Nature Exchange Visit

10th to 17th October 2011
Slovenia

Renewable Energy

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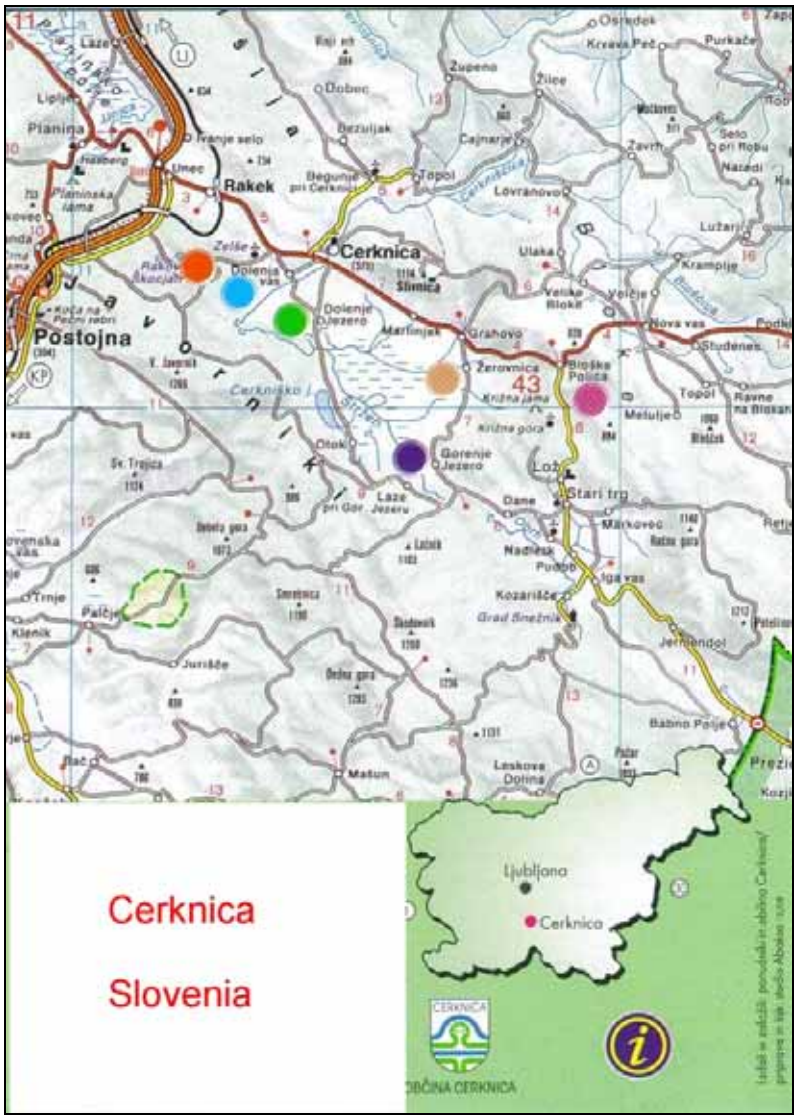
Introduction

This report is an account of a recent fact-finding trip to Slovenia to study the development and recent changes in renewable energy technologies and energy conservation there in comparison with Scotland.

The exchange visit was funded through the Leonardo da Vinci programme of the European Commission.

The project is promoted and managed in Scotland by ARCH network, based in Comrie Perthshire, and the host partner organisation in Slovenia, the Vitra Centre for Sustainable Development, a non government organisation which encourages the use of local resources in a sustainable way in the Cerknica region of Slovenia.

Slovenia



Slovenia one of Europe's smallest nations is located in central Europe and has a population of around 2 million and an area of 21,000 square kilometres, roughly the size of Wales Population density is only 98 per square kilometre with 50% of these living in rural areas. . By comparison Scotland is 79,000 square km with a population of around 5.2 million, a density of 64 per sq km.
The country extends from the Alps in the north to the Mediterranean in the South. Slovenia is one of the most densely afforested countries in Europe. Forests cover 54 percent of the surface area, and dominate as much as three-quarters of the landscape.

