosphere among participants was that the workshop created a lot of understanding regarding the positions of the other participants. New options could be explored to resolve issues in the hydropower debate. The discussion was seen as constructive since the participants strived to open up as many issues as possible within the limited timeframe. The willingness towards consensus was indicated through the remarks of the participants, and the ways towards the consensus were even shaped, such as the proposal regarding the electricity certificate system, which was articulated in the concluding session.
6 Reflexion

The most important success of the workshop was that an environment favorable for informal and constructive discussion was created during the event. A main factor for this was that there was a protected space with no pressure of publicity and the stakeholders could interact and uphold their positions by argumentation and counter argumentation. The resistance against tape-recording the workshop is a further indication for this.

The scenarios were crucial for good interaction, not for conveying data but for presenting coherent worldviews to discuss and help actors to articulate positions and provide background arguments.

An interesting point was that so many stakeholders agreed and showed willingness to participate. This was even surprising for themselves. It shows that there was something at stake for them, and that they felt the need to interact. The round of interviews that Olga Petrik had been carrying out beforehand certainly played an important role. During such interviews the CTA agent creates awareness through probing. It stimulates reflectiveness and awareness among stakeholders.

The issue is where the interaction that took place during the workshop can normally take place in modern society. The absence of media pressure was regarded as crucial by the participants of the workshop. Public media foster confrontation instead of interaction on arguments. This points to a problem in industrialized society: a lack of protected spaces to have real interactions on issues that involve expertise. Public spaces create political arenas where an open interaction on arguments is often not a strategy for success. Perhaps universities might find a new task in creating such protected spaces for high quality interaction.

CTA workshops may be successfully orchestrated bridging events [12] between the designers of new technologies and the comparing and selecting stakeholders that have the power to select new technological options. Such type of CTA workshops have been organized and evaluated more often [13]. In CTA in general, scenario workshops deal with anticipated technological change as a source of novelty for society. The aim of the workshop is then to bridge perceptions of various actors, and aim at feeding these results back into the technological design process. In this case the source of novelty was not primarily in anticipated technological change originating from techno-scientific research; it was in new demands that require electricity systems to adapt. These new demands could be met in various ways with various impacts, and would touch existing tensions in the electricity system. This type of CTA workshop as bridging event does not primarily help in bridging the technological designers and the various selecting stakeholders. It contributes to clarifying the issues on which stakeholders could agree and the issues on which they disagree. It could even help then participants identifying options by which they could optimize achieving their own goals by compromising with other stakeholders. Thereby, a CTA workshop might contribute in bridging different actor worlds, like the actor worlds of ‘balancing an electricity grid’, ‘maintaining a good quality river eco system’, ‘creating a good economy for power companies’, and ‘preserving local communities and their inheritance’. These ‘actor worlds’ have their own expertise that shape the perceptions of specific stakeholders. They are all relevant for the future of a complex system like hydropower electricity.
References


