
THOUGHTS FOR THE ALTERNATIVE ENERGY IN AUSTRIA

Abstract

Austria is a country with a very mature and diverse energy sector. From Biomass to Hydro Power, the nation has very lofty goals in order to develop its own alternative fuel sector. As the private and public sector have managed to branch out with alternatives, it is clear that Austria is motivated to meet the needs of its various domestic industries. This diversification has brought with it the ability for the country to make important decisions about the future of its energy sources as well as the acquisition of foreign sources. A lower reliance on foreign sources not only means financial savings but also environmental advantages. In addition to being a general overview of the Austrian Alternatives energy industry, this paper will analyze a range of different power plants as well as leading alternative energy research companies in Austria so as to discuss both positive and negative aspects of the growing.

When we take an overall view of the energy situation in Austria we need to examine some key statistics. According to the Austrian Energy Agency¹, a non-profit organization established in 1977, "The share of renewable energy sources in the total energy system has been rising since the mid 70's and amounted to 22.65 percent of total energy supply in 2001." The official mission of the AEA is mentioned in the footnote below.² Although the most significant renewable energy is hydropower at more than 11%, the reliance on non-renewables is still troubling because it is nearly 80% of the

¹ Austrian Energy Agency, "Renewable Energy In Austria," Austrian Energy Agency. <http://www.energyagency.at/projekte/ren-in-a.htm> (accessed July 24, 2009)

²The AEA is the principal partner of the federal government in its effort to attain its energy policy objectives, which aim mainly at a macro-economically efficient production and a rational use of energy, at a stimulation of renewable energy sources and of innovative technologies. The overall mandate of the Austrian Energy Agency is to make "energy savings" an energy source which can successfully compete with conventional sources of energy, and to advocate boundary conditions under which market forces can act in favor of renewables and improved energy efficiency.

total energy consumption.³ In addition to this, since Austria is not an oil-rich country this means increasing reliance on foreign sources. Considering these factors, it is clear why the Austrian government is creating more and more opportunities for the development of the alternatives' sector.

As aforementioned the diversity among sources is quite beneficial to Austria. This section will serve as a brief introduction to these alternative energies. Small Hydropower is quite an active industry in Austria. "A power station is referred to as small-scale if its bottleneck capacity amounts to up to 10 MW."⁴ Although approximately 1273 small scale plants fed primary supply network it is estimated that an additional 3,000-4,000 small hydro plants also exist. the write down an abstract of all energy production methods in Austria (Biogas, Biomass, Biofuels, Solar Heating, PV, Small Hydro Power)

Austrian Institute of Technology:

Although not technically a power plant, this institution has made some very valuable additions to the alternatives sector in Austria. Some of the research and technology that has developed as a result of AIT has helped to propel the alternative industry forward and has helped to keep it on the cutting edge of technology. Although the headquarters is located in Vienna, it should be mentioned that there are in fact 9 AIT locations, each with a specific mission based on the company's departmental structure. The basic organization of the company is simple, it includes "five specialized

³ Alice Sedmidubsky, "Renewable Energy in Austria," Austrian Energy Agency, <http://www.energyagency.at/projekte/ren-in-a01.htm> (accessed July 15, 2009).

⁴ AEA

departments researching the key infrastructure issues of the future which include: Mobility, Energy, Health & Environment, Safety & Security, Foresight Policy & Development departments.”⁵

If we look at the success of the company we can perhaps contribute it to the fact that the government has, “through the Federal Ministry for Transport, Innovation and Technology a share of 50.46% of the company.”⁶ The government of Austria has a vested interest in procuring its own energy and with its investment in this Institute, it is helping to develop technology that will assist it with energy production in the present as well as in the future. What is more, the message that the Austria government is sending is quite progressive. It believes that academic research for energy and energy procurement should be supported. This idea is very forward thinking and will have a very positive impact on the future of the Austrian Industry because rather than waiting for the problems to develop, AIT is trying to devise solutions to potential problems such as foreign energy dependence.

