TAMK UNIVERSITY OF APPLIED SCIENCES
Environmental Engineering

Final thesis

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SUSTAINABLE VILLAGE IN NORTHERN CONDITIONS - ALTERNATIVES FOR SUSTAINABLE ENERGY PRODUCTION IN RURAL AREAS

Supervisor Senior Lecturer Eeva-Liisa Viskari
Comissioned by Sustainable village in Northern conditions –project/Outi Palttala
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ABSTRACT

The aim of this work is to find sustainable solutions for renewable energy sources to sustainable villages and ways how to support financially the usage of this kind of solutions. The study is mainly done by studying electronic- and literal data sources. Also visit to sustainable village located in Kangasala and questionnaire done via e-mail was included to the work. Finding reliable information turned up to be quite challenging in the end. Most of the material concerning funding and legislation could only be found in native language of these countries. It was surprising that any of the villages in survey did not have any funding to build up environmentally friendly solutions.

TIIVISTELMÄ

Kestävän kehityksen kylillä tarkoitetaan kylä yhteisöä joka pyrkii kaikissa ratkaisuissa mahdollisen ekologiseen tapaan elää. Energia ratkaisuissa tämä tarkoittaa ekologisinta sähkö ja lämmitys vaihtoehtoa mikä vain on mahdollista. Sähkön suhteen tämä tarkoittaa Suomessa lähinnä eko sähkön ostamista sähköyhtiöiltä sillä ainakin tällä hetkellä on lähes mahdoton olla omavarainen sähkön suhteen Suomalaisissa ilmasto olosuhteissa. Tulevaisuudessa tilanne tulee todennäköisesti muuttumaan, sillä myös Suomi on ottamassa käyttöön syöttö tariffi järjestelmän joka takaa myös pien tuottajille kohtuullisen hinnan verkkoon syötetystä ylimääräisestä sähköstä. Tämä järjestelmä on toiminut erittäin menestyksekkäästi esimerkiksi Saksassa jossa se on lisännyt varsinkin tuulivoiman määrää merkittävästi.

Merkittävä ongelma koskien kylien ekologisuutta on sijainti. Usein nämä kylät sijaitsevat syrjässä kaupungeista ja yleisen liikenteen väylistä. Asukkaiden on kuitenkin käytävä töissä ja asioilla mikä taas aiheuttaa pitkiä matkoja yksityis- autoilla ja tietenkin päästöjä siinä samalla.

Tämän työn tavoitteena on tutkia Ruotsalaisten, Tanskalaisten ja Saksalaisten kestävän kehityksen kylien käyttämiä ratkaisuja koskien energian tuotantoa sekä käyttöä sekä sitä onko nämä ratkaisut mahdollisia myös Suomen ilmasto olosuhteissa.

Osana työtä oli kysely joka tehtiin sähköpostin välityksellä, kysely sisälsi kysymyksiä koskien kylien käyttämiä ratkaisuja sekä mahdollista rahoitusta. Yllättävää kyllä yksikään kylistä ei ollut saanut tai hakenut rahoitusta energia ratkaisuihinsa. Suurin osa kyselyyn vastanneista kylistä hoiti talojen lämmityksen puu lämmityksellä, myös sähkö lämmitystä käytettiin lähinnä tukemaan puu lämmitystä. Yksikään kylistä ei ollut täysin omavarainen sähkön suhteen.

LIST OF ABBREVIATIONS

EU – European Union

CO_2 – Carbon dioxide

RES-E – Electricity from renewable energy source

EREC - European renewable energy Council

PEM - Proton exchange membrane fuel cell

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1 INTRODUCTION

In the future energy will become more and more expensive at the same time when reserves of fossil fuels diminish. Acceleration of green house effect will also set limits for using unsustainable ways to produce energy. All EU countries have committed to cut down their carbon dioxide emissions by 20% and increase energy production from renewable energy sources to 20% from all energy produced. To achieve these goals it would be important that also small scale RES-E production would increase. This work processes energy issues through sustainable village's point of view. /19/,/10/

Encyclopedia Britannica defines sustainability as "being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged"/2/. When talking about energy production and consumption in a sustainable way of living, the sustainability means avoiding the use of unsustainable and non-renewable energy sources. To make definition of sustainable energy more difficult there are some exceptions. An energy source can be renewable, but still unsustainable. For example water energy could be unsustainable if constructing large water reservoirs will destroy valuable wilderness areas.

Insulation makes a big difference in energy consumption of houses. With better insulation less heat is needed to heat buildings. This way also less fuel is needed. Structures of house makes big difference as well it is possible to make house in such way that it will utilize the natural heat of the sun.

Transportation is one key factor which makes or breaks whether living is sustainable. Very often villages that aim at sustainable and environmental friendly way of living locate in isolated areas with long distances to work places and services. Best option for transportation would be public transportation but unfortunately in rural areas possibilities for that are often very limited. Next best option would be using electricity or renewable fuels to power cars. At the moment there are not too many options to do this economically but in the future there are many options such as bio diesel,

electricity, hydrogen and many others. Often even if the way of living generally would be sustainable, the need for transportation can make living even more unsustainable than living in cities for example /1/.

1.1. What are sustainable villages?

Sustainable villages are usually located in rural areas. Main principle is to live in a way that will stress environment as little as possible. Villages often have own sanitation and dry toilet systems. Also energy and heat production have been arranged as environmental friendly way as it is possible. There is often also social aspects related to these villages inhabitants do work together in task which are related maintaining villages. Sometimes even some small scale agriculture is taking place.

