An authentic story about how a local community became self-sufficient in pollution free energy and created a source of income for the citizens.

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I. Sydthy municipality.

The municipality of Sydthy is a district of lovely landscapes. The 322 square kilometres between the North Sea and the Fiord offer an unusual variety of landscape, characterized by tracts of blown sands in the West and lush, rolling hills in the East with a large number of tumuli that bear witness that this is an area where people have been cultivating the land for thousands of years. 11.800 people live here.

Sydthy offers more space than most other places. The average population density is as low as 37 persons per square kilometre, compared to 122 in Denmark as a whole. But the households are larger here than in other places, averaging 2,4 persons.

It is a real rural community. Only half the population live in towns or villages, and farming is still of central importance. That means that the independence culture dominates the lives even of those who work for wages.

The average income for those in employment is 26.300 €. In Denmark as a whole, it is 28.600 €. This part of the country has always been frugal, but perhaps the quality of life is above average. That can hardly be measured, but the frequency of theft and violence is, anyhow, significantly lower than in most other areas in Denmark.

II. Wind power in Sydthy - the story of a success.

The 145 windmills that are harvesting energy out of the almost permanently blowing winds place Sydthy in a class of its own when you talk about energy policy. The majority of the wind energy is coming from 200 to 300 KW units but some of the newest wind mills belong to the 600 KW class. Megawatt-size wind mills have not been installed in Sydthy by 2002 but will appear in the coming years as part of a repowering programme during which small-size wind mills initially up till 150 KW will be replaced by large megawatt wind mills leading to a significant increase in the energy production from the wind.

A large majority of the wind-mills of Sydthy are scattered throughout the agricultural landscape at sites that are well known for good wind resources. Out of the 145 units only 20 windmills are installed in regular wind farms in geometric patterns. This is the preferred solution among the central landscape authorities but in general criticized by the local residents due to the remote placing from the owners and dominance in the landscape compared to the existing more dispersed siting that is supporting the contours of the landscape and the location of the of the farm buildings.

Before installation the wind potential is carefully investigated by means of the wind atlas method. Guaranteed electricity production by the wind mill supplier is often achieved within 5% of the predicted annual production, which in itself provides high confidence in the investment from the side of the owners and the financial institutions.

There are hardly any areas in the world that can show such massive utilization of the power of the winds. The windmills produce more than 100 per cent of the power consumed in the area. This feat is the result of a development that has taken only a few years. It is no more than 20 years since the first modern windmills were built by experimenting master smiths.

The scope of the following account is to offer an overview and give an explanation of this revolutionizing development which not many people would have imagined to be possible.

Sydthy, situated between the sea and the fiord, is one of the most windswept areas in the country. But you could easily point out other areas favoured by the winds, where the exploitation of the energy is far from equally intensive. Other and more complex explanations are needed.

In order to evaluate them it is necessary to move beyond the horizons of Sydthy. Sydthy may be seen as a focal point for wind energy where the energy policy conducted by the government and Folketing (parliament) joins forces with an unusually high degree of popular activity.

One has to investigate to what degree NIVE (local energy organization) and Folkecenter for Renewable Energy have played a part as initiators and mediators. Add to this the role played by the local power utility as partners and opponents. Finally, the local and regional planning authorities became decisive agents, not least as during the1990es the windmills developed fast as regards their capacity and size.

One might see Sydthy as the future laboratory of wind power which has got its high share of wind energy by exploiting the prevailing natural energy resource. However, this has not caused the local conflicts and rejection of wind mills, which is the lesson learned from many other local communities where the residents have protested strongly against this new form of energy technology and thereby blocked for a future-oriented transition from atomic power and fossil fuels to the clean renewable energy solutions of the future.

In contrast an opinion survey from 1996 based on interviews of almost 1000 residents representative for the local population, clearly demonstrated a massive good-will in favour of wind energy. 80% expressed a positive attitude to the local wind mills. Especially

surprising was that people living closest to the wind mills were the most positive. The negative minority primarily consisted of senior and retired citizens in the towns.

The conclusions of the investigation were quite clear: Ownership and direct economical participation in the installed wind mills, create a tolerance to the visual impact of wind mills in the neighbourhood which is significant

Because the sympathy increases the closer you live to the wind mills, we can observe a clear indication that in order to obtain a high share of wind energy, involvement by joint ownership paves the way for maximum utilisation and thereby transition to renewable energy without causing conflicts in the local community.

However, by the turn of the century the region is fighting against a number of new problems that other areas will also experience when the national targets with regard to wind power capacity is to be realized.