The Energy department itself has created a structure that includes both research and business. The research side includes topics such as Electric Energy Infrastructure and Energy for the Built Environment. However the business side of energy includes a three part department made up of: Electric Energy Systems, Sustainable Thermal Energy Systems, and Sustainable Building Technologies.

Another important department is the Mobility department which similar to the Energy Department and is divided into a research and business side. Mobility’s research seeks to investigate, transportation and infrastructure solutions as well as

⁵ Austrian Institute of Technology, “Research,” Austrian Institute of Technology, http://www.arcs.ac.at/research/research_en.html (accessed July 20, 2009).

⁶ AIT “About Us”.

future integrated vehicle concepts. However their business side is devoted to: Electric Drive Technologies, Transportation Infrastructure Technologies, Dynamic Transportation Systems and LKR Ranshofen.⁷

AIT has some great advantages for Austria because it is infusing the country and its employees with knowledge. By investing in research, AIT has made it clear that it is trying to solve the pressing global problem of energy source acquisition.

Vienna Biomass in Simmering, Wein

This power plant has been in operation since 2003 and has made some significant contributions to the alternative energies industry though the field of biomass. The power and heating that is produced at this plant is via the process of cogeneration which is conducted at the Simmering location. Cogeneration in energy is quite effective and the plant has an estimated 85% efficiency rate because of the simultaneous production of heating and power generation.⁸ The total fuel input is 65MW but the output results in 23 MW of electrical output as well as approximately 37MW of district heating.⁹

In an attempt to be economically efficient, the company relies on a steady input of wood supplies. It is estimated “the operation of the 65MW plant requires about 650,000 srm (chipped wood metre) of wood which corresponds to approximately 35 truck loads, 30 wagon loads or 1-2 ship loads per day”.¹⁰ The resources involved in the

⁷ AIT, “Mobility”.

⁸ RES Management, “Biomass Plant Simmering, Vienna,” RES Management, http://www.res-investgroup.com/en/maps/projects/pdf/Biomasse-Simmering_en.pdf (accessed July 22, 2009).

⁹ Ibid RES Management

¹⁰ Ibid RES Management

plant can perhaps be seen as a disadvantage because in order to produce the material for energy production, the logging industry needs to cut down wood sources in Austria. Yet when we look at the advantages of the biomass industry we can see that since 2006 this plant has contributed to the reduction of over 144,000 tons of carbon dioxide and which translates into not using nearly 44,000 barrels of oil.¹¹ Now this not only has a positive environmental impact, it also is economically beneficial.

Wind Park Weiden

This power station has a remarkable output with 79.2 MW and is rated as the largest producer of wind energy in Austria as well as a significant producer among European countries. What contributes to the plants success is the installation of 44 Enercon E66 Turbines.¹² The rated power of each of the three-bladed turbine is 1800 kW. While the Enercon provides turbines at a variety of height, such as 65, 85 or 98 meters, The Neusiedl has opted for all its turbines' hub to have a standard height of 85 meters. The plant which was constructed by the company International Wind Power in 2003 has been concerned with providing clean energy for Austria.¹³

The advantage of this type of power plant is quite obvious because it leads to the production of clean energy with a very low carbon imprint. What should also be mentioned about wind power is the choice of an appropriate turbine company. Enercon, which produced the wind turbines for the Neusiedl plant has an EIA, Environmental

¹¹ Post Graduate Program in Renewables Energy in Central and Eastern Europe, "Excursion 2009," *Vienna University of Technology Program Schedule*, 2009: 11

¹² Excursion 2009 pg 9

¹³ Enercon, "Designed to Perfection: Enercon E 66," Enercon, <http://www.spitia.gr/enercon/E66/E66.htm> (accessed July 24, 2009).