1.2. Aim of the study

Aim of this work is to find out how sustainable villages in Sweden, Denmark and Germany have managed their energy issues and if it would be possible to implement same methods in Finnish climate.

2 ALTERNATIVES FOR SUSTAINABLE ENERGY PRODUCTION

There is a lot of different ways to produce sustainable energy although there is a lot of discussion whether some thing is sustainable or not. Good example about this is Finnish peat production. There is a lot of industry around peat in Finland and there would be plenty of raw material to produce electricity and fuel for transportation for long time. Problem is that for peat it takes thousands of years to renew. Other problem is that peat is binding a lot of CO_2 and by utilizing peat this CO_2 would get in to atmosphere very rapidly. This proves that even if something seems very ecological it might be quite opposite of that. Same problem considers bio fuels. They are good option as long as they are produced from waste for example. But if fuel is produced from palm oil

cultivated in some third world country far a way then it is not sustainable anymore. /5/

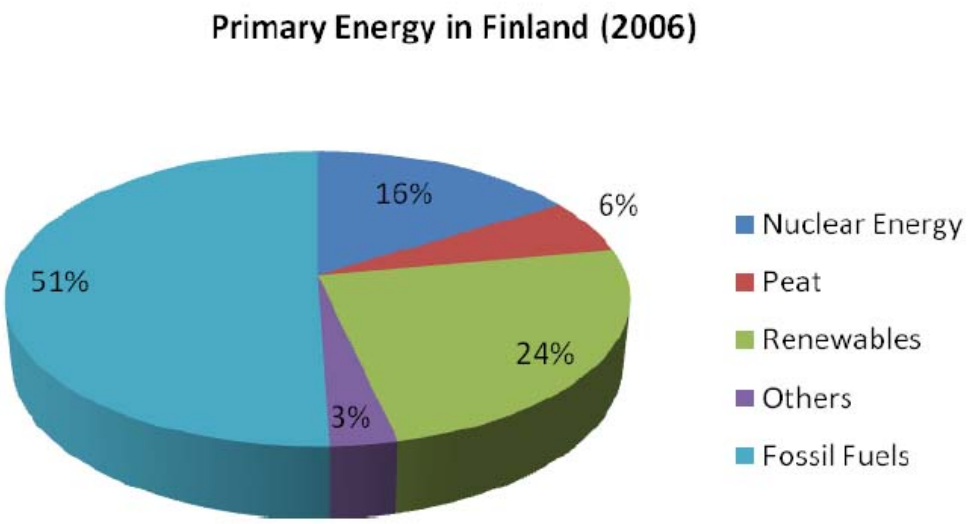

Figure 1. Primary energy production in Finland according to EREC/5/

. In Figure x the primary energy production in Finland is presented. It shows that in Finland only 24 % of the energy is produced using renewable energy sources. Finland is dependent about energy produced with fossil fuels. About half of the energy is produced with fossil fuels.

3 Electricity

Electricity plays very important part in today's community. Without electricity it is impossible to use computers, information networks, lightning, electric tools and etcetera. Basically it is impossible to live modern life without electricity.

Legislation in Finland is changing in near future in a way that it makes possible to produce electricity and sell it to the grid in fixed price. This is very critical change to current situation.

The way how electricity is used in sustainable villages is very critical when considering the level of sustainability. Basic rule for sustainable electricity is that it is produced by using renewable energy sources for example solar power, wind power, hydropower, and biomass etcetera.

If someone wants to have electricity from renewable energy sources there are two options, either to produce it locally or buy ecological electricity from the grid. In this chapter I have mainly concentrated in methods to produce electricity locally.

When thinking practically the only realistic ways to produce electricity locally in Finland at the moment are photovoltaics, wind power and biogas. All of these are very good options, but at least with photovoltaic's it would be really difficult to produce enough energy to cover whole household consumption in Finnish climate conditions at least during winter time. This is why it is necessity to be connected also to the electric grid. It would be important that also Finland would adapt the feed-in tariff system as soon as possible. This system would make it possible to utilize small scale production of RES-E. At the moment Finnish system does not encourage for small scale production of RES-E. Grid connections and feed in tariffs are only for large companies. For example in Germany system favors small scale production of RES-E by using feed-in tariffs. At the moment RES-E produced locally is supported only by tax reliefs and investment subsidy. It is easy to see that this is not enough when

consider that share of electricity produced by wind is les than 1% of whole electricity production in Finland./10/,/25/

3.1.1 Photovoltaics

Technologies for solar cells have been available already for quite a long time. In the beginning solar cells were quite inefficient and expensive, but now prices are more reasonable and output is much better.

In the Finnish climate there are some problems related to use of solar cells. Snow and long dark periods during winter do cause some problems on the effective usage. On the other hand there is a lot of light available around the clock during summer time, when the need for electricity for heating is lower.

3.1.2 Biogas

Technology of utilizing biogas is already existing and in use in many places. In sustainable villages biogas could be manufactured from the biowaste and sanitation waste from toilets. Depending on the size of villages it could be so that amount of bio-sanitation waste is too small for efficient production of biogas. This is not necessarily a problem if village is located near cattle farm for example because then it would be possible to combine waste of the farm and village to achieve necessity amount of waste to produce gas efficiently.

