Ten regional RES-FCHS market development plans

Østergaard, Poul Alberg

Publication date:
2008

Document Version
Publisher's PDF, also known as Version of record

Ten regional RES-FCHS market development plans: Guidelines on developing regional market development plans

RES FC Market Work package 3 - Deliverable 3.2

Poul Alberg Østergaard

January 2008

Work package 3: 10 regional RES-FCHS market development plans

The objective of work package 3 is in accordance with the grant agreement page 17 to make market development plans (MDPs) for the 10 potential RES-FCHS markets for the three RES FCHS solutions in the five involved countries.

The work package is split up into three deliverables of which this report contains the second which partly is the template used to create the individual market development plans for the various technology / geography combinations and partly is a result of modifications caused by the generated market development plans so that the actual process has been iterative. These guidelines are thus made partly on the basis of incurred problems and issues in the market development plans from Deliverable 3.1 which have subsequently been re-formulated to a more general description here.

Such occurred issues include not surprisingly the lack of e.g. a heat demand in Southern European countries; a heat demand which in Northern European countries increase the utility and thus economic feasibility of the RES FC units. Less obvious issues include actors within the methanol industry in Germany that are more keen on developing a market within transportation than developing a market within RES FC. This has added emphasis to the circumstance that a proper actor analyses must be carried out outlining not only power, organisation, information, access and knowledge but also interest. It is of no help if an actor has all the correct credentials in terms of technological abilities, if the actor does not also possess an inherent interest in promoting a certain technology.
The case of Demark demonstrates that it is important applying a holistic approach to the energy system. RES FC units cannot be considered isolated from the rest of the energy system. Apart from the direct value they have from the perspective of the owner in terms of delivering heat and electricity to the dwelling, they also have a value for systems with large scale integration of fluctuating energy sources such as wind power. Here they are able to supply up and down-regulating services needed in such systems. They may even be able to supply ancillary services such as voltage and frequency control and short-circuit power. This is required if electricity is shifted towards distributed generation technologies and the ancillary service providers of the past lose their production thus also making it too expensive to have them remain solely as ancillary service providers. This could bring added value to the existence of RES FC units in the electricity systems.

Deliverable 3.2: Guidelines on developing regional market development plans

General description of the Market Development Plans

The general idea behind the template for the MDP is

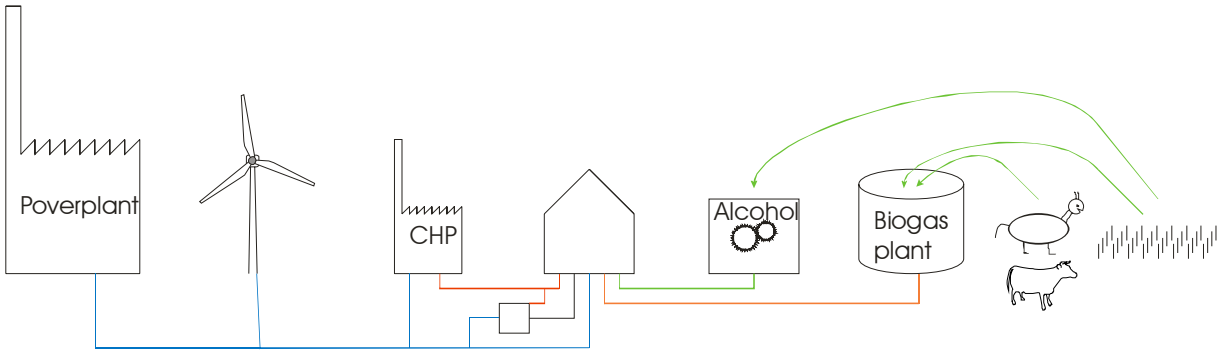
- first to demonstrate that there is a technical perspective. This includes an evaluation of the local energy situation in terms of potentials for producing fuel (hydrogen/methanol/ethanol/biogas) from locally available resources as well as establishing that there is a potential need for the electricity and/or heat produced by the fuels cell systems in the geographic region. This gives a variation between the technologies and geographical setting in the projects as e.g. biomass recourses and available wind resources vary much according to setting. Likewise, electricity and heat demands vary from the Southern European countries Spain and Portugal in the project to colder countries in the project like Denmark, Iceland and Germany.
- Secondly to demonstrate or ensure that the technology is economically feasible and attractive for end-users. This requires that technology suppliers and fuel suppliers appreciate that there is an attractive market where technologies and fuel may be provided at a sufficient scale to allow for competitive prices through economy of scale. It also requires that end-users are able to sell surplus energy or other energy services to energy companies at prices sufficiently attractive to off-set the added investment and the possibly higher fuel costs. Finally it requires that regulatory authorities establish framework conditions that not only permits the introduction of the technology but actively encourages its introduction and use. However these pre-conditions are not linear but rather intertwined so that favourable conditions in one area may overcome less favourable conditions in another area while unfavourable conditions in one area on the other hand may also offset better conditions in other areas. If for instance electricity prices generally are low, then production of hydrogen on electrolysers or reversible fuel-cells may be feasible – however the re-introduction of electricity from the fuel-cell unit into to the grid will also only be met with a low price thereby making the system unattractive from an economic perspective. Instead, large diurnal electricity price variations may enable the units to consume electricity when priced low and sell electricity back to the grid when expensive. If this is not possible in the market in question, then supplying e.g. regulating power may counter the generally unfavourable electricity prices as regulating power almost per definition is priced better than normal spot market prices. This however requires