One question in particular becomes urgent: how to resolve the conflict between aesthetic impact on the landscape and the demand for a continued growth in the utilization of renewable energy sources when you demolish relatively small community owned wind mills and replace them by megawatt machines with predominantly single or non-local ownership, which clearly distorts the previous well balanced economical and ecological structure in the neighbourhood.

A. The Danish windmill tradition.

"As I rode my bicycle about in Northern Jutland on my lecturing tours before and during the last war, it was impossible to avoid noticing the many windmills on the farms. The farms were self-sufficient in electricity. At that time I did not know that this state of things originated in an idea issuing from the folk high school of Askov, and that it was not only a technical issue, but that a far-reaching social idea behind it: Giant business corporations must never be allowed to monopolize the power production. It should be taken care of in small local communities and on the individual farms."

This is how folk high school professor Richard Andersen saw the landscape of Jutland a little more than half a century ago (Quote: preface to H.C. Hansen: "Forsøgsmøllen i Askov", 1981). A statistical handbook from the beginning of the 20th century tells us that 35.000 "wind engines" were registered on Danish farms, to which number should be added 2.000 grain mills. The classical Danish landscape was very much characterized by mills.

The special Danish windmill tradition originated with scientist and Askov folk high school professor Poul la Cour. From 1891 on he conducted an extensive research and product development in the field of practical utilization of wind energy. The first experimental mill was built - with subsidies from the state - at Askov in 1891, and as early as in 1895 Askov was illuminated by means of wind energy; certainly a breakthrough of world-wide dimensions. In 1897 a new and bigger experimental mill was built; still in the "Dutch" style, like the old one.

From here disseminates.the movement which from the beginning of the 20th century equipped almost all larger farms in the Danish civilized landscape with a "wind engine" or "klapsejler" (a wind mill with the blades consisting of a system of adjustable narrow, horizontal slabs made from wood).

The wind mills delivered mechanical energy for grinding , threshing, pumping of water and also for the production of electricity for lighting and radios resulting in an enormous improvements of the living in rural areas. The wind mills were providing nearly all the conveniences that otherwise could only be satisfied in the cities.

To meet the needs of installation and maintenance of the new energy source, Poul la Cour organized the education of rural electricians who became very valuable in the ongoing modernisation of Danish agriculture. For some decades prosperity and welfare improved and made the rural lifestyle attractive compared to neighbouring countries which did not offer similar opportunities for the rural population. However, the wind mill was a key factor in this development.

After a fire and a re-construction in 1929 the Askov mill worked on until 1968, the year in which so many old things were discarded. It was also in the 1960es that the farmers effectively stopped maintaining the iron constructions of the windmills and pulled them down.

The history of the "klapsejlers" has a special Sydthy angle, as the foundry in the village of Hurup (Hurup Jernstøberi) was one of the country's major producers of these wind mills, producing no less than one thousand of these proud farm mills.

Already in 1929 the writer, Poul Henningsen, wrote in a good-bye poem to the "wind engine": "No one can avoid the evening of life, the times are changing for the motor power. Everything has its chance, and you have had it". The power station produced electric power, the petrol engine was triumphant, and few people thought that wind power had any future.

Among the few people who after the second world war went against the spirit of the times was J. Juul, engineer. In 1951 he started full-scale experiments, first with a two bladed 11 kW windmill, in 1953 with a three bladed, 45 kW asynchronic generator for alternating current, Bogø, and in 1957 his research and innovative ideas resulted in an extremely successful experimental wind mill in Gedser of 200 kW. Demonstrating high reliability and efficiency it was in continuous operation till 1968.

Nobody realized that this was building a bridge to the future. His epoch-making principles of construction are in fact the experimental point of departure for the pioneer work in the wind mill area of the 1970es.

B. The big energy crisis.

The historical turning point was the 1973 energy crisis which caused something like a shock to the Danes in their life of affluence. At the same time the debate on utilizing nuclear power in Denmark worked as a forceful stimulant for bringing alternative energy

sources unto the agenda. The slogan "sun and wind" made it possible for the many people who were active in the movement against nuclear power to say not only "No", but also "Yes" to an alternative.

The energy crisis caused the set up of two scenarios. One was the movement "from above" originating from government and legislator initiatives, seconded by research at the atomic power experimental station Risø, mastered by the big central power stations.

But at the same time a movement "from below" arose, rooted in a new popular awareness of energy and environment. Experiments were made and experience was exchanged with a will during the latter half of the 1970es, especially in Central and Western Jutland.

The media favoured in particular the Tvind Schools' giant still operative 2 MW wind mill in Ulfborg with their attention, but many others were also in the run. Around 1978 the first initiatives to a commercial production was taken, and in the following years a quite new, dependable concept with a distinct "Danish design" emerged. During the 1980es the mills came back in the Danish civilized landscape.

