

Case Study 18

Samsø - renewable energy island programme

Denmark



Samsø Energy Academy

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Changing Behaviour



Work package 2

Development of the conceptual model: Analysis of success factors, underlying models and methods in target group interaction

Case Study 18:

Samsø - renewable energy island programme

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Content

| | |
|--|----|
| Summary of the case | 5 |
| Step 1: Context of the programme | 6 |
| <i>National context in general</i> | 6 |
| <i>Local context</i> | 6 |
| Step 2: Focus of the programme | 8 |
| <i>General issues, initiator and partners</i> | 8 |
| <i>Problem definition, goals, objectives and target group</i> | 8 |
| Step 3: Design of programme | 10 |
| <i>What knowledge and ideas informed the design of the programme?</i> | 10 |
| <i>Research conducted on target group</i> | 10 |
| <i>What barriers, motives and capacities did the programme aim to target?</i> | 10 |
| <i>The intervention methods/instruments and activities used</i> | 10 |
| <i>Participation and commitment</i> | 11 |
| <i>Communication, learning, evaluation and monitoring</i> | 11 |
| Step 4: Process of programme | 13 |
| <i>Interaction between the different participants</i> | 13 |
| <i>Reaction of the project manager to issues/problems</i> | 13 |
| Step 5: Outcome of process | 15 |
| <i>Objectives/goals/outcomes/effectiveness</i> | 15 |
| <i>Social learning</i> | 15 |
| Step 6: Analysis and conclusion | 17 |
| References..... | 18 |

Summary of the case

A small Danish island Samsø won the contest to be “Denmark’s Renewable Energy Island” in 1997. It meant that Samsø would be expected to convert all its energy supply to 100% renewable energy within 10 years. The means to achieve this included: Cuts in consumption and increased efficiency in terms of heat, electricity and transport; Expansion of the district heating supply systems combined with utilization of local biomass resources; Expansion of individual heating systems using heat pumps, solar heating, biomass-plants and other means; Construction of land-based and offshore wind power plants to cover electricity production.

The programme was very ambitious, because it tried to change the energy production and consumption of a whole island within a decade. Before the project started, Samsø didn’t have any conventional energy resources of its own. All fossil fuel had to be transported by tankers, and electricity by connecting to the mainland grids.

A large network of different actors evolved to support the project. In addition to the RE island project personnel, also private citizens of Samsø, Samsø municipality, Danish Government, and local and external business took part in the project. An energy plan, that investigated the available resources and made a rough time schedule to the project, was made by PlanEnergi, an independent consultancy firm specialising in renewable energy, environment, sustainable systems, energy planning and technology transfer. The plan was used as a guideline through the project.

At first, the citizens were invited to participate in work groups for the planning and development work. In these meetings the citizens were given information about the costs, payback time, possible technological solutions etc. Local citizens were also involved in choosing the technologies that were going to be used in the project. Later in the project, they also made financial investments to these technologies.

The project conducted several campaigns that aimed to give knowledge and practical abilities to local citizens to save energy and get acquainted with renewable energy technology. These campaigns included education and certification of local entrepreneurs, house calls by energy advisors, and energy saving campaigns.

Overall, the renewable energy island project must be deemed almost completely successful, because it fulfilled most of the goals that were set. The primary objective - 100% self-sufficiency with renewable energy using local resources - has been achieved in 8 years, two years ahead of time. Other accomplishments include three new district heating plants that were built and 10 offshore and 11 onshore wind turbines that were established. The project was less successful in the transportation sector and in behavioural changes that the project aimed at.

The results of the project are communicated both to the local populace and the world at large. Local media have been used extensively, both to inform and mobilize participation in different activities, as well as to give status reports about the progress of the project. The results are broadly presented also in international media coverage. The success of the project can also be seen in growing interest of renewable energy tourism. Samsø Energy Academy, that was opened in 2007, is now the basis for renewable energy research, education and training.

Step 1: Context of the programme

National context in general

Denmark is located in Scandinavia, Northern Europe. The country consists of a large peninsula, Jutland and many islands, most notably Zealand, Funen, Vendsyssel-Thy, Lolland, Falster and Bornholm, as well as hundreds of minor islands. Denmark is a rather small country, 43,000 km², that has 5,5 million habitants, and is quite densely populated.

Denmark is a wealthy nation with a high standard of living. Because of energy taxes, Denmark has the highest household electricity prices in the world, while industries pay just below EU average. Most electricity is produced from coal, but Denmark also uses a lot of wind power.