Forests of the Karst Plateau

The climate in central Slovenia is continental with hot summers and cold winters. 40% of the country is mountainous and the remainder is sub-alpine hills, karst plateau forests and flat plains with a 50 km Adriatic coastline.
Cernika has average July and August temperatures of 19°C and -1°C in January.

Slovenia became an independent republic in 1991 and a member of the European Union in 2004. Slovenia has never been a poor country and before independence was by far the wealthiest republic in Yugoslavia, although they represented only 8% of the national population the industrious Slovenians produced 20% of Yugoslavia's GDP and exported more than a quarter of its goods.

Slovenian people generally remain within their local area throughout their working lives with close family ties to the land, properties and businesses.

Details of sites and locations visited

Visit	Day	Date	Facility/ House and Heating System	Location
Factory	Tue	11 Oct 11	Fibran Insulation Factory	Novo Mesto
Factory			Riko House Factory and Museum	Ribnica
House			Old log boiler	Sodrazica
House			Air source and wood pellet	Bloke
House			Log boiler	Grahovo
Factory	Wed	12 Oct 11	Window Factory	Planina
Facility			College, wood chip boiler	Postonja
House			Wood chip boiler and solar	Postonja
Facility			Wood chip District Heating	Postonja
House			Solar panels for heating	Postonja
House	Thu	13 Oct 11	Log and solar	Preserje
House			Log and solar	Preserje
House			wood pellet boiler	Preserje
House			Solar,air source heat pump	Brezovica
House	Fri	14 Oct 11	Solar collectors	Grahovo
House			Log boiler and insulation	Grahovo
House			Solar Thermal on Ground	Grahovo
House			Ground source heat pump	Cerknica
House			Solar hot water	Begunje
House	Sat	15 Oct 11	Air source heat pump	Cerknica
House			logwood stove	Rakek
House			logwood boiler and insulation	Begunje
House			Passive heating, solar and photovoltaic	Begunje
House			Passive solar and ground source	Begunje
Factory	Sun	16 Oct 11	Pallet Factory	Rovte
House			Passive House air source	Rovte
Facility			Wood chip boiler, solar, heat recovery	Hotedrsica
House			Log boiler and solar	Logatec
House			Insulation and log stove	Logatec

Housing in rural Slovenia

The majority of the older houses in the area we visited were two storey detached family houses, built mainly of stone walls plastered inside and rendered externally, The more modern houses were constructed with reinforced concrete frames and floor slabs with walls built with clay air bricks or concrete blocks plastered and rendered externally.

Typical mix of housing in the area

Energy Production in Slovenia

Within city areas of Slovenia power has been produced by coal power stations, using Slovenian mined lignite. The nation also has one nuclear power station which provides 40% of the country's electric power but this is half owned by Croatia, Slovenia plans to stop using it by 2023. There are also hydro electric plants in the north of the country. Slovenia produces 1.2 million tonnes of waste a year almost half of this domestic, much of which ends up in illegal tips. No waste incineration is carried out in Slovenia to provide energy from municipal waste.

With the abundance of wood in the countryside, the traditional rural houses in Slovenia were heated by a wood burning ceramic stove with the log stove in the kitchen used for cooking and the thermal mass of the store in the adjacent living area and also used for dried fruit etc some refurbished houses we visited had retained theses traditional features.

A traditional Slovenian heating system and a unit retained in a refurbished house

Oil

Many houses with central heating, installed oil boilers, but as oil prices have increased by around 400% in the last 10 years this fuel source has been under increasing pressure and people are again looking at alternative fuels.
Several houses we visited had opted to retain their oil boilers and incorporate them into a biomass system as a backup or for water heating only in the summer months.

Biomass boiler and oil boiler installed in tandem

Biomass

Wood and biomass powered systems have become much more sophisticated and efficient, up to 90% in recent years using high temperature and flue gas recirculation. Many of the biomass boilers seen in Slovenia are manufactured in Austria and Germany.

Because of the inability to turn biomass boilers on and off quickly to control their output, they are usually linked up to a large buffer tank of water kept at a high temperature with the heating and hot water for the house are delivered from this tank as and when required.