Impact Assessment. The company has thought of the potential disadvantages that wind power production might produce and has produced a study that aims to address these potential problems. Since this company is very forward thinking as well as precautionary, we can see that the future of this alternative energy as well as the environment surrounding the plant is secured as well. EIA objectives can be seen in the footnote listed at the bottom of the page.¹⁴

An area which can be seen as potentially disadvantageous is the initial production of the turbines. In the production of these fiberglass turbines, a great deal of energy is spent and this can lead to the production of greenhouse gases such as CO₂ or other types of pollution. Another area which has also been cited as potential dangerous is the harmful effect wind energy may have on birds. Wind power stations and the blades associated with turbines have been known to cause bird injuries or deaths. These cases are quite low in number but have been cited by environmentalists as arguments for placing wind parks out of the scope of bird migratory patterns.

Another area which could also be a point of contention is the noise of turbines. Noise pollution has been cited as a problem with certain wind plants yet I could not find any indication that this has happened at the Neusiedl plant. There are also individuals that complain that the plant is not aesthetic in its appearance. Some claim that the

¹⁴1) to avoid environmental damage from the outset by applying the precautionary principle.

2) to take an integrated and comprehensive approach to environmental impact, which is not simply sectoral and focused on detail.

3) to achieve better preparation for projects and approval processes.

4) to give environmental considerations the same significance as other issues in evaluation and decision making processes.

5) to develop project approval processes that are more transparent and more easily understandable, with involvement from the general public.

construction of such large and towering turbines in fact leads to lower property value because it creates an unattractive view.

Biomass Educational Plant at Hartberg

The Plant in Hartberg is similar to the AIT mentioned earlier in the paper but approaches research and learning on a more commercial level since 2001. Presented in a theme park format, the Oekopark tries to incorporate educational programming for the public as well as commit itself to research in the field of sustainable energy. The park educates people about developments in ecological research as well as informs them about important environmental themes.¹⁵ One of the main goals of the park is to be totally self-sustaining as well as economically viable. What makes this park unique is that it is, “is a commercial park set up exclusively for firms in the environmental sector or applying environmentally friendly methods.”¹⁶ This mission reaffirms the park commitment to educating the public about the need to support the alternative energies sector as well as a individuals’ impact on the earth. There are a variety of branches that range from recycling, to water treatment to reuse of materials that contribute to the success of this program.¹⁷

One of the main advantages of such a program is related to the future of the Austrian population. It is clear that educating individuals about environmentally pressing issues as well as potential solutions will result in an environmentally conscious public that will be more likely to sway the political environment to support alternative projects.

¹⁵ Msc Excursion 2009 pg, 11-13

¹⁶ European Academy of the Urban Environment, “Hartberg: Ecopark for environmental businesses and explorative exhibitions” as found in SURBAN Database, <http://www.eaue.de/winuwd/119.htm> (accessed July 24, 2009).

¹⁷ Ibid pg, 11-13

Glessing

One of the more interesting aspects of this region in Austria is the dynamic change that Gussing has undergone in the past twenty years. Located near the border of Hungary, in the past there were no industrial plants constructed there due to the proximity to the former Iron Curtain regime. What was even more damaging was that the town did not even have a railroad link so it was essentially forgotten. People were accustomed to commuting into Vienna every day and this set up an out migration pattern due to the lack of potential that existed in the town.¹⁸ Yet today, it is the perfect example of a town which has rejuvenated itself in the wake of large obstacles. Furthermore, it has even taken alternative energy production to an impressive level with respect to the rest of Europe. This traditionally neglected town made a critical decision in 1990, which was the “100% reduction of fossil fuel use.”¹⁹ In practice as well as speech, the Gussing region has greatly reduced its carbon footprint from nearly 35,000 tons in 1995 to 5,000 in 2007 and is steadily working to reduce it even more. The region is able to meet its heat consumption needs as well as surpass its totally energy needs by nearly 50%.²⁰

What was eventually created was the European Center of Renewable Energy in Gussing. EEE is, “an organization recognized in professional circles, developing sustainable regional concepts regarding the use of renewable energy carriers in cooperation with its European partners.”²¹ What has made this region so successful is

¹⁸ Msc Excursion 2009 pg, 14

¹⁹ Oekoenergieland, “English Information”, Oekoenergieland, <http://www.oekoenergieland.at/english-information.html?start=2> (accessed July 23, 2009).