The Danish energy sector has a fairly decentralized structure and a high degree of co-operative and municipal ownership. Together with the central government, the municipalities participate in the decisions on fuel choices, waste incineration and surveys on renewable energy sources. Many district heating and co-generation companies are owned by co-operatives or municipalities. (IEA 2006b)

Denmark has a longstanding tradition of community ownership and civic engagement in renewable energy. For example, it is estimated that approximately 150 000 families have an ownership stake in wind energy projects. Due to this co-operative tradition, acceptance of renewable energy is reported as being high. (Sørensen et al, 2001; Predac 2003.)

Denmark has a long history of energy policy that aims to save energy and support the use renewable energy. The Danish Energy Authority (established in 1976) is responsible for laying down guidelines for the best possible production and distribution of energy. Recently it has administered, for example, subsidies for energy savings and green energy taxes, liberalization of the electricity and gas markets, and the introduction of CO² quotas. (<http://www.ens.dk/sw12333.asp>)

Government support has been very important in increasing Danish renewable energy production. This has included intensive R&D investment in renewable energy, as well as early capital grant schemes, investment incentives and purchasing agreements (later converted to feed-in-tariff). The current government has sharply curtailed subsidies for renewable energy, as it believes they are no longer necessary or compatible with competitive markets (IEA 2006).

Local context

Samsø is an island located in the North Sea bay of Kattegat, between the mainland of Jutland and the island of Zealand. The island has 4,100 inhabitants and covers 114 km². Its main activities include farming, tourism, and - lately - renewable energy. Samsø is a small island and community, where almost all the residents know each other. Therefore, trust isn't a problem, when the locals are interacting with each other.

In 1997 Samsø won the contest to be "Denmark's Renewable Energy Island". The aim of the RE island project was to convert all of Samsø's energy supply to 100% renewable energy within 10 years. It's a one-of-a-kind experiment and there isn't any historical predecessors for a project like this.

Energy behaviour and climate issues hadn't really been in the focus in Samsø before, but ever since the Renewable Energy Island project started, there has been a growing interest in these

issues. Nowadays the Samsingers are very committed to using and promoting renewable energy.

Samsø Energy- and Environmental Office was established in 1997 to promote the Renewable Energy Island project and to counsel the citizens who wanted to establish their own renewable energy projects. Its main partners were Danish Energy Agency, Århus Regional Authority and Samsø Municipality. Other partners included Samsø Business Forum, Samsø Farmers Association and Danish Ministry of Energy. In 1998, Samsø Energy Company was founded to implement RE projects, especially wind turbine and district heating projects. Together with Samsø Energy- and Environmental Office they also organized campaigns and meetings.

Before the project started, Samsø didn't have any conventional energy resources of its own. All fossil fuel had to be transported by tankers, and electricity by connecting to the mainland grids. Since then, Samsø has invested heavily on local energy production: wind power, biomass, and solar energy. Being a very windy island, Samsø is an ideal location for wind turbines. There are currently 10 offshore wind turbines and 11 onshore wind turbines on the island. Local agriculture provides a base for production of biomass, mainly straw and wood chips.

Renewable Energy island is an individual project, but for a while (1998-2002) it was also a part of the EC's ALTENER Programme that encouraged the development and expansion of an already-viable market for renewable energy sources by, among other things, promoting islands and small cities towards becoming 100% reliant on renewable energy. Subsidies were received from the ALTENER programme.

Step 2: Focus of the programme

General issues, initiator and partners

The programme started in 1997, when Samsø won a renewable-energy contest, sponsored by the Danish Ministry of Environment and Energy, and was named “Denmark’s Renewable Energy Island”. It meant that Samsø would be expected to convert all its energy supply to 100% renewable energy within 10 years. An engineer, who didn’t even live in Samsø, thought the island would make a good candidate, consulted the Samsø major, drew up a plan and submitted it. To everyone’s surprise in the island, Samsø won the contest.

At first, Samsø received basically no benefits from the government: no prize money, no tax breaks, and not even government assistance. The interest of the Samsingers started to fade. Then some government money was found to fund a single staff position in the programme. Søren Hermansen became the project’s first employee and he tried to get the programme really going.

The start was slow and not much happened. Hermansen knew the community, and that the Samsingers were conservative and hesitating, and waited for the neighbors to do the first move. Tiredly he participated the local meetings and brought up the renewable-energy project. At the same time he tried to get the support of the island’s opinion leaders. When he got them involved and being active, the same social dynamic that had first stalled the project, began to work in its favor. When more people got involved and were active, that prompted others to follow. And when enough people were in, the participation became the norm. The Samsingers got excited about the project and energy issues became a kind of sport where everyone tried to excel. Also, it was important that the first onshore wind turbines proved to be good investments. That made it easier for farmers and other investors to join the next projects.