Production of biogas can be economically very profitable. Legislation in Finland is changing in near future in a way that it makes possible to produce electricity and sell it to the grid in fixed price. Technology needed is rather simple. There is also many other advantages beside of electricity production and economic aspects. When bio waste/manure is going trough process it will dry, pathogenic bacteria will die due to heat in process and waste doesn't smell any more. /6/,/25/,/4/,21/

Figure 2. Biogas plant /6/

Working principle of biogas plant is based on fermentation of biomass in anaerobic environment. Bacteria's growing in a certain temperature produces methane which can be used to produce electricity trough generator.

Biogas is burned and converted in to electricity trough the turbine and generator efficiency of this process is not very good because lot of energy is lost as heat but if excess heat is recovered and used for heating process can achieve good efficiency./8/

3.1.3 Bioreactors

Bioreactors in hydrogen/electricity production have not been widely utilized at the moment. This field is under intensive research but it seems that here could be a lot of potential in a future because of various different fuels which could be used in reactors. Many of these fuels could be something which is basically bio waste at the moment./2/

Bioreactor does not produce electricity by itself but it gives way of producing very clean energy. With bioreactors it is possible to produce hydrogen from a certain type of bio waste. There are some limitations what kind of waste can be used depending on what kind of bacteria is used in reactor. For example when *Clostridia* bacteria is used it is possible to use almost any waste with high glucose content after treating it. Other good example is usage of *Rhodosphirilla* bacteria with this bacteria it is possible to use residue of cider making process. These are only two examples when future research work is done also many other waste or residues of some process which could be used as fuel for bioreactors. In large scale these reactors also produce also quite a lot of heat which could also be utilized./2/

From hydrogen it is very easy to produce electricity trough fuel cell (see chapter 3.14). Problems considering hydrogen are mainly related to storing because it is highly flammable substance. /2/

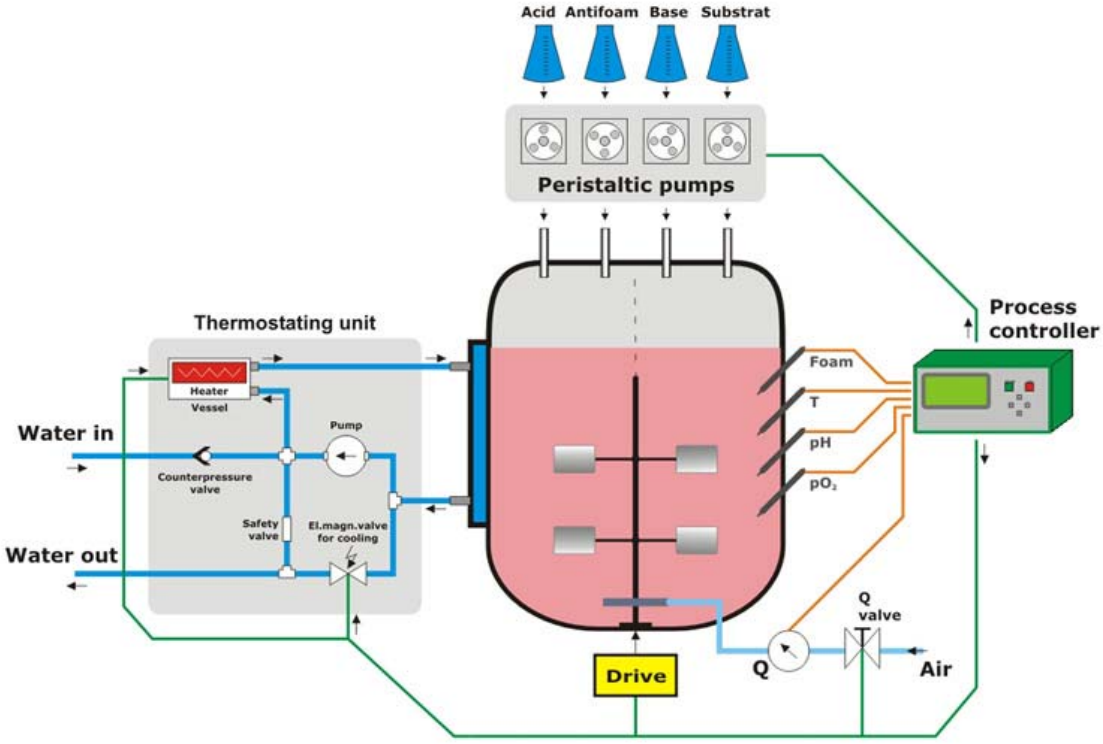

Figure 3. Operation principle of a bioreactor /9/

3.1.4 Fuel cell

Most common type of fuel cell is proton exchange membrane fuel cell (PEM). PEM can produce electricity from hydrogen, methanol and methane. Working principle is based on non-conductive polymer membrane which is build as a gastight barrier for electrons, only protons are able to to diffuse trough the membrane. Hydrogen molecules are separated in the anode side with help of a platinum catalyst in electrons and protons. Different electric potential is generated between two sides. Free electrons and protons recombine with oxygen and build water which is only emission in this process./2/