Wind power utilization reached a popular level far beyond the calculations of the planners. In 2002 wind power is representing a total capacity of almost 3 000 MW including off-shore wind energy which is going to have increased importance. The goal of the energy plan has more than been fullfilled as the national target originally was 1 500 MW by 2005.

Around 90 per cent of the wind mills were built by private customers in Jutland as distributed generation. So in 2002 nearly 20% of the country's electricity consumption is coming from wind energy, with a much higher proportion west of the Great Belt that is dividing Denmark into 2 separate electricity systems without connecting cables. In the western part of the country independent power producers representing cogeneration, wind energy, biogas etc. delivers 60% of the needs of electricity, replacing coal power from central utilities. The bulk of this share has been achieved in less than 10 year and is of historical significance.

An important cause of this growth which had hardly been anticipated at the end of the 1970es, had been the guaranteed minimum price system of pollution free energy. In the original legislation the leading principle had been in the first place that the wind mills should be owned by people living in their neighbourhood, and next that private individuals could only own shares in windmills corresponding to their household's private consumption. Farmers were allowed to install one wind mills at their property. The intention had been to create broad popular involvement and local ownership in the development of Danish wind energy.

To-day this perspective may be less striking. The 1993 tax reform favoured mills owned by individuals and gave less favourable conditions to those owned by a community. Furthermore, it became possible to buy a tiny piece of land suitable for wind mill installation and add it to one's own property, resulting in the loosening of the rule saying that you should live near the mill.

The size of shares has been raised from 9.000 kWh per family to 30.000 kWh per person over 18 living in the household. Year 2001 there are no regulation of ownership. Anyone, also investors from abroad may own wind mills in Denmark in accordance to globalisation and liberalization policies. All this has led to a development that is increasingly making windmills a sheer investment projects.

C. Wind power and community power.

In a process running parallel with the government and power utility based initiatives, grassroots, do it yourself people and master smiths joined - after 1973 - in a job, both idealistic and business conscious, to develop mills, and this joint effort came by and by to form the foundation of the present, globally oriented windmill industry.

Seeing the standardized and elegant wind mill concept that we now have become used to, it may be difficult to imagine the diversity and insecurity that reigned in the mid-seventies. A long series of technical options had to be tried out, and many disappointments to be experienced.

A broad exchange of experiences and openness in the field of information were decisive conditions for the gradual narrowing of the field in the direction of functional and efficient mills. Engineer Juul's experimental work during the 1950es contributed strongly towards turning the development in the direction of what came to be the special Danish concept. It was, however, necessary to learn about his experiments from United Nation's renewable energy conference reports edited 1960.

During the bi-annual windmill sessions, initially arranged by the Organization for Renewable Energy (OVE) lively discussions and comparisons took place contact were made, strategies and initiatives were decided. It was possible to exchange the experience; harvested by many experimenting wind mill builders, inventors and other creative people contributing to the development of the emerging wind industry.

Here we find the incubator that solved research and development challenges which large professional laboratories and corporations did not have practical and economical solutions to, The early sessions that were to be of decisive importance to the course of the technological development, were co-ordinated by Preben Maegaard, chairman of OVE and later director of the Folkecenter, and his workmate in OVE, Lars Albertsen.

A key question was: how to get a real and professional manufacturers of equipment going? The Tvind school people had stipulated that their findings however important were not to be utilized for profit.

On the other hand, NIVE, (the local development organization), represented by Preben Maegaard and Ian Jordan, was eager to find ways and means of making possible an industrial production of wind mills and in that way stimulate a regular serial production by involving the mechanical industry and organising consortiums covering the required production skills in already existing small and medium size companies especially

motivated for entering into the emerging renewable energy sector . Instead of building on a total concept (e.g. the Riisager Mill, produced from 1976), NIVE saw that it might be possible to produce industrially by going in the opposite direction, by seeing the mill as a number of components coming from a variety of industries like tower building, fibre glass, electronic controls, machinery etc.

Especially the Danish Black Smiths' Association showed serious understanding of this manufacturing concept using existing experiences of successful transfer of technology know-how within its membership of 2 000 independent companies. 25 year later the sector is still benefiting strongly from this process as supplier to the wind mill industry.

III. The cooperative wind mill – a case.

During the mid-eighties people began to form mill cooperatives (guilds) on a shareholder basis. The Helligsø windmill cooperative, "Simonshøj" may be seen as an instance of this bottom-up movement.

The cooperative was formed in March 1988. The initiative came from a local teacher, Bjarne Ubbesen. At that time there were only two major mills in the area. Bjarne Ubbesen was inspired to start his work by taking part in meetings of people who took an interest in windmills.