The project used a rough timetable that was included in the energy plan made by PlanEnergi. The aim of the project was to convert all of Samsø’s energy supply to 100% renewable energy within 10 years, but renewable energy issues are going to be on the agenda even after that.

The project did not have a fixed budget. At first, financial resources came primarily from Danish Energy Agency, Århus Regional Authority and Samsø Municipality. But most of the investments of the project have come from local residents. A qualified guess is that 53.3 million EUR has been invested into the project, and 4 million EUR has come from public subsidies.

Problem definition, goals, objectives and target group

The aim of the programme was to change the island of Samsø to be supplied with 100% renewable energy within 10 years. The most important means to achieve this were:

- Cuts in consumption and increased efficiency in terms of heat, electricity and transport by the introduction of up to date energy technologies and adjusting people’s behaviour patterns.
- Expansion of the district heating supply systems combined with utilisation of local biomass resources.
- Expansion of individual heating systems using heat pumps, solar heating, biomass-plants and other means.
- Construction of land-based and offshore wind power plants to cover electricity production.
- Gradual conversion of the transport sector from petrol and oil power to electrical power, and later on hydrogen. (http://ec.europa.eu/energy/idaeu_site/depoy/prj029/prj029_1.html)

The original master plan of the project included detailed plans and calculations. These plans changed along the way, when local residents took part in the planning processes.

The target group of the programme was all the residents of Samsø island, 4.100 people in all. Demographically the target group is very heterogeneous, but culturally quite homogeneous. The project tried to reach the Samsingers in many roles: as citizens, consumers, household owners and property owners.

It could be said that the programme was very ambitious, because it tried to change the energy production and consumption of a whole island within a decade. The goals included changing of people's behaviour patterns and building of new infrastructure, like the wind turbines and solar panels.

Step 3: Design of programme

What knowledge and ideas informed the design of the programme?

The Samsø Renewable Energy island project was not based on any formal theories of human or organizational behaviour. Rather, it was based on a vision that the project should be approached by a bottom-up method by creating citizen involvement right from the start. It was a rather loosely organized project, where the ideas and methods evolved along the way.

Research conducted on target group

The project started after winning a national competition, and there wasn't any research conducted prior to its start. Instead, the project was based on strong local grass-root knowledge of the people and conditions in Samsø.

What barriers, motives and capacities did the programme aim to target?

The project initiator knew that the local people were conservative and reluctant to new ideas. The aim of project initiator was to get the support of the island's opinion leaders. When he got them involved and being active, more and more people got involved and were active, and that prompted others to follow.

The project conducted several campaigns that aimed to give knowledge and practical abilities to Samsingers to save energy and get acquainted with renewable energy technology. These campaigns aimed at e.g. savings on household heating and conservation of energy.

The programme was designed so that the target group would also have other benefits than energy savings as a result of their behavioural change. They would get economical benefits not only from saving energy but also from making investments to new technology, like wind turbines. The project also relied on the social benefits that it would create when the Samsingers would work together to contribute to renewable island project.

The intervention methods/instruments and activities used

The intervention started after Samsø had won the national renewable energy competition. It was coincidentally timed and positioned so that it took place in the middle of the rising environmental awareness and governmental subsidies for environment friendly actions.

The project used several methods to get people involved in the project. Some of the intervention methods were preplanned, some were chosen along the way. At first, they invited citizens to participate in work groups for the planning and development work. Local citizens were also involved in choosing the technologies that were going to be used in the project. Later in the project, they also made financial investments to these technologies.

The intervention methods included also:

- Education and certification of local blacksmiths and plumbing and heating service providers, so that they could install renewable energy equipment and systems.
- Energy exhibition in 1998, where RE was presented.
- Personalised approaches and advice in the form of house calls by energy advisors, who evaluated the insulation and energy solutions of the households and gave recommendations.
- Demonstration of alternative materials for insulation, which included insulation of selected houses and presenting the results for interested parties.

- Energy appraisal and energy savings campaigns in small villages, that are outside the district heating system.
- Energy saving campaigns that promoted low energy light bulbs, low energy appliances and improvement of consumption habits.

There were incentives available to finance the purchasing of new technology. According to the calculations, the wind turbines would pay themselves back in 8 years. District heating was immediately cheaper than using oil, and solar panels would also make savings in the long run. There were also government subsidies available for households, e.g. installing RE heating and electricity systems

Issues of trust were never really a problem in this project, because the planning and decision making was strongly in the hands of the local residents. The whole project was based on an open, trustworthy environment.