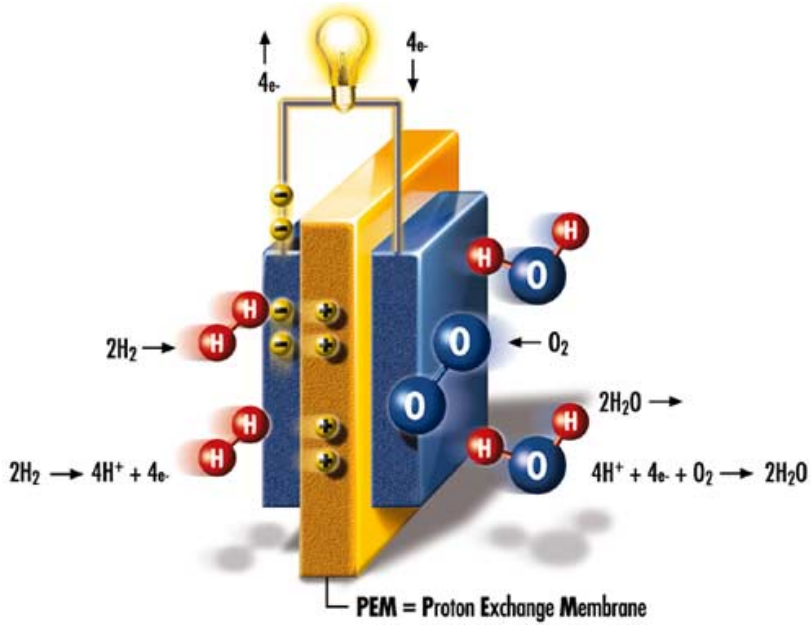

Figure 4. Operational principle of a fuel cell. /2/

3.1.5. Wind power

Operational principle behind wind power is very simple. Wind rotates blades and turbine will converts this kinetic energy in to electricity.

Wind power is very clean electricity. Still it has met some protest against it because of loud noise it makes and some people think that it ruins scenery because of its large size. It also can be dangerous for migrating birds.

Wind power is very good option to produce electricity in a small scale. In Finland this is not happening yet. For example in Germany, however, there is widely used system which allows selling excess electricity to grid when it is not needed and producers can also by electricity when own capacity is not enough. This system makes complicated backup battery systems unnecessary. In Germany building of wind power is promoted with feed in tariff system which guarantees fair price for electricity which is fed in to national grid.

Figure 5. Wind power in Germany. /7/

3.2 Heat

3.2.1 Solar

Solar collectors are very environmentally friendly way to produce heat for warming water or to be used to heating of the house.

Inside solar collector panels are pipes which are filled with antifreeze liquid. This liquid is heated by solar radiation and heat is transferred trough pipes in to the house and there it can be used to warm water or heat the house.

3.2.2 Geothermal

Geothermal is heat source with a lot of unused potential. At the moment it is still relatively expensive solution, though using it after installation is very cheap.

3.2.3 Biogas

Biogas can be burned just to get heat but much better solution is to capture heat from turbine in electricity making process. (See chapter 3.1.2)

3.2.4 Wood and pellets

Pellets or wood is usually fed in to a boiler by screw transporting system where it is burned and heat is utilized.

In all burning wood or pellets is quite sustainable way to produce heat because carbon dioxide emitted during burning is same amount which wood have used during it's growth. Problem with this method is the control of particulate matter emissions which can contribute to lung cancer for example.

3.3 Fuels for transportation

Fuel used to transportation has a great impact to whether living in certain place is sustainable or not. There has been a lot of debate in public about bio fuels, mainly concerning if bio fuels are produced in a sustainable way. Mainly this debate has concerned biodiesel made from palm oil and ethanol made from sugarcane. This debate has brought up the fact that even if fuel would be made of renewable materials it is not necessarily sustainable option. Unfortunately environmentally friendly fuels are still more expensive than traditional fossil fuels. After all Eu legislation prohibits production in third countries. Also peat can be used to produce diesel but due to its very slow growing time it cannot be classified as bio fuel.

4 SAVING ENERGY

Saving energy is very important aspect in sustainable energy use. At the moment there is not enough capacity to produce as much ecologically friendly energy that would be needed.

Energy saving solutions should be taken to account already when buildings and villages are planned, starting on location. If villages are located in a way that usage of public transportation can be used a lot of usage of fossil fuels could be avoided. Unfortunately this is not the case usually. Also fast internet connections should be available because that would make remote work possible and at the same time reduce need for private transportation.

5 EU AND LEGISLATION

Climate packet of European union sets very ambitious goals for all EU countries to achieve. All countries have committed to increase RES-E energy production to 20% of all energy produced and increase amount of bio fuels used in transportation to 10%. These goals might be quite hard to achieve because Energy politics and ways to produce electricity differs a lot from country to country. Also fact that regular people need electricity and they can not necessarily pay very high price from it might have effect how well goals considering RES-E can be achieved.

It is clear that RES-E is not economically profitable by it self. This is reason why there has to be legislative ways to support production of RES-E. Circumstances and culture differs a lot between different countries and so does ways to promote RES-E. Until now Finland have mostly promoted RES-E by tax concessions it seems that it has not been very effective way when compared figures in Finnish RES-E energy production to other EU countries. Especially Germany had have very effective way to promote RES-E energy. Instead of tax concessions Germany is using feed-in tariffs which basically means fixed price which is paid for producer. This model has been very encouraging even for small scale electricity producers.

In near future also Finland is planning to take same kind of tariff system in use.

According to research made by EU, RES-E is not financially very profitable at the moment. For example wind energy cost more to producers than it’s market price is. /25/,/20/,/23/,/19/

6 FINANCIAL SUPPORTS

Financial support would be good way to promote renewable energy sources. Unfortunately it seems that financial support is very rarely used method for promoting new ways to produce sustainable energy at least in small scale.