institutional set-ups where this is opened up for. Some countries in the project have long-standing traditions for having well-established frameworks for non-utility owned distributed generation being grid connected and being treated on a level playing field. This applies to Denmark where a long standing tradition of wind power has brought distributed generation into general acceptance both among policy makers and energy sector actors. This does not mean that there are no administrative barriers against RES FC systems in Denmark. Development so far has mainly included more simple systems like wind turbines and solar cells with a unidirectional energy flow. Fuel cells utilising either hydrogen produced on the basis of electricity of biogas/biofuels from biomass complicate the issue. If run on fuels produced on the basis of a fuel that is already taxed, should production then be taxed? What if it may be argued that hydrogen is produced only during hours of excess production – which may or may not be attributed to wind power – could taxes then be relieved entirely arguing that the combination of wind turbine and RES FC unit should be considered one single virtual power plant with built in storage functionality? Would it suffice that it was a virtual power plant or would it need to be specific pairs of wind turbines and RES FC units owned by the same owner. Would there need to be a particular private connection between the two? This is currently the case with the comparable technology heat pumps in Denmark, where electricity taxes are relieved is but only they are directly coupled to the wind turbine with a proprietary cable.

- The market development plan should end up with a step by step summary of what must be done to establish the market including the specific requirements at each different level – e.g. grid connection requirements, feed in tariffs or establishment of an obligation for transmission system operators to pick up excess electricity generation.

Description of the regional markets

The description must contain information on the current energy system with a focus on the potential for applying the relevant technology in the region. The entire system as depicted in the figure below is to be described with this in view.



This hence includes considerations of

- the appropriateness of the fuel or fuel mix in question under the local conditions in the area. This includes a resource availability assessment considering e.g, local wind power conditions, biomass production and productivity and the extent to which these resources may be exploited,
- the technology with characterization of the technology, prices, guarantees, service, operational costs
- domestic heat and electricity demands per dwelling. Using a heat-producing unit such as a fuel cell unit, some heat demand is naturally very relevant as the heat production will not have a monetary value otherwise. There will always be a demand for hot water, but lack of space heating demand will limit the value of heat produced from the fuel cell unit. Consideration must also be given to the net balance of the houses as different pricing regimes for domestic electricity consumption and production often favour not using the general electricity grid as a virtual storage system.
- number of dwellings in the region and also to some extent the concentration of the dwellings if grids are considered to fuel the household fuel cell systems
- the performance of the energy system. Fuel cells may turn out to be one of the elements that facilitate or even enable large scale integration of fluctuating energy sources such as wind power. So focussing narrowly on the individual houses and their individual FC systems do not take the benefits for the overall energy system, the societal economy or energy policy objectives such as climate change mitigation into account. The performance of the RES FCHS energy system within the frame of the overall regional energy system must thus be analysed with the aim of documenting its advantage vis-à-vis present technologies.