The technical solutions (wind turbines, district heating plans, solar panels), that came along the project, and the behavioural changes that they create, are lasting and will outlive the project.

The project itself - although it has its origins in a competition - didn't have an element of competition in it, officially, at least. Unofficially, the residents of Samsø were competing with each other in the field of environment friendliness. It became a sort of sport. And when island got international visibility, it encouraged the residents even more.

Participation and commitment

In the beginning, the aim of project initiator was to get the support of the island's opinion leaders. When he got them involved and being active, more and more people got involved and were active, and that prompted others to follow. Then he invited citizens to participate in work groups for the planning and development work. Locals were also involved in choosing the technologies that were going to be used in the project. The locals also made financial investments to these technologies.

The programme had high-level support. It was started by the Danish Government. The Samsø Municipality was supportive and involved from the beginning. The project aimed to use the social pressure generated by a small community to promote the programme, and succeeded in that.

Communication, learning, evaluation and monitoring

The renewable energy island project did not have a specific communication plan. Nevertheless, local media have been used extensively to inform about and mobilise participation in different activities, and to give status reports about the progress of the project.

Information about the project was also presented in the numerous meetings that took place during the project. In these meetings the Samsingers were given information about the costs, payback time, possible technological solutions etc.

Samsø Energy Academy, that was opened in 2007, is now the basis for research, education and training. It's a community hall for energy concerns, a meeting place for energy and local development. They also operate a school service that prepares educational materials and confronts a large number of local and visiting school classes with a "hands-on" learning experience.

A 10-year evaluation report of the project was published in 2007. It was made by Peter Jacob Jørgensen from PlanEnergi, together with Samsø Energy Academy. The report looks back and evaluates how the ambitious goals of the original master plan have materialised.

Samsø Energy Island is a display window for Danish RE technology. It's achievements are presented in broad media coverage. In that way the lessons learned from the project are disseminated to all interested parties. Also, all the networks that they were involved in, work a way to disseminate the results.

Step 4: Process of programme

Interaction between the different participants

A large network of different actors evolved to support the project. In addition to the RE island project personnel, also private citizens of Samsø, Samsø municipality, Danish Government, and local and external business took part in the project.

At first, the project initiator got the local opinion leaders involved and being active. Then more and more people got involved and were active, and that prompted others to follow. Probably most of the Samsingers were somehow involved in the project; some were more active than others (e.g. those who took on the RE technology or invested in the wind turbines).

The network of participants grew along the way. More and more parties, who could realise their own interests, came along. The main project was divided into several subprojects, in which the participants could negotiate the different expectations.

The participants and their tasks and roles can be presented as follows:

| Participants | Tasks and roles |
|----------------------|--|
| RE project personnel | Initiator Planning Information provider Provides contacts |
| Citizens | Participating in planning Bring out their interests Choosing and implementation of RE technologies Economical investments |
| Municipality | All kind of support (incl. financial) |
| Business | Learning RE technology Installing RE technology Implementing the projects |
| Government | Initiator Subsidies |
| Other organizations | Support Know-how |

Reaction of the project manager to issues/problems

There were some problems during the project, e.g. when they tried to implement district heating plans in open countryside or introduce electric cars in the island. If the original plan encountered problems, then they usually tried to solve it another way. E.g., when it came evident that a proposed district heating plant couldn't produce heat to four villages (as planned) without a large heat loss from the distribution system, they changed the plan so that district heating plant would cover only the two nearest villages. In some cases, if the original plan didn't work at all, then they abandoned it. Like in the case of electric cars, when it came evident that there wasn't a market for them.

There was also an external problem to be faced, when in 2001 Birdlife Denmark opposed the building of the 10 offshore wind turbines, claiming they would disturb over 20 species of birds. The issue was resolved (it's not documented how) and the wind turbines erected.

There wasn't really a system of feedback in the project. Nevertheless, the participating citizens and organizations had their saying about each subproject, and were able to influence it. The participation to these projects was voluntary, so perhaps it could be seen as a form of feedback, if people didn't take part.

Step 5: Outcome of process

Objectives/goals/outcomes/effectiveness

Overall, the project must be deemed almost completely successful, because it fulfilled most of the goals that were set. The primary objective - 100% self-sufficiency with renewable energy using local resources - has been achieved in 8 years, two years ahead of time.

Three new district heating plants were built: one that uses wood chips and solar heating, and two that use straw. Private installations included, a rough estimation is that 70% of the total heat production is now produced by renewable energy. However, the heating sector was only partly successful. Heat consumption aimed at 25% reduction, but instead ended up with 10% increase.