²⁰ Msc Excursion 2009 pg, 14

²¹ Oekoenergieland

that it does not include merely one plant rather incorporates a series of alternative energy technologies. In fact, presently within a 10 kilometer radius of the region there are over 30 facilities involved in alternative energy production. Over the past twenty years, the region has seen the development of the following plants: biodiesel, biomass, district heating, biogas, photovoltaic as well as the beginning of research for synthetic fuels.²² This diversity in energy sources is quite advantageous for the region because in the event of one industries failure or decreased productivity, the region should easily be able to compensate by turning to an additional industry.

Although this paper cannot analyze all thirty facilities, I will outline the major plants in the Gussing area. The biomass plant at Gussing is quite unique because it involves a system of gasification. This allows for 1760 kg of wood per hour, 2000 kW electricity and 4,500 kW long distance heating energy to be created.²³ Another impressive fact about the biomass plant is that, “the engine creates electrical energy from the chemical gas energy. But the warmth of the engine is turned into long-distance heating energy.” What this means is that the efficiency of the entire plant is quite significant; quoted at 25-28% in electricity and the total efficiency is more than 85%.²⁴

In addition to the gasification plant there is also a state of the art biomass long distance heating plant that has been in operation since 1996. It supplies approximately 260 objects and has a network length of 24,000m. The performance is rated at 14kW with a breakdown in the following: a 5MW organic matter boiler, a 3 MW organic boiler,

²² Msc Excursion 2009 pg, 14

²³ Biomasse Kraftwerk Gussing Gmb & Co KG, “Biomass power plant Gussing,” Biomasse Kraftwerk Gussing Gmb & Co KG, www.netequity.biz/docs/BioChip/Gussing.pdf (accessed July 23, 2009).

²⁴ Ibid Kraftwerk

and a 6 MW oil boiler for peak hour production. The plant delivers approximately 26 mil kWh/year to the towns of Gussing, Krottendorf, Tabaj as well as the industrial part of North Glassing.²⁵

One of the advantages of the plant is that it buys all its products from local wood producers. According to the company this ensures the careful upkeep of local forests because the company is always requiring a steady flow of wood resources for energy production. Yet there is also a negative aspect to this energy production because local timber sources are being depleted to provide energy. Should these sources run out, the plant would no longer be functional. Additionally, cutting down trees also reduces the amount of CO₂ that is removed from the atmosphere. Although this system does have the obvious economic and environmental advantages of locally produce energy, the company does admit like all biomass plants, the plant does generate greenhouse gases such as carbon dioxide. Yet the company also claims that the waste gas is carefully controlled to minimize its production.²⁶ The production of greenhouse gases from this method of energy production is far less than those produced by fossil fuel burning.

Gussing also has a significant solar energy sector. In order to demonstrate the installation and use of this valuable resource, since 2003, Gussing has implemented a “Solar School” where craftsmen can learn about solar plants for hot water and heating as well as a photovoltaic plant for the feed-in of solar-power.²⁷ Training craftsmen such

²⁵ Gussinger Fernwarme GmbH, “Biomass long Distance Heating Plant Gussing Ltd,” Gussinger Fernwarme GmbH, www.alr-sh.de/modules/downloadliste/.../FernwaermeGuessing.pdf (accessed July 23, 2009).

²⁶ Ibid Gussinger Fernwarme GmbH

²⁷ BORG Gussing, “Solar School: Trade Grammar School: BORG,” BORG Gussing, www.eee-info.net/cms/netautor/napro4/wrapper/media.php?id (accessed July 20, 2009).

as plumbers and carpenters about solar devices increases the chances that this technology will be present in homes and businesses. Gussing has made it more likely that consumers would invest in this technology because it has become more popular.