This description of the regional market should lead to an overall description or assessment of the potential for the relevant technology demonstrating that the technology is relevant in the region from a technical perspective. Note that this regional market description is detached from the more conventional economic market considerations described in the following. It rather takes a starting point in a techno/socioeconomic optimisation where the fundamental concept is that markets are constructed, so that what is viable from techno/socioeconomic point of view can be made viable also in a market economic perspective by constructing the market appropriately. So the approach is what might be labelled institutional feasibility study. The difference from an ordinary market perspective is of course that these are performed under specific existing market-defining settings that may or may not

promote technologies or solutions that are favourable from a socioeconomic perspective.

Description of the frame-work conditions and barriers for implementing RES FC systems

The description of the framework conditions must contain a summary of the main frame-work conditions regarding the technology in question and most notably also any barriers against the introduction or use of the technology. This will form a starting point for the remainder of the market development plan, where these barriers are sought overcome. In the context of this specific project, this corresponds to taking a point of departure in the findings regarding barriers and framework conditions established in the work of package 2.

This framework description and barrier analysis should cover appropriate areas which can be

- Organisational issues – e.g. how the current organisational structure is and whether there are important actors with vested interests that can form barriers against the implementation of the technology. This may also treat issues such as vertical and horizontal integration in the energy sector and the impacts of this on the potential market for RES FC systems. Vertical integration refers to energy sectors characterised by more or less direct cross-ownership in the energy supply from fuel to final distribution of energy to consumers. E.g. power producers owning transmission companies that in turn own distribution companies – or vice versa. Horizontal integration refers to situations where there is a tendency of monopoly within the different levels of the energy supply chain – e.g. distribution. It also refers to situations where e.g. gas distribution, electricity distribution and district heat distribution is within one single company. In common for horizontal and vertical integration is that the institutional setups may not be so accommodating for new companies entering the market.
- Economic issues – e.g. prices of sold electricity to the grid, cost of electricity bought from the grid; avoided and incurred taxes and subsidies; market description in case a power pool is present, the general issue of feed-in tariffs versus market-based prices. The economic issues also include less conventional areas such as payment for regulating power and payment for the supply of ancillary services where applicable.
- Legislative issues – e.g. most notably obligations of transmission system operators to purchase electricity from independent producers – but also e.g. technical standards to grid connected systems or technical requirements of systems to operate in normal dwellings that may impede the introduction of RES FC systems if the standards are not fair and level for different

technologies. I.e. if they are too rigorous and thereby form an unnecessarily strict barrier against the implementation of the technology. If for instance it is require that actors operating on spot markets or on regulating power markets are of a certain size – and if this size is not based on concrete technical considerations, then this may form a barrier against the RES FC units operation.

Identification of relevant stakeholders

The stakeholders are very important for the implementation of the RES FC technology, and involvement of the potential stakeholders is important in the development of market development plans due to their crucial roles as carriers of technology (see later) and due to their perception of the potential barriers and means to overcome these.

Relevant stakeholders include various companies or entities within the following list:

- Energy supply (potential suppliers of the primary energy source – e.g. electricity or biomass for biogas or alcohol)
- Energy transformation (potential suppliers and potential owners of the equipment producing and distributing biogas, alcohol or hydrogen)
- Energy end-use (potential end-users of biogas, alcohol or hydrogen; potential users of heat)
- Energy buyers (mainly utilities buying electricity from RES FCHS)
- Ancillary service buyers (TSOs buying regulating power, and voltage and frequency regulation)
- Potential users of other by-products (e.g. de-gassed biomass used to improve soil quality)
- National, regional, country, municipal authorities setting framework conditions

In the identification of the relevant stakeholders, a brief description of the stakeholders' influence on the technology-system in question is required. The stakeholder description ends up with an actor analysis (see separate template) identifying technology carriers.