According survey made for this research (see chapter 7) any of the so called eco-villages who replied to questionnaire had not got any subsidies for their projects.

One reason not to have any financial support is limitations coming with outside financing. Very often external subsidies limit technology and materials used this can make recycling materials and using old technology impossible.

Sweden and Germany have also subsidies for converting house for more energy efficient and at least n Germany it is possible to have some financial support when building new houses if houses low energy solutions are used.

In Sweden there have been also subsidies to promote municipalities to invest biogas production for transportation purposes./17/

Feed-in tariffs seems to be most effective way to promote renewable energy. /19/,/25/,/22/,/20/

7 METHODS

In order to know, how sustainable villages have implemented and their energy production a questionnaire survey was made to different villages in Europe.

7.1 Survey

Questionnaire study was made via E-mail. E-mail was sent in to 27 ecological/sustainable villages located in Germany, Sweden and Denmark. Eventually only six answers were received. This questionnaire was sent in ecological villages located in rural areas found trough internet. Questionnaire was sent 24th of April there was time to answer until 9th of May. Some answers were received after the deadline. Questionnaire was done with Helene Salminen and questions considering sanitation are included in her final thesis.

Questions included in the survey were as follows:

1) How is the wastewater treatment organized in your village? How is it functioning, technically and in the opinion of the users? Are there any on-going or already finished follow-up research projects connected to the wastewater treatment in your village?

2) How is energy management organized in your village (heat and electricity)? How reliable is the system? Is there any back up electricity source if system fails for some reason? What kinds of measures have been taken in use to prevent any excess energy loss (heat and electricity)? Is there any on-going or already finished follow-up research projects connected to the energy management in your village?

3) In the planning or building phase of your village, did you get any financial support from any direction, e.g. the state / the region/ the municipality/ other organization? Can you state, what proportion the possible outside support was

from the total financing of the village project? Are there any ongoing financial supports for your village?

4) Were there any difficulties related to either the organising of wastewater treatment or energy management in your village? If so, how were they overcome?

8 Results

In the following are the summarized results of the answers from each village that replied to the survey.

According to the results of this survey any of the villages have not received financial support from any party. This seems to be one reason why there are no many innovative solutions in use considering electricity and heat. On the other hand one reason for lack of funding was limitations coming along. Very often financiers do have rules considering materials, technology and schedule in the construction.

Approach to electricity seems to be quite conventional. Solar power was used in many cases, and at least in Zegg Germany case excess electricity was also sold to the grid. In all cases villages were connected to grid and if there was solar power it was just extra electricity.

In all six villages heating was done with wood or with pellets. Some cases also electric heating is used (two villages). Warm water was warmed by solar collectors in four cases. In one village also wood heating was used.

Especially in Swedish villages insulating seemed to be very important issue also design of house is important large windows heading to south do improve passive heating.

In the table 1. are answers concerning the electricity use and financial support village by village.

Village	Heating	Electricity	Warm water	Financial support
Rydebacke	Wood pellets	Grid	Solar	No
Smeden	Electricity/Wood	Grid	Solar/Wood	No
Åkestaby	Wood	Grid	Electricity	No
Bålarna	Wood/Electricity	Grid	Solar	No
Zegg	Woodchip	Photovoltaic	Solar	No
Kesselberg	Wood	Wind/Grid		No

Table 1. Results of the survey.

Smeden, Jönköping Sweden

Electricity is bought from the grid. There is three different energy sources for heating. Solar collectors, electric heater and tile stoves. All of these are connected to an accumulating water tank which is used as hot water supply.

Smeden did not get any financial support.

Rydebacke, Västra götalands Sweden

Electricity is bought from the grid. Heating is managed individually house by house by using wood/pellets and solar collectors.

Rydebacke did not get any financial support.

Åkestaby, Åkesta Sweden

Electricity is used for heating. All electricity is bought from the grid.

Åkesta did not get any financial support.

Ekobyn Bålarna, Bergsjö Sweden

Heating is done with wood. They have high efficiency burner with two 500 liters hot water boilers. There is also photovoltaic cells which are used for heating water during spring and fall. Electricity is bought from the grid.

Bålarna did not get any financial support.

Zegg, Belzig Germany

Electricity is produced with photovoltaic cells and it is fed into grid. Photovoltaic cells produce about 10% of electricity used rest is bought from the grid.

Solar collectors and woodchip burners are used for heating.
There are also plans to insulate houses for a low energy standard.

Kesselberg, Neu-Zittau Germany

Electricity is produced with windmill and when capacity is not enough it is bought from the grid.

Heating is handled with ground heat and wood by burning wood.

They had well considered decision for not to have any financial support, because it gives freedom to use technology and materials by their own choice.

According to survey Kesselberg had lack of some knowhow and technology to execute all theirobjectives.

9 DISCUSSION

There would be many ways to produce energy in sustainable way.

It is surprising how common solution is to use electricity for heating in sustainable villages when there would be many much more environmental friendly options available, for example geothermal heat or wood and pellets. It seems that financial support would courage builders to try new solutions. On the other hand restrictions and rules considering materials, technology and timetables seems to reduce interest toward seeking this kind of support.

10 CONCLUSIONS

In all sustainable villages is not living form for major group of peoples, because of problems with transportation and particulate matter emissions. Other hand these villages have very important role in finding more environmental friendly methods to handle energy issues in rural areas and some of the methods could even be adapted in urban areas.