Additionally, by educating their craftsmen about the values as well as processes involved in their procurement of this resource, the Gussing municipality has signaled their support for this alternative technology. The demonstration plant at BORG has a collector surface of 20 sqm roof and storefront. With a storage volume of 3,000 liters, the demo plant also has an approximate floor heating space of 36 sqm and can provide for a hot water consumption of 1,500 l/d and a total energy performance per year of about 14,000kWh.²⁸ The photovoltaic demonstration plant also has a solar power performance of approximately 9,000 kWh per year although the collection surface is nominally larger at 92 sqm.²⁹

Solar energy has obvious environmental advantages. After paying for the initial cost of the solar panels, the cost of solar energy is minimal and it is estimated that consumer begins to financially benefit from solar energy after 5 or 6 years. There are some individuals that simply do not want to spend the large cost for panels that will not return a profit until years later. The other slight disadvantage is that if the weather is poor such as in winter in Austria, there may not be enough available sunlight to activate the cells. Additionally, for a large amount of generation, the surface area of the panels has to be quite large as witnessed in the examples above.

SEEG Mureck

²⁸ Ibid BORG Gussing

²⁹ Ibid BORG Gussing

There are three companies which make up the SEEG Mureck Energy Cluster and they are as follows: SEEG Mureck, Nahwärme Mureck and Ökostrom Mureck. The output from this Energy block helps the region to meet its energy needs.³⁰ The three companies use different alternative energies to help generate the energy for the local consumers and businesses.

The first company, SEEG Mureck, founded in 1989, has produced biodiesel fuel for farmers of the area since 1991.³¹ What is interesting about this company is that it functions a bit like a cooperative in that there are nearly 600 owners from the region, most of whom are farmers. Although it began with a very modest production of capacity of 0.5 Mio liters, its size gradually began to grow and since 2005 has had the capacity to produce 10 Mio liters of biodiesel.³² Additionally, in 2006 it opened its own biodiesel filling station, where individuals other than the farmers in the cooperative can purchase biodiesel as they like. Making this fuel available to consumers as well has helped to raise the profile of biodiesel.

Basically the farmers provide the plant with rapeseed which is then turned into biodiesel fuel and then returned to the farmers for mobility of tractors or other forms of transport which in turn increases the agricultural output of the region. In addition to the biodiesel there is another byproduct of this process, colza cake, which can be used as animal feed.³³ The farmers are receiving valuable products from their input which helps them to develop their farms. Yet SEEG is not just helping farmers, it also contributes a

³⁰ SEEG Mureck, "Bioenergy, Pathways to a Livable Future," SEEG Mureck, <http://www.seeg.at/en/index.php#> (accessed July 23, 2009).

³¹ Ibid SEEG

³² Ibid SEEG

³³ Msc Excursion 2009 pg, 15

great deal to local businesses as well with its cooking oil processing plant. Collecting the used oil from restaurants or other local venues since 1993, the plant has turned this formerly unusable substance into biodiesel as well. There are obviously many advantages of biodiesel production, one of the most attractive is financial. The SEEG website lists the per liter price of biodiesel of 0.839 Euro, this is in sharp contrast to the present price of regular diesel which was listed July 25th by the Auto Club of Austria at: 0.864 Euro. We can see that in addition to the environmental benefits of reducing the CO2 in the atmosphere, biodiesel also has economic advantages.