All parties with an influence on the implementation on a project or parties that are being influenced by a project are denoted "actors". The aim of the actor analysis is to identify the most important actor; the actor that has the power to introduce the technology, ensure its successful implementation into the energy system and ensure that the technology will remain in use. This actor is called the "Carrier of technology" as detailed on the following page.

Carriers of technology: A carrier of technology is an actor (a person or an organisation) able to influence the direction of technological change in the society. In the context of RES FC Market, it is an organization with the capability and interest in implementing a technology based on small-scale RES FC systems in dwellings

In order to be a carrier of technology, a number of preconditions must be met.

1. The actor(s) must have an interest in choosing, innovating and implementing the technology or at least a component of the technology
2. The actor(s) must have sufficient social, economic and political power to materialise its interests
3. The actor(s) must be adequately organized to be able to formulate and decide what technology is able to solve their problems.
4. The actor(s) must have information about the existence of the technology – or at least a component of the technology.
5. The actor(s) must have access to the technology
6. The actor(s) must have or must be able to gain sufficient knowledge about how the specific technology is used.

These points are based on work by professor Anne Lorentzen with subsequent paraphrasing by associate professor Marianne Rostgaard, Aalborg University, Denmark.

All actors must be identified, listed and considered vis-à-vis points one through six above. This must be followed by an overview of the actors using the table below for easy identification of the carrier(s) of technology.

	Actor 1	Actor 2	Actor 3	Actor 4	Actor n
Interest					
Power					
Organisation					
Information					
Access					
Knowledge					

Finally, as a summary of the actor analysis, deliberate whether the conditions are adequately satisfied to have a “carrier of technology”. Also deliberate whether any actor not fulfilling the requirements can be “up-graded” to become a carrier of technology – and how.

Involvement of relevant stakeholders and stakeholder analysis

Use the actor analysis in subsequent talks with the actors to ensure that potential barriers are overcome. Consult with the relevant stakeholders regarding how to overcome barriers and determination whether they are bound by other stakeholders’ conditions. There is no simple and unequivocal way to describe this process apart from the fact that it is necessarily an open-ended process and that it is very important getting the input from the actors as these are the ones with direct and immediate influence on the implementation at the same time as these are directly impacted by any hindrances giving them very concrete motivations to overcome these hindrances in order to expand their business. As identified in the German Market development plan in Deliverable 3.1 of this project, it is an impediment that producers of methanol are focusing their attention on the transport sector, This would be an issue to address.

Developing the Market Development Plan

In the development of the MDP plan, three issues are addressed:

The core of the market development plan is an economic assessment of the use of the technology, demonstrating the technologies’ economic feasibility. The economic assessment of the market development plan contains all relevant information on economic conditions surrounding the technology.

Secondly, organizational conditions are addressed with a basis in the actor analysis.

Thirdly, any regulatory changes that are required for the successful implementation of the project are outlined.

Optimally, the market development plan includes actual agreements with relevant partners on establishing the required pre-conditions to make the regional market for the technology in question viable.

Summary

Main findings and recommendations: The market development plan ends up with a step by step summary of what must be done to establish the market including the

specific requirements at each different level – e.g. who should own the various technologies (fuel-production, RES FCHS, distribution grids), should energy technology requirements be included in municipal or regional plans, grid connection requirements, feed in tariffs or establishment of an obligation for TSOs to pick up excess electricity generation from small-scale producers.

The summary must also contain a time-line of the proposed market development plan – outlining the planned development as well as any changes that are foreseeable or expected along the way such as changes in costs or the entrance of new actors or relevant technologies on the market.