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SUMMARY

The paper describes the "power rush" that is under way in Iceland to supply electricity to aluminium smelters. Two plants were commissioned in the past year and a half and two more turbines will come on stream before the end of the year. Six drill rigs are now active in winning steam for projects that are in the pipeline. In addition to the active home scene Icelandic banks and project developers have been very active overseas and have set their aims at becoming global players within the geothermal industry.

1. PUBLIC/PRIVATE VENTURES

The geothermal industry in Iceland is an important one as 89% of all houses are now connected to geothermal district heating systems (1700 MWt) and the growth lately in electric generation (total 478 MWe installed power) has been rapid to meet the demands of the aluminium industry. The economy has boomed and Icelandic companies have expanded mainly through foreign mergers and acquisitions in banking, real estate, retailing and transport in the Nordic countries and England. This development is spilling over into the geothermal industry, now seeking to become a global player. Private/public investors are now actively pursuing foreign opportunities in financing and project development and through investment in foreign firms. A major merger of the investment arm of Reykjavik Energy, by far the largest geothermal utility, and Geysir Green Energy, a private company owning Iceland Drilling and other geothermal assets, in early October 2007, caused a political storm and a new coalition came to power in the city of Reykjavík. The debate was over whether a public utility should be engaged in risky foreign ventures and the speed and lack of information the politicians were confronted with in approving the merger. Once the merger was announced the leading party in the ruling coalition wanted to sell the shares as soon as possible. Incomplete information on the valuation of the company, stock options offered to key Reykjavik Energy employees, exclusivity for 20 years on exchange of expertise and technology in relation to developing new geothermal projects were a few of the items that had not been fully disclosed, which reporters then had a heyday of exposing. There are other public/private energy related ventures that have not met the same scepticism such as stocks of the three major utilities in ENEX that represented the foreign interests of most geothermal players, Landsbanki/National Power Company on hydro projects and earlier purchase of Geysir Green Energy of the governments shares in Sudurnes Regional Heating.

2. POWER GENERATION

Iceland has a series of high-temperature areas in the volcanic zone crossing the central part of the country which straddles the Mid-Atlantic Ridge. There is now power generation at six sites, and by the end of this year Reykjanes will have 100 MWe, Svartsengi 75 MWe, Hellisheiði 120 MWe, Nesjavellir 120 MWe, Krafla 60 MWe and Bjarnarflag 3 MWe. Last year the Reykjanes and Hellisheidi plants came on stream with the bulk of the power sold to an expanded Century aluminium factory. A major hydro-project, Kárhahnjúkar, is coming on stream to generate up to 690 MWe mostly for a 346 thousand tonnes Alcoa aluminium plant at Reyðarfjörður in the east. At least four other aluminium projects are in the pipeline and there is competition between them to sign power purchase agreements and also to take advantage of any unused carbon allowances under the present Kyoto protocol, where Iceland secured an increase in the quota to enable renewable energy projects to be built. This construction activity has met with resistance from environmentalists and is slowing down approval of hydro-power projects. The first aluminium plant in Iceland at Hafnarfjörður, now Alcan, met local opposition to a planned expansion as rezoning of the site was rejected in a popular vote, in spite of having completed the EIA process and having signed a MOU for power purchases. Geothermal projects are also facing more scrutiny than in the past, mainly for their and associated power line visual impact in wilderness areas. A committee that ranked the environmental impacts of hydro- and geothermal projects showed geothermal projects generally to be more favorable and thus the three power generators, National Power Company, Reykjavik Energy and Sudurnes Regional Heating, are all actively pursuing drilling at new geothermal sites. Presently there are six drill rigs engaged in the drilling effort. The drilling contractor, Iceland Drilling, has acquired new highly automated top-drive rigs whereby the time to drill a well has been shortened as well as throug the application of

down-hole motors and aerated drilling. Well outputs have been good. The 100 MWe plant at Reykjanes uses 11 production wells and the first 90 MWe plant at Hellisheiði 6 wells. The spent brine is being reinjected except at Reykjanes and at Svartsengi half of the brine, the other half going to the Blue lagoon a popular spa and pool.