The second company which makes up this energy block was created in 1998 after nearly 3 years of preparation, Nahwärme Mureck. Is basically a biomass plant that provides energy to the local towns. The heat is essentially provided by, “two 2-MW heating furnaces and currently, 200 buildings are hooked up to this network - its length measures approximately 12 km, and has 6.5 MW of Connection Power as well as an electricity output of 0.4 MW el.”³⁴

The fuel is received from farms and sawmills throughout the region and “the sources for heat production are wood and waste wood allocated by the timber industry and forestry. The Nahwärme Mureck heating system also utilizes the industrial waste heat from common electricity production.”³⁵ The region has basically discovered a way to eliminate the waste from its region by utilizing it in biomass plants to produce energy for the region. The advantages according to the company itself are: secure jobs, environmentally friendly energy, use of local resource as opposed to importing fossil

³⁴ Ibid SEEG

³⁵ Ibid SEEG

fuels, reduced air pollution, independence in the area of energy supply.³⁶ Another significant advantage that this plant offers is that the energy is available to all residents of the region, without discrimination. The website even recognizes that individuals may have some difficulty meeting their economic responsibility and there is financial support available. This company seems to have recognized that all individuals in the region have the right to access this environmentally friendly and locally produced energy.

The only disadvantage that could be cited once again is that the biomass plant depends on the acquisition of sources such as wood. Should this resource become in short supply, the plant would have some difficulty in procuring energy for the region.

The third company that makes up this energy block is a biogas plant created in 2005 after 4 years of preparation and construction. The Ökostrom Mureck GmbH is a company owned by Nahwärme Mureck GmbH and seven farmers from the region. According to the website, the company's plant has an operating capacity of 1.165 kW. However the total energy production is 8,000 MWh per year and has a similar heat supply as well.³⁷ What is more is, "the electricity produced from it is fed into the public electricity network and the waste heat is fed into the distribution network of Nahwärme Mureck." By this process the plant can attain a high level of efficiency. There are many sources for this production including, liquid manure, renewable vegetable raw materials and by-products from the biodiesel production of SEEG Mureck.³⁸

What is so advantageous about this tri-part energy cluster is that some of the byproducts or waste products can be reused by one of the other companies and made into some other form of energy that supports the region. In addition to financial benefits

³⁶ Ibid SEEG

³⁷ Msc Excursion 2009 pg, 15

³⁸ SEEG

such as making energy resource importation unnecessary, there are environmental benefits such as the elimination of a potential 45,000 tons of CO₂ per year that would have been released into the atmosphere via fossil fuels.³⁹ Once again a potential disadvantage is that the resources for the production of this energy are heavily reliant on agricultural or farming wastes. Should these industries fail or decrease in capacity, it is quite likely that there will not be sufficient resources to produce this green electricity. Something else to consider would be the loss of potential sources for fertilizer. Since manure is being processed to create electricity, if this system is not carefully controlled, is it possible that this valuable resource could be diverted from nutrient deficient farmland.

AEE Intech Glesidorf

Austria also has another company, AEE Intech, located in Glesidof, which is helping to make solar energy a reality in the country. Since 1988, the company has performed research as well as provided consults to various private and public organizations concerning solar energy.⁴⁰ By personalizing the solutions, the company has helped individuals and companies understand the benefits as well as the limitations of solar energy, sustainable buildings as well as sustainable water management.

In the solar energy sector, the company is most versed in the area of providing domestic hot water and space heating. Yet recently AEE has expanded its work into

³⁹ Msc Excursion 2009 pg, 15

⁴⁰ AEE Intech, "Institute for Sustainable Technologies," AEE Intech, <http://www.aee-intec.at/index.php?seitenName=themenDetail&themenId=1> (accessed July 22, 2009).

fields such as solar cooling and solar heat for industrial processes.⁴¹ An interesting figure that AEE cites is that, “Austria, with its approx. 400,000 solar thermal systems, covering a total area of 3.3 million m² (2.3 GW_{th}), is one of the world leaders in solar energy use.”⁴² It is obvious that this alternative energy has great potential in Austria as well as support. With AEE’s help, the country has begun to move forward in this alternative energy sector.