10 REFERENCES

Printed

/1/ Kari Ojala –Kestävän yhdyskunnan käsikirja. Jyväskylä: KL-Kustannus, 2000. ISBN951-98498-0-7

/2/ Report Hydrogen production from residues of cider-Distillation with Rhodospirilla. University of Applied Sciences Braunschweig/ Wolfenbüttel 2007.

Electronic

/3/http://search.eb.com/dictionary?hdwd=sustainable&swap=Dictionary&book=Thesaurus (encyclopedia –Britannica online) koulun tietokannat

/4/ Decentralised Sanitation and Reuse, Concepts, systems and implementation. Edited by Piet Lens, Grietje Zeeman and Gatze Lettinga. Page 172-176.
ISBN: 1 90022247 7

/5/ EREC (European renewable energy Council) March 2008. Renewable energy policy review Finland.
http://www.erec.org/fileadmin/erec_docs/Projcet_Documents/RES2020/FINLAND_RES_Policy_Review_April_2008.pdf

/6/ Farmit.net 3/2008. Page 48-51.

/7/ Photo: Toni Järvinen

/8/ www.maakaasu.fi

/9/ Biotechnical Center, Latvia.
http://www.bioreactors.net/eng/requirements.control.html

/10/ EurActiv, United Kingdom. http://www.euractiv.com/en/energy/eu-renewable-energy-policy/article-117536

/11/ OECD(Organisation for Economic CO-operation and Development). Economic instruments in practice.
http://www.oecd.org/dataoecd/25/0/2108273.pdf

/12/ Federal Ministry for Environment, Nature Conservation and Nuclear Safety Germany.
http://www.bmu.de/files/pdfs/allgemein/application/pdf/broschuere_waermegesetz_en.pdf

/13/ Federal Ministry for Environment, Nature Conservation and Nuclear Safety Germany.
http://www.bmu.de/files/pdfs/allgemein/application/pdf/brochure_electricity_costs.pdf

/14/ Federal Ministry for Environment, Nature Conservation and Nuclear Safety Germany.
http://www.bmu.de/files/pdfs/allgemein/application/pdf/erfahrungsbericht_eeg_2007_zf_en.pdf

/15/ Federal Ministry for Environment, Nature Conservation and Nuclear Safety Germany.
http://www.bmu.de/files/english/renewable_energy/downloads/application/pdf/broschuere_ee_zahlen_en.pdf

/16/ Business Insights, United Kingdom.
http://www.globalbusinessinsights.com/content/rbef0001m.pdf

/17/ The Swedish Environmental Protection Agency.
http://www.sustainablecommunities.fcm.ca/files/Program_Docs/2004_Sweden_Mission/local_invest-program.pdf

/18/ Commission of the European Communities. Renewable energy Road Map.
http://eur-lex.europa.eu/LexUriServ/site/en/com/2006/com2006_0848en01.pdf

/19/ Commission of the European Communities. Promotion of the use of energy from renewable sources.
http://ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf

/20/ Commission of the European Communities. The Support of Electricity From Renewable Energy Sources.
http://ec.europa.eu/energy/climate_actions/doc/2008_res_working_document_en.pdf

/21/ European commission. The State and Prospects of European Energy Research. http://ec.europa.eu/research/energy/pdf/portfolios_report_en.pdf

/22/ Fraunhofer Institute System and Innovation Research. Feed-In Systems in Germany and Spain and a comparison.
http://www.bmu.de/files/english/renewable_energy/downloads/application/pdf/langfassung_einspeisesysteme_en.pdf

/23/ Federal Ministry for Environment, Nature Conservation and Nuclear Safety Germany. http://www.erneuerbare-energien.de/inhalt/4306/36356/

/24/ European Union, Summaries of legislation.
http://europa.eu/scadplus/leg/en/s14004.htm
http://europa.eu/scadplus/leg/en/lvb/l27065.htm

http://europa.eu/scadplus/leg/en/lvb/n26104.htm#INTELLENERGY
http://europa.eu/scadplus/leg/en/lvb/l27063.htm

/25/ Finnish parliament, Eduskunta.Hallituksen esitys eduskunnalle sähkömarkkinalain muuttamisesta.
http://217.71.145.20/TRIPviewer/show.asp?tunniste=HE+181/2006&base=erhe&palvelin=217.71.145.8&f=WORD
/26/ Motiva. http://www.motiva.fi/fi/toiminta/uusiutuva-energia/bioenergia/biokaasu/biokaasun-tuotanto-ja-hyodyntaminen.html

Appendix 1: Cover letter

We are two students in the field of Environmental Engineering, from Tampere, Finland doing research for our final thesis projects. Both our theses are connected with sustainable villages in rural areas in northern conditions. Following are a few questions we would like to ask you in connection with your village.

1) How is the wastewater treatment organised in your village? How is it functioning, technically and in the opinion of the users? Are there any on-going or already finished follow-up research projects connected to the wastewater treatment in your village?

2) How is energy management organised in your village (heat and electricity)? How reliable is the system? Is there any back up electricity source if system fails for some reason? What kinds of measures have been taken in use to prevent any excess energy loss (heat and electricity)? Is there any on-going or already finished follow-up research projects connected to the energy management in your village?

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4) Were there any difficulties related to either the organising of wastewater treatment or energy management in your village? If so, how were they overcome?