3. DISTRICT HEATING

District heating continues to be the main application of geothermal energy in Iceland (pop. 300,000) as it has a large natural market in the cold climate where heating is required most days of the year. There were 24 municipally owned systems and some 200 private ones at one time but mergers and purchases mainly by Reykjavík Energy and some by Sudurnes Regional Heating have consolidated the ownership. Houses in the rural areas are still being connected, mainly via insulated plastic pipes, as there is a government incentive program that will pay up-front 8 years of subsidies that go to the unfortunate few who do not enjoy geothermal heating (appr. 1000 US$/year per household). There is increased consumption of hot water due to building activity; now almost every town wants a covered football field that is heated. There are also some 130 geothermaly heated swimming pools. The use in industry has, however, declined as the Kísiliðjan diatomite factory in at Mývatn was closed down in 2004 after 37 years, the salt factory at Reykjanes has been idle for years, the wool washing plant at Hveragerði was moved and drying of hardwood in Húsavík stopped.

4. ICELAND DEEP DRILLING PROJECT

The Iceland Deep Drilling Project (IDDP) is planning to drill one deep well at Krafla and at two other sites in short progression. The power companies will at their own cost drill to 3500 m and then turn the well over to IDDP for deepening by the consortium. Funding the IDDP effort are the three main power companies, the Icelandic government, Alcoa and with scientific funds for coring and studies from foreign sources. Earlier it was envisaged to take a continuous wireline core from 3500-4500 m but the plans have been modified to take spot cores at selected depths instead, and drill the well with an 8-1/2” bit rather than 4” for the cored hole.

5. EDUCATION

The present “power rush” is not limited to the generation of power for the aluminium industry and in overseas ventures. The universities have set up programs in renewable energy technologies and in geothermal science and engineering. The longest standing is the United Nations University Geothermal Training Programme (UNU-GTP) which offers an intensive 6 month program in eight lines of specialization. Annually 21 fellows graduate and the total is 380 over its 29 years history. There are also 12 ex UNU-GTP fellows pursuing their Masters studies at the University of Iceland under a cooperation agreement with the UNU-GTP. The University of Iceland, Reykavik University and Reykjavik Energy have agreed jointly to develop a graduate programme at the masters and doctorate level in energy science. At the University of Akureyri in the north The School for Renewable Energy Science is accepting students to their MS program with one of the three lines focused on geothermal energy. At the newly vacated American NATO base in Keflavík, Keilir Atlantic Center of Excellence intends to start a program with emphasis on energy and environmental technology.

6. ADVANCES

There have been advances in drilling effectiveness as the result of new technology and more wells being drilled of the same type in known geological environments. The design of power plants has evolved and an important component of three plants is the co-generation of heat and power. Then there is the unique Kalina pilot plant at Húsavík where ammonia-water mixture is the working fluid. Iceland takes part in four EU projects addressing geothermal with the acronyms ENGINE that has dissemination of knowledge on enhanced geothermal systems (EGS) as its main activity, I-Get looking at geophysical mapping of deep geothermal structures, HITI development of high-temperature logging tools and Lo-Bin to optimize generation of power from low temperature resources with binary units.

Iceland is fortunate to have access to geothermal resources in most regions of the country at shallow depths and the water is relatively pure and can be used directly. This has meant relatively low energy prices that are decoupled from the hydrocarbon ones. Many countries now have on their agenda to increase the share of renewable in the energy mix. There deeper drilling will be required and the natural permeability and temperatures may not be as high. It will be a challenge to bring such power to the market, but the pressing needs for non-polluting power is likely to keep geothermal power on the agenda for years to come.

7. PEACE TOWER LIT BY GEOTHERMAL

Geothermal electricity was in the news when IMAGINE PEACE TOWER in Reykjavik was unveiled by Yoko Ono and dedicated to John Lennon on his birthday, October 9th. The tower is a powerful vertical beam of light from nine lamps. There Yoko Ono said “The light is the light of wisdom, healing and empowerment. Even in the moments of confusion, fear and the darkness of your souls, hold the light in your hearts, and you will know that you are not alone, that we are all together in seeing the light of peace.”