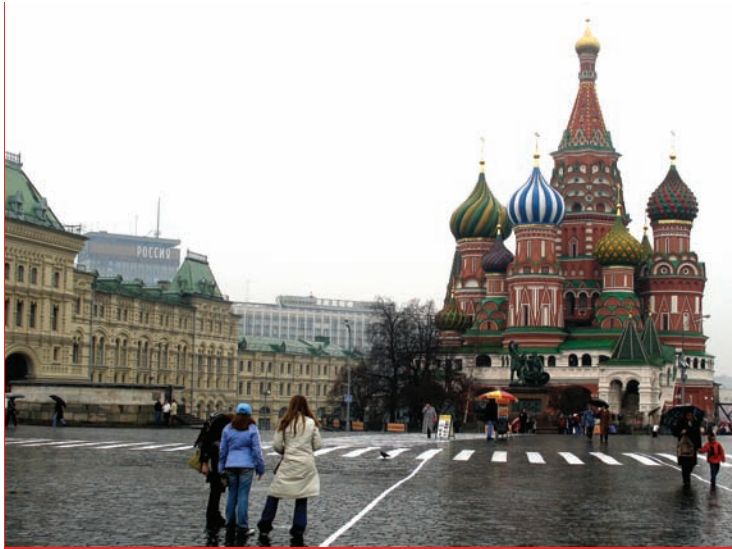




# The break-out of Rafteikning



At the Red square

"market rules" as they are in the society, but also to use the common western business ethics as much as we can. Rafteikning has also been working in Russia, in cooperation with Linuhönnun, the engineering company Afl and a Russian contractor company in St. Petersburg. Russia is in much need of repair and build-up of power stations and high voltage distribution systems. It is however nearly impossible to gain foot on the market without participation or joint operation of local firms, which can be trusted and have connections at the right places. Likewise as in Bulgaria the business ethics are somewhat different from what we are used to and it takes time to get used to it. Rafteikning has sent their representative with business committees from the Trade Consil of Iceland to Rumania, Bulgaria and now lately to Ukraine and Kazakhstan. These business trips can be useful and often high ranking officials are with the business committee, which excel the possibility to gain connections high in the bureaucracy of the nation visited. It is right to urge Icelandic engineering firms to participate in these business trips and use the available opportunities.

Through the years Rafteikning hf. has always had much cooperation with foreign firms. Mostly the cooperation has been because of projects our firm has been involved with in the field of power engineering, and also with our participation in the firm Virki and later in the firm Enex. Lately we have become aware of the necessity to be more active in expanding our work systematically to foreign markets. Both to strengthen the firm's position and also to have a better hold when there will be a slowdown on the Icelandic market. Which may be expected to happen after 10 to 15 years, or even sooner, if the political opposition against building hydro- and geothermal power stations prevail. In the year 2005 Rafteikning established a firm in Bulgaria, which was given the name Rafteikning Bulgaria. The primary reason for the location was the intended work the firm Actavis in Bulgaria and partially at their initiative. The anticipated work for Actavis there has not yet started. There are now three young engineers working for the company and the start-up and build up has been slow. It seems like getting projects for the company there depend heavily on who knows who in the society.

We have gained valuable experience from our firm in Bulgaria. It has told us what we need to do and what we need to avoid in a market as there. It is clear if we are to survive we must play by the



**Gunnar Ingi Gunnarsson**  
Executive manager



Holding the umbrella



Exhibition in Russia



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Rafteikning hf  
Suðurlandsbraut 4 - 108 Reykjavík  
Iceland

Tel: 520 1700  
Fax: 520 1701  
r@rafteikning.is  
www.rafteikning.is

# The Reykjavik

# University



Panorama of the University

The Reykjavik University is to be built at a new location. The area is of the size of about 20 ha and is near the Pearl and the Reykjavik Airport and sea.

The plan is the university moves into the new building in the year 2009 and there will be about 3500 students. Then the first construction is to be of the size of about 34 thousand square meters. Later teaching and laboratories will be built of 28 thousand square meters. An enlargement of the school will follow of about 72 thousand square meters, mostly housing for laboratories. The construction is to be completed in the year 2015. In addition to this, dormitories will be built of about 40 thousand square meters and buildings for car parking will be built of about 40 thousand square meters.

A preliminary selection was made before architectural competition for the area arrangement and the building design in the university area. Thirty five groups sent in proposals and thereof five groups were selected for the architectural competition. The selected proposal was like it says in the judicial committee "The buildings form a circular group, which ledge from a joint centre, large internal central square. Here we have a fascinating approach, where the scale of the building is delicate, it blends well into the surroundings and opens up convincingly towards the Nauthólsvík and the Öskjuhlíð". Also it says "It is planned the ground floor will be jointly used area, classrooms and main auditorium, also the library, dining area and cafeteria, which all lay at a centre square which enjoys the ocean view and the neighbourhood to the Nauthólsvík. Detailed location of lighted areas and also since the walkways radiates from the centre square of the building and opens up to the natural surrounding area, add grace to the interior and promises of flow, aura of transparent and lightness".

Rafteikning has done the preliminary work of the first phase of the project in cooperation with the Danish engineering firm COWI.

Then Rafteikning, in cooperation with the winners of the architectural competition for the Reykjavik University and others involved in the project, has done preliminary work for the first construction phase. The project has been defined and preliminary budget cost estimate done.

The time constraint for the project has been estimated and the necessity for special measurements, investigations and calculations valued. The predesign work has started and Rafteikning will take care of the electrical design of the project. The firms cooperating with Rafteikning in this ambitious project are the Danish architectural firm HLT, the Icelandic architectural firm Arkis, the engineering firm VGK-Honnun, the Danish engineering firm COWI and the landscaping architectural firm Landmotun. The Project Proposal is to be completed in July. It is anticipated the final design will start in August, it will be finished in April 2008 and the project will be ready for tenders. It may be assumed it will be several tending documents for the project.