Generally speaking biomass boilers and systems are much larger than oil or gas and require considerable sized rooms or boiler houses, many continental houses have basements which are an ideal location the boilers, equipment and fuel stores.
The practicalities of wood boilers include the requirement to be able to ensure a good supply of quality wood, the ability to store it in dry surroundings for up to two years and the work required to process it prior to use.
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Biomass alternatives to oil boilers also include wood pellet boilers, which use wood particles that are compressed into pellets which have a consistent density and a higher calorific value, up to twice that of logs, these pellets can be automatically fed via a hopper or adjacent storage area to the boiler as required. Pellets can be delivered in 20 kg bags 1000 kg bags or bulk tanker and blown into the store.

The advantages of pellets are a consistent, clean fuel source that can be fully automated but against this is the higher cost of the boiler and pellets

Wood chip is also an alternative fuel source for biomass boilers but is much more variable in quality, not as readily sourced and generally requires a larger storage capacity. Wood chip is only likely to be viable for larger installations in excess of 50 kW or where the end user has a suitable supply of wood and access to a chipper.

Two installations we visited where wood chip were used were a college which in 2008 invested in a 1M Euro scheme to change the existing oil heating to wood chip together with the improvements to the insulation this has resulted in an annual reduction in energy costs from 100,000 Euro to 42,000 Euro.

Similarly a district heating scheme which we visited that had just been completed has installed two woodchip boilers one of 1.5 MW and one of 1 MW together with a 0.5 MW oil boiler to cater for the 5 to 10% peak loads.

The capital cost of the plant was 1.5M Euros with an expected 8 to 10 year return on the investment. The annual requirement for 5,000 to 6,000 cubic metres of chip is through a contract to supply an output of 2,700 MWh, ensuring the responsibility for quality of chips rests with the supplier.

1.5MW Biomass District Heating Plant

During our trip we were able to visit and talk to several people who had installed heating systems where considerable innovation, and ingenuity had been employed.

At one house the owner who had access to his own forest used his tractor and chipper to produce his own supply, around two cubic metres of wood that had been seasoned for 6 months could be chipped in 30 minutes and then blown into his adjacent store.

Solar Power

Solar systems can be divided into two types, solar water heating and photovoltaic used to produce electricity

Several of the systems we looked at used solar panel systems to increase the water temperature in the buffer tanks connected to biomass boilers. These systems then

used the large volume of water at a temperature of around 80 ºC to heat the radiators throughout the houses.

Another owner, who had an industrial boiler business, had installed an array of solar tubes on a pedestal behind his house which rotated to track the sun in order to maximise solar energy output.

Photovoltaics

Photovoltaic or PV panels produce electricity directly from solar energy falling on a silicon panel this electricity can be used directly or to heat water in the accumulator tank. One house visited and just installed a 52 panel system, with a maximum output of 11Kw, but had not yet connected to the grid but the owner's expectation was to generate all his electricity year round from this source.

Heat pumps

Ground source

Ground source heat pumps work by extracting the latent heat from the earth and then using a heat exchanger to increase the temperature to provide usable heat, the houses we visited with this form of heating were new houses with high levels of insulation and underfloor heating where the system works very well

Air Source

Air source pumps work on the same principle by extracting heat from surrounding air and through a heat exchanger increasing the temperature to a usable level for heating, in one particular house the owner had develop an ingenious way of increasing the air temperature at the intake by using an underground pipe to by convection draw cold air from a lower level in this garden to the upper level.

12 KW Air source heat pump and 14 Cu M swimming pool used as heat store

One advantage of heat pumps in a climate where summers are hot is that they can be used in reverse as air conditioning units to cool the interior of houses

Energy conservation

In several of the houses we visited measures had been put in place or are being carried out to improve insulation and energy efficiency of the houses. Many houses had opted to apply external installation to the walls. A visit was made to a factory where expanded polystyrene insulation was produced, the factory included an in-house training facility for architects and builders where models of construction details were on display