The driving force was not a dream of economic gain. The enterprise was quite insecure; what they wanted was to produce pollution free energy. According to calculations, a wind mill could be called "pollution free" when it had operated for one year in the sense that the energy production had by then made up for the consumption of resources necessary for the building of the mill.

Bjarne Ubbesen began to gather people who were interested in the project, concentrating on the local area and limiting himself to families living within a radius of about 5 km. It was very important for him to make the families living nearest to the site to join. Only one refused, he was against mills on principle. But his sons joined the project.

The most important reason for hesitation was the size of the investment in the light of the insecurity of the profit. The guild was formed on March 3 by 51 members as owners of the 200 kW windmill.

At that time it was possible to own eight shares at 1.000 kWh per family. The return from eight shares was approximately 700 € per annum, making an additional income of 270 – 450 € per annum after payment of instalments and interest.

The greatest challenge for the wind mill cooperative was connected with the co-operation with the local power utility, Thy Højspændingsværk. The ruling principle was that the wind mill guild would have to pay the actual costs of connecting the mill to the power utility for making the necessary grid reinforcements.

The cost was 45.000 €, and the guild had good reason to be dissatisfied because costs varied very much from one place to another. Several other cooperatives paid only 3.000 € for being connected. Despite much attention from the national television and writings in the press the wind mill guild did not succeed in altering these conditions.

Bjarne Ubbesen was of opinion that the attitude of the power utility was "political" in the sense that the station profited from the connection with the windmill to generally renew its power lines.

The guild had an annual general assembly attended by 40-50 members combined with a social dinner, enjoyed after the results of the year had been presented, accounts approved and the coming year's budget decided.

In the early phases when the project was being built and while it was new it occasioned many good talks among neighbours, as everybody was eager and curious. During the first years many members visited the wind mill regularly to keep an eye on the energy production meter.

The wind mill guild has strengthened the local community and thus counteracted the tendency towards the closing down of functions within the village culture.

The 200 kW wind mill turned out to be a far better business enterprise than anyone had dared to hope for. The price of the mill was 160.000 €, to which came expenses for buying land 3.000 € and expertise 2.000 € and finally the unfortunate 45.000 € for being connected to the power station. The wind mill has proved to run with very great stability. The costs of maintenance have been between 700 – 1.400 € per annum, primarily the costs of regular servicing.

Economically the mill has been a success. The original expectation of the guild had been an interest return rate of 12-13 per cent, but the actual rate has been more than 25 per cent per annum.

IV. Towards an ecological community.

We are convinced that the change into an ecological community is less a question of money, subsidies, timetables and diagrams than of talent, co-operation, past experience and perseverance.

It this report we have given a brief sample of what happened when Thy at an early stage engaged in the development of wind power which was to be victorious. The local pioneers contained an extremely active and creative environment for development, involving engineers and enterprises all over the country.

Regrettably this has not resulted in the emergence of a local wind mill industry, which must be put down to mischance. But Thy, and in particular Sydthy, has unusually many windmills contributing strongly to the local economy.

In the late 1990es more than all electric power consumed in Sydthy was produced by privately owned local mills, bringing the citizens an income of 7-8 mio € per annum through sale of electricity replacing power which would otherwise have had to be produced from coal from Australia and South Africa. This change from fossil fuels to the energy sources of the future is not exclusively a question of technology and planning but also of new ways of organizing and cooperating in the local community.

Renewable energy is by nature de-centralized, and in Thy it has been possible to organize things in a way that makes new technology a part of ordinary people's everyday life, thus not only serving local development and the environment, but also as a manifest instance of how the individuals and the households may play an active part in changing the social system and create a model reaching out far beyond the borders of the local area and the country.

As almost all the mills are owned by people living in the area this has meant an extra average income of between 1500- 1800 € per household. That income did not exist before the coming of the windmills.

This aspect gives rise to much interest to-day because it means that the wind mills are regarded in the same manner as other human activities, while at the same time producing power that holds no future threat to the climate and international conflict to secure the necessary energy. Seen in the long perspective, a very great change has begun.

Facts 2001.

Calculated and read production and consumption.

Consumption 2001 kWh	Production 2001 kWh
Sydthy municipality appr. 12.000 inhabitants	75.000.000
Accounted in the local power station, the Thy Højspændingsværks area, Sydthy municipality.	58.000.000
Sydthy Kabellaug 26 mills	18.000.000

2 Wind farms:
1 750 kWh
9 600 kWh 24.000.000

Total 75.000.000 1.000.000.000

Number of mills 145

1 kWh sold to the power supply system at 7,5 €ct.

100.000.000 kWh x 7,5 €ct. 7,5 mill €

is the value of power sold per
annum in Sydthy municipality