In addition to solar energy research, the company since the mid 1990’s has begun to research sustainable buildings technology. Its two-fold goal is “product and system development and the planning of holistic energy concepts for new buildings and renovation projects.”⁴³ Finally, AEE in recent years has become more and more involved in the area of sustainable water management. Some of the systems it is involved in procuring are, “zero outflow systems for domestic water supply and sanitation, on a household as well as a community scale”.⁴⁴ AEE develops treatment systems such as constructed wetlands for the treatment and reclamation of waste water for irrigation purposes.

The company has some obvious advantages considering its research and technology development. With respect to its solar technologies research, AEE is helping to harvest a readily available resource. Sustainable buildings help to prevent inefficient energy use policies as well as use the natural environment in conjunction with produced materials to reduce energy costs. Finally, AEE’s water management program helps to

⁴¹ Ibid AEE

⁴² Ibid AEE

⁴³ Ibid AEE

⁴⁴ Ibid AEE

recycle valuable wastewater as well as reduce overall waste that might otherwise end up in groundwater or other locations.

Weiz-Elin

The Elin company, established in 1892, has undergone many transformations as it has changed hands, seeing significant evolutions in 2002 and 2005 when it became partially owned then fully owned by TRASYS respectively. While not a power plant itself, it provides key equipment that allows for the construction of key alternative plants in countries such as Germany, Qatar and even New Zealand. With three main facilities in Weiz, Salzburg, and Weiner Nudorf, the company has a very important goal which is to “attach great importance to monitoring, maintenance, service and refurbishment of transformers in the context of “Life Cycle Value”.⁴⁵ With such a value, it is clear that this company is motivated to provide quality equipment for energy production. Additionally, Elin’s mission statement includes sentiments about protecting the environment, “Our mission is to provide products and services that warrant the safe, environmentally-compatible and efficient transmission of electric energy.” So while not an actual power plant, this is a leading company in the region that makes clean energy possible.⁴⁶

Companies making choices about products need to consider the longevity of companies such as Elin and recognize their commitment to energy. In the town of Weiz there is a production facility that provides “transformers for the transmission and distribution of electric energy.”⁴⁷ Additionally, the company does not discriminate against

⁴⁵ VA Tech Elin Transformatoren, “About US”, VA Tech Elin Transformatoren http://www.vatech.at/profile/company_info.asp?LNG= (accessed July 22, 2009).

⁴⁶ Ibid VA Tech Elin

⁴⁷ Ibid VA Tech Elin

alternative technologies equipment. Many of its products are used in the production of alternative energy such as wind energy and hydroelectricity. For a full list of products see footnote below.⁴⁸ Elin is also experimenting with the efficiency of electrical engines and doing research in order to make them more efficient. Something to note is that there is an obvious economic advantage of producing this type of machinery in Austria because it can either be used locally for energy procurement or can be exported for profit to neighboring countries. One quite successful plant, located in Neudorf, Germany is using the material from Weiz-Elin. This technological development in Austria has also spurred Germany, to experiment with methods that increase the efficiency of power plants via the use of electrical engines.

Hydropower Kapfenberg

The power plant in Kapfenberg is a perfect example of a small hydro power plant in action. The plant has dammed the river Murz in order to supply the approximately 22,000 residents of Kapfenberg with nearly 12% of their total energy demand for a

⁴⁸ BusinessWeek, "Elin EBG Motoren GmbH," BusinessWeek, <http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapId=26359872> (accessed July 24, 2009).

Manufactures and supplies electrical motors and generators. It offers liquid-cooled generators, such as induction and synchronous generators, variable-speed drives with dual feed induction generators, and frequency converters for wind power stations; liquid-cooled three-phase induction engines for plastics, tunnels, and mining; and products for mills, boiler feed pumps, main-cooling-water pumps, air-intakes, and induced-draught fans to the power-supply companies and coal power plants. The company also provides solutions for turbo, spiral lobe-type, piston, and rotary-piston compressors; induction and asynchronous generators for decentralized power generation for the use in gas engines, and gas and steam turbines, as well as asynchronous generators for hydroelectric turbines. In addition, Elin EBG offers drive system solutions from low-voltage engines to high-voltage engines, surface-cooled, air to air, and air-water-cooled engines to the plant construction for the paper, cement, chemical industries, materials handling, and hydropower technology industries; and products for railway engines.