Appendix 2: Answers

Rydebacke, Västra götalands Sweden

Hello
I have tried to answer your questions below. Don't hesitate to contact us again if you have further questions!
Best wishes
Piers Byford

1) On an individual property basis. Most of us have urine separating toilets with composting of faecal waste. The urine is taken by the local farmer as fertilizer for his silage. Grey water is either treated in a fairly conventional infiltration (gravel) bed except in the case of our house where we have a sand filter in our green house and use the filtered water for watering plants.

2) The infiltration beds work as per usual except that we have thin soil on bed rock which means that there is probably to much nutrient leakage to the local environment (my opinion). Our sand bed has been problematical since there was no existing design or experience to work from and we made a few mistakes.
Are there any on-going or already finished follow-up research projects connected to the wastewater treatment in your village?
Unfortunately not, it would be good to know what's really happening!

3) We are grid connected so everyone can choose electricity supply according to the Swedish deregulation model. Heating is also individual, with both wood and pellets boilers and solar heating panels.
4) Reliability is no different to any other "normal" installation. There are no special measures for energy conservation taken at village level.

Is there any on-going or already finished follow-up research projects connected to the energy management in your village?

No.

3) No, not a bloody cent!

Can you state, what proportion the possible outside support was from the total financing of the village project? Are there any ongoing financial supports for your village?

N/A

5) None specific except that there is a mismatch between local council and organic agriculture certification bodies requirements for the storage of urine before it is used. And all the requirements are excessive to the point of silliness. Apparently this is because it was the German Demeter movement that set the rules of organic growing in the EU as no one else was interested at the time – and Rudolf Steiner had some bloody funny ideas about how the natural world works :o)

Smeden, Jönköping Sweden

1) See the description in English from the West report.
We've had som problems from the start due to a mistake in construction of the basement rooms (lacking 10 cm in height), which has made the Aquatron system instable in some apartments. New inhabitants are not so willing to deal with the problems and their neighbours are sometimes tired of helping them. We also think that there isn't capacity enough for big families. The problems are mainly in the big apartments.
Since a year back we are now discussing connection to the sewage treatment of the municipality. There are also plans to build new houses on the farm land next to us, which will create problems with passing through with a tractor and urine tank. The distance to farm land with possibility to receive urine for fertilising will also increase.
There is no on-going research that we know of. There been some students from the Swedish University of Agricultural Sciences (SLU) in Uppsala asking questions some years ago, but we haven't seen any result. From the same university a researcher named Håkan Jönsson has done a lot of research on human urine used on farm land. Usually students are interested in the Ecovillage concept as a whole, not only sewage treatment. There been som surveys like in the West report describing different sewage systems, but no following-up research except on the Bioclere greywater treatment in 2001. Two students from Jönköping Technical University studying chemistry at C-level made an evaluation of our biological treatment compared to the plant in the municipality of Nässjö.

2) We use three different energy sources for heating; solar collectors (7,5 m^2 on each apartment), electric heater and in some apartments tile stoves – all connected to an accumulating water tank of 500 liters. From the tank emanates the floral heating as well as the hot water supply. Electricity is bought from the municipality company (Jönköping Energi AB). Nothing special about that.
Good insulation, triple glazed windows, sun radiation and the architecture of the houses with lots of open space, glassed-in verandas and windows mainly in

south help to save energy. The houses have an average of 0.161 w/m2 in energy loss. The system is reliable. There has never been any failure. No back up. See a) for constructing measures. Water saving systems also help to keep hot water use on a lower level. There are not enough hot water to fill a bath tub for instance. No ongoing research. Some students have been interested in the subject during the years.

3) The village is built under the same conditions as any other project in those years.

4) The wastewater treatment system were new to everyone involved. We hadn't seen it in function anywhere. Still there is little knowledge about how to organise a whole system from the toilet to the recipient. We put together different existing parts and we couldn't find any appropriate consultant to help us. We were lucky to have architects who didn't give up.

Zegg, Belzig Germany

We have a waste water treatment with marsh plants and willows working very good since 16 years. Now there is no research project running.

We produce 24KW photovoltaic energy and feed it into the grid. Germany has a very good system there. This is about 10% of our use.

We have solar warm water and a woodchip heating also working very fine since 16 y. And since then we are busy insulating houses to a low energy standard. We are on the way but by far not there yet. We use cellulosis or wood fibres for insulation and cork or cane from wetlands.

We never received any outside money for all we did. That is why the process is slow.

Åkestaby, Åkesta Sweden

1), we've had separate treatment for urin, the solid human waste and grey water. However, for cost and comfort reasons, this was changed to a connection to the local wastewater net in 2006. So, now we are acting like any other houses.

For 2), we are connected to the normal electricity net. There is no own back-up system. As we use electricity as the main source for heating, this is in principle critical, but here we have a back-up system with wood-fired oven's that are connected to the 300l water tank, normally heated by electricity. There are no follow-up projects, but it might be an idea to do that.

3) There was no financial support given to my knowledge, but I'll check in detail.

4) The difficulties of the wastewater treatment in the village, lay, among other things, in the investment side (short lifelength of the sandbed for filtering the grey water) and comfort reasons. These difficulties were overcome by changing to connecting to the local wastewater (and water) net.