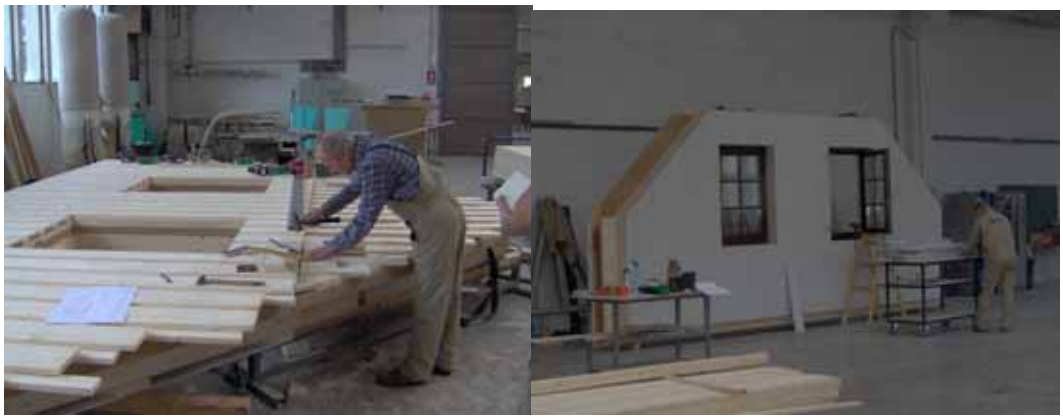
Wall and roof insulation model showing use of expanded polystyrene

External Insulation and Re-rendering

Similarly we visited a window manufacturer where very high thermal property windows were being manufactured with triple glazing.
Grants of up to 3,000 Euro are available in Slovenia towards the average costs of 9,000 to 15,000 Euro costs of replacing existing windows with new wooden windows.

Section through triple glazed window

A visit to a system built housing factory demonstrated the advantages of prefabrication of high quality wall and roof sections within a moderate computer-controlled factory environment the costs of factory built units were 600 Euro/sq m compared with 1600 Euro/ sq m for site construction, with the added advantage of no downtime due to weather and better quality control.



System build housing factory.

Passive housing

Passive houses are defined are those requiring very low levels of energy input, <1.5 KWh/ sq m, compared to conventional buildings of around 150KWh/sq m.
and include systems to exchange any heat from the air being exhausted from the house to pre heat the incoming air. One passive house we visited had recently been constructed and was said to be only 10% more expensive to construct.

Using by-products of industrial processes

Two of our visits were to production factories where boilers were installed to utilise the waste from manufacturing processes.

The window factory manufactured high-quality windows made from spruce and larch much of the larch imported from Russia

As part of the production around 700 cubic metres of waste wood per year is generated and investment of 100,000 Euros in a waste sawdust boiler capable of producing 200 kW provided heating a factory unit.

Sawdust waste boiler and sawdust extraction silo

The other factory unit visited manufactured pallets and similar products, cutting 50 cubic metres of timber per day on their production line and generating a total of 20 cubic metres a day of sawdust and 10 cubic metres of chips are produced of this 10% is used on site and 90% are sold on.

Comparisons with Scotland

Although wood has been used in Scotland for centuries for heating this has generally been on open fires, with the increased use of wood fuel stoves and boilers it is necessary to have a large area in which to store the wood and time to dry it prior to use. It is also essential that good burning wood is sourced and this is often not easy to acquire. Wood costs appear to be similar to those in Slovenia at around £50 per cubic metre although in Scotland it is generally sold by the ton or load. Wood pellet stoves and boilers have started to enter the market in recent years and in general require a large space for the boiler and the fuel storage, the cost of pellets appears to be similar to Slovenia at around £200 per tonne.
It is hoped that the renewable heat premium payment and the renewable heat incentive will make these systems more attractive as the capital costs of these systems are high.

Solar water heating appears to be a good prospect in Scotland with the possibility of all domestic hot water being produced this way in the summer months. Also PV appears to be attractive because of the renewable heat incentive payments currently available but these will be considerably less attractive following the recent announcement of the cut in the rates.
Unfortunately we were unable to visit a micro hydro site in Slovenia, this is a form of renewable energy to which Scotland is well suited but the required construction consents can make it less attractive to individual households.

Conclusions

Slovenia appears to have a similar approach to energy conservation as Scotland with respect to new build housing but has addressed the energy policy for refurbished housing in a better way by providing grant assistance and advice for external insulation and more efficient windows.

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I am sure that they would agree that we have all benefited immensely from the experience, and will endeavour to disseminate the information gained widely and welcome a reciprocal visit from a Slovenian group with similar interests, in order to further the development of renewable technologies in both countries.