New wind turbines were established: 10 offshore and 11 onshore. The electricity production exceeded its goals: The production not only covers fully the electricity consumption of the island, but also compensates the energy used in the transportation sector. Savings in electricity consumption weren't that successful. The project aimed at 15% reduction, but achieved only 3-4%.

The transportation sector was the least successful. The aim was to reduce the energy consumption of transportation by 5-10%, but instead it increased by 5%. The few projects in this sector, like the electric cars, failed. The pragmatic solution to this was to compensate the energy used in the transportation sector by the surplus energy from the offshore wind turbines.

The behavioural changes that the project aimed at, were not successful. The achievements in energy savings and conservation were minimal, despite of the several campaigns aiming to reduce the energy consumption.

The success of the project was evaluated in an evaluation report in 2007 (Samsø - a Renewable Energy-Island. 10 years of Development and Evaluation). The evaluation was done by PlanEnergi (which is an independent consultancy firm specialising in renewable energy, environment, sustainable systems, energy planning and technology transfer) and Samsø Energy Academy. In the report, the project was deemed almost completely successful.

The project was quite cost-effective. The original calculations estimated that in order to succeed, the project would need 78.7 million EUR investments and 9.1 million EUR public subsidies. The main goals were achieved with much less money: 53.3 million EUR investments and 4.0 million EUR public subsidies. The project also gained economic savings and profits to those who participated.

Social learning

Samsø Energy Academy was established in 2007. It's a community hall for energy concerns, a meeting place for energy and local development. The Energy Academy houses the renewable energy organizations of Samsø Energy Agency, Energy Service Denmark and Samsø Energy and Environment office. It also provides RE education and communication by mediating workshops, conferences and exhibitions.

The results of the project are communicated both to the local populace and the world at large. Local media have been used extensively, both to inform and mobilise participation in different activities, as well as to give status reports about the progress of the project. The results are broadly presented also in international media coverage.

The success of the project can also be seen in growing interest of renewable energy tourism. The island has welcomed several different kinds of RE tourists since project started: political visitors, government professionals, private businessmen, students, and also vocational tourists.

Some of the changes brought by the RE island project have been sustainable and durable. The changes to technology and infrastructure have been successful, but the behavioural changes - energy saving and conservation - that effect the consumption have not been successful.

Even though the project has achieved its main goals, the renewable energy is going to be an important element in Samsø. The new RE infrastructure and the new RE organisations guarantee this.

Step 6: Analysis and conclusion

The five most crucial factors influencing the project's success are:

1. The economic benefits of the programme. The islanders have gained economic benefits from the programme in several ways. It has brought investments and more tourism to island, and thus generated jobs. The residents are shareholders in the wind turbines and are gaining profits from it. The price of heating energy has decreased after the early investments have paid off.

2. Local participation. The islanders have participated in the project in many levels. They have taken part as individual citizens, consumers, household owners and property owners. They have also participated through their own organizations like Samsø Trade Organisation, Samsø Farmers Organisation and Samsø Municipality. Also local business has been heavily involved. The project has also represented several new ways of organizing, financing and ownership. Multi-level participation has probably had a positive effect on the outcome. The Samsingers had a sense of "ownership" for the project and were comprehensively involved in it. It also emphasised the bottom-up approach of the project when the islanders could bring forward their preferences in several roles and situations.

3. Use of existing networks and organizations. The project was based on networks and communities that already existed. That increased the reliability of the project. The project initiator was a local insider, who knows the locals and their habits, is already inside the community, and thus trustworthy.

4. No free-riders. Many - if not all - are taking part. The social pressure works on two levels: the participants can presume that their action really can change things, when they are working together; the social pressure also creates habits and norms.

5. The goals for savings in electricity usage and heating failed. This failure might be a consequence of the success in other fields. People seem to "distrain" the benefits they get elsewhere (e.g. in home insulation and economical savings). When people get better insulation, they heat their home as much as used, and get a warmer home. Also, the trend to build larger houses increases heat consumption. And when people save money in using local electricity and heating sources, they buy more electric appliances that use energy. It could be that people felt that they deserved a "reward" after all the hard work they did for the project. It could also be that the positive social dynamics that worked in favour of building RE production units did not work in the field of energy savings. Energy savings are more of a private matter that takes place within homes. It lacks the joy of doing things together and the results are not that spectacular (compared to e.g. a wind turbine built through common effort). Also, the targets of energy savings are more undefined and the process itself infinite, compared to e.g. building RE production units, where you can clearly see when the project is finished.

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