Ekobyn Bålarna, Bergsjö Sweden

1)Virtsa erotetaan jo vessassa ja harmaavesi (pyykinpesu,-kylpy,-ja tiskivedet) menevät kaksikammiokaivoon ja siitä sitten suureen infiltratioon.
Kunnan ympäristökemistit ottavat kokeita, jos me sitä pyydämme.
Tutkimusraportteja:
VA-FORSK
Utvärdering av VA-lösningar i ekobyar.
Title of the report: Evaluation of systems for handling of water and wastewater in eco-villages
ISBN-nummer: 1102-5638
ISBN-nummer: 91-88392-13-9
Författare: J-E Haglund, B Olofsson, RUST VA Projekt AB
Utgivningsår 1997
Rapporten beställes ifrån: AB Svensk Byggtjänst, Litteraturtjänst

Toinen raportti on Luleå tekniska högskolan
Examensarbete 1996:176 E
Institutionen för samhällsbyggnadsteknik
Urinsorterande avloppssystem
Författare, Åsa Haneus och Erica Johansson

2) Lämmitys kokonaan puilla. Omasta metsästä. Ympäristömääräykset täyttävä tehopannu, ja kaksi 500 litran vedenvaraajaa.
Katolla on aurinkopanelit ja kevään, kesän ja alkusyksyn saamme lämpimän veden niitten paneleitten kautta tai avulla.
Sähköpatruunaa on käytetty talvena 1998, kun oli pitkä pakkasaika yli kolmekymmenta astetta ja puut olivat loppumassa.
Halkoja tai polttopuita laitamme vapun aikaan kolmen päivän työnä ja kokoamme n. 80 km3(kubikmeter).
Kylässämme on n. 800 neliötä, joita pidetään asuntoina ja siis lämmitetään puilla. Lattialämpö, sekä ylä-että alakerrassa.

Sähkönkulutus vaihtelee.

Esim 2006 käytimme yhteensä, viisi perhettä , 44461kWh

2001 meni 55375 kilowattia sähkönkäyttöön.

3) Emme koskaan ole saaneet mitään apuja. Kunta rakensi vuokrapohjalta ja me aluksi vuokrasimme. Kooperativt hyresrätt.

1999 ostimme koko kylän ja muodostimme kaksi eri yhdistystä, jossa me osaksi omistamme metsän ja toisessa on yhteiset rakennukset, kuten tallit, sauna, autotallit ja puutallit ja koko lämmityskeskus, itse talot ja n. 600 neliön tontin ostimme eroon ja joka perhe omistaa siis oman talonsa. Pankkilainalla tietenkin ne ostot rahoitettiin silloin.

4) Ei ole ollut pahempia häiriöitä. Oma maa, omat tontit ja samat ihmiset ovat olleet mukana suunnittelusta asti ja tänne me kai jäämmekin. Lapset ja lapsenlapset viihtyvät myös.

Katsokaa seuraavaa:

http://ns1.bergsjodata.com/ekobyn/index.html

Kesselberg, Neu-Zittau Germany

1) wastewater is collected centrally and treatment is as you see at our homepage.
useropinion is that its sad its still not finished, hopefully it will this summer. its a very beautyfull difference to the dry aridlike klima vegetation on the hill having a swampzone with swampflowers, for the birds bees, other insects like dragonflys or even for mammels like squirl and fox its the only possibility around some two three kilometers to get water, so already theire's more wildlive around.
theres a follow up research, a measurment planed, but first step is still getting the equipment together to measure, so if you hear something....

2) Heating is manly wood, most is still in planing, there are ideas to make a ground heating with hot air saisonal collected in summer and additional dezentral woodheaters for getting more heat if the 10°C ground heat is to less. also we make communityrooms nicer for people stay and head more together they need less wood for heating. and we are giving energy to insulate the houses better.
electricity we get from the net (ews-schönau) and form our windmill (old südwind maschine build by atlantis ggmbh with maximum 36kw)- when their is
wind, we try to look if the wind turns when using big maschines. the windmill saves us half of the costs for electricity means we use aroung 2/3 from the mill.

we are planing to make the in-out of electricity visible with some sort of scale bzw lights, and there are alot of ideas how to maybe store or improve (e.g. build a woodgas driven electromaking station (blockheizkraftwerk) and use the fall of heat for heating) - but its all just ideas.
we just started to make ourselfes an overview about our demand of electricity/heat and how to need less, so we cant make a follow up

research at this time.

3)we did not get or want finnancial support, we actually want to show that buying and building up something like an ecovillage can happen on your own effort independent from the state. its slower, but we have the freedom to do things in which timeframe and way we like to, with as much material recyceled as we want. for the problem with fonts is that they mostly want to see you using new stuff (you can f.e. get small trees from where theire to many - you have to buy them and show the bill or building solarthermic installations cant be made from rycyeled stuff), this we dont want, we want as less as possible to be made new. another point is that a lot of project begin to relay only on fonds, and when the frames of the support changes the projects change with or die for they didnot build up a structure to be independend, selfsufficient, ongoing etc

4) knowlege and research is often on hightech variants not on lowtech, also it seams there is not much effort to find out renewable/natural materials to subsidy f.e. plastic materials which have a big eco-backpack and which are not compostable - the whole thinking of a circular and suistainable economy is at a depressing low standart , so we had to depend on our own fantasy alot.
the same problem we face with the heating/electricity planing, theire are no led-lamps for houselighting, or some 12v-systhems for computers and light, wabout using air as medium for solarthermic installation (a lot less effort to look after while running) and an saisonal storage with not chemestry waste or again water, which can get leek after some years, as storage medium - you also dont find a lot of information.