yearly total of 10 GWh. Composed of 2 generators in operating since 1996, the plant also includes turbines with a nominal power of: 2 X 881 kW.⁴⁹

There are advantages to this plant in that it encourages local production of energy, which saves surrounding towns and residents financial resources. As with all dams, the water can be stored until there is a peak demand for energy and then it can be released. Also dams do not have greenhouse gas production associated with them and modern technology has allowed for hydro power turbines convert up to 90 percent of their energy into electricity. This near twice what coal plants can offer.

Unfortunately there are also negative consequences associated with dams. In times of drought, which is becoming more and more of a reality with climate change, energy production may be lower due to lower water flow. Additionally, by damming one area of a river, there can be negative consequences on the local environment or even disputes from neighboring towns downstream due to managed water flow. Maintaining a dam can also be quite costly. In an area such as Kapfenberg with a low population, taxes may have to be raised in order to pay for the cost of maintaining the dam.

Small Hydro Power Gaming 1 and 2

There is also another example of small hydro power in Austria in the region of Gaming. In fact there are two different plants established here, each with a different goal. In Gaming 1 what we see is the production of both energy and drinking water for the capital Vienna. Since 1926, the plant's inception, energy has been procured due to

⁴⁹ Excursion 2009 pg, 20

the natural conditions provided for by the river. There is nearly a 220 meter drop over the course of the 11 kilometer range of the river after which the water is lead through an 8,000 meter gallery in Grubberg. From the gallery, the water is moved to a water castle and then a 588 and a 188 steep pipeline lead it to 2 Francis turbines in the power plant.⁵⁰ The Gaming II plant was installed in 1990, nearly 80 years after the Gaming 1 plant. This plant also uses the difference in the height of the river to produce electricity which is then fed into the Gaming 1 grid.⁵¹

The hydro plant saw the replacement of one of the turbines in 1998 after having functioned for nearly 70 years. According to Voith Hydro, “The new 5.5 MW unit generates 42 GWh annually, this means that the annual use of the turbine is on average at approximately 90% load, without any interruption of the drinking water supply.”⁵² This has resulted in a net increase of 7% in energy production.⁵³ Although there many have been some concerns about the water quality, it was discovered that energy procurement could occur without any negative impact on the water supply. There are even provisions for water diversion in the event the plant breaks down. These safeguards were implemented to ensure the pristine quality of the water.

The advantages of this plant are numerous and include many of the aforementioned reason of both financial as well as environmental sustainability. Yet a possible negative consequence would be if the existing plant did break down and the safeguards did fail. In this case then the city of Vienna might be left without quality

⁵⁰ Excursion 2009 pg. 21-22

⁵¹ Ibid Excursion pg, 22

⁵² Voith Hydro Holding GmbH & Co. KG, “Gaming, Austria,” Voith Hydro Holding GmbH & Co. KG, http://www.voithhydro.com/vh_en_references_small_hydro_gami.htm (accessed July 22, 2009).

⁵³ Excursion 2009 pg. 21

drinking water. Also since the upkeep of a plant is quite expensive, as was seen with the replacement of a turbine in 1998, this may raise local taxes. Another factor which might one day be significant is the ever changing development of hydro energy systems. The turbine was replaced nearly 10 years ago but in the last few years, dams and hydro systems have become better and better at maximizing their electricity generation capability. So in a sense perhaps the Gaming 1 plant is missing out of the production of potential energy that it could sell to other regions. This would drop the overall cost per kilowatt hour. Finally, although it seems that the natural environment is not affected by this power plant, it should be mentioned that every building or incursion that people make into the natural environment has some effect on the region. By diverting the flow of the water, the plant over the long term could be disrupting the natural river dynamics.

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