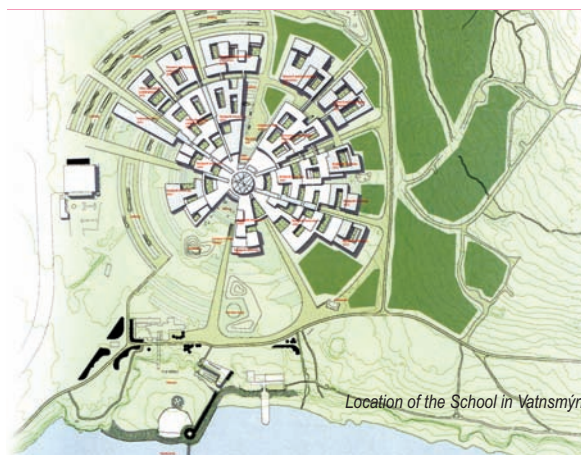
The design of the facility is in many ways a challenging task. The exterior of the university and the layout is unusual. The speed in the design work is and will be great until design is completed. Both Icelandic and foreign designers design the facility and the building is designed simultaneously at several engineering- and architectural firms in two countries. The user of the facility and the one providing the capital for the project are not the one and the same. Emphasis is made both by the user and the one providing the capital to keep the cost of the building down through the complete design process of the facility. Therefore it will be a challenge to keep the cost within the original budget cost. It is obvious the complexity of the design is high due to many designers, at various engineering- and architectural firms in two countries and the time is limited. In order to the design will be a success a consensus, good cooperation and communications must prevail in the design team during all design phases.



Role model of the school



**Steinar Jónsson**  
Electrical Engineer, MSc



Location of the School in Vatnsmyri

# SUBSTATION FLJÓTSDALUR ■

## STATUS REPORT

The contractor's installation and testing of the equipment in substation Fljótsdalur was mostly completed in the end of year 2006. The testing was very thorough as the substation's equipment is state of the art with control- and protection equipment requiring extensive testing. In December 2006 and in the beginning of 2007 the employees of Landsnet worked on acceptance tests of the substation's equipment. A 145 kV cable has been laid from the substation to the national 145kV line ring connection and is a part of the HV line Fljótsdalslína 2 that connects substation Fljótsdalur and substation Hryggstekkur. A 145 kV



Substation Fljótsdalur

substation has started to provide power from the national system and Kárahnjúkar to the Fjarðaál aluminium smelter in Reyðarfjörður.

Substation Fljótsdalur is one of the largest substations in Iceland and the country's largest 245kV gas insulated switchgear assembly so far.

Rafteikning has provided consulting, design and design review for all electrical equipment in the substation within the consulting group KEJV, as well as project management. The detail design of the equipment has been handled by contractors but the final design of the electrical house installations has been handled by Rafteikning.



**Helgi Þór Helgason**  
Electrical Engineer, MSc



Control and protection equipment

line was also built from the 145kV line ring connection to power plant Krafla down the mountain above substation Fljótsdalur to an end mast located by the substation. An 145kV cable connects the end mast to the substation. The substation was energized for the first time on January 9th 2007 from Fljótsdalslína 2. On the 29th of January the first of the two 220/132kV interconnection transformers, all the 245kV circuit breakers and 245kV Fljótsdalslína 3 to Reyðarfjörður were energized. Shortly after that 245kV Fljótsdalslína 4 to Reyðarfjörður was energized. The power transformers of the substation had to be fixed and that work is about to be finished as this article is written in the beginning of April. The substation should now be in full operation. Some smaller matters are still unfinished but the



GIS equipment

# Refurbishment of control systems in Sigalda and Hrauneyjar



*Sigalda power plant*

There has been a lot of discussion in Iceland the last months about exporting technical knowledge in exploiting hydro and geothermal power. We at Rafeikning believe we are one of the front runners in this area and we have for instance participated in various projects regarding power plant control-, protection- and power systems. We owe this to the foresight of the national power companies, as earlier such work was done by foreigners by default.

The newest examples of Rafeikning's projects in this area are the refurbishments of control- and protection equipment in Sigalda and Hrauneyjar hydro power plant.

In these projects we undertook to integrate equipment from the company VA Tech with existing equipment in these old powerstations, which is in some cases the original equipment. That included drawing these systems and supervising commissioning. Rafeikning will also maintain and manage this equipment in the future.

These projects and many others that Rafeikning has participated in prove that Icelandic technicians are at least as good as their foreign colleagues that have been handling comparable projects in Iceland.



*Hrauneyjafoss Powerplant*



**Jón Pálmason**  
*Electrical Engineer, MSc*



*Staff at RT Akranes*

## Health inspection

An health inspection was carried out at Rafeikning's headquarters on 17th and 18th of May where a short health history was registered and individual health factors measured. This is the second time this kind of inspection is carried out and it is safe to say that Rafeikning's employees have taken them with open arms.

For this occasion all the employees from the branch office in Akranes came to the headquarters and the opportunity was used to photograph them.

From left:

Bragi Þór Sigurdórsson  
Elínborg Guðmundsdóttir  
Jens Heiðar Ragnarsson  
Ólafur Davíð Guðmundsson



The Powerplant



**Snæbjörn Jónsson**  
Electrical Engineer, MSc

The March issue of RT news included an article about the preliminary work for the geothermal project at Hellisheidi. Since then the first phase of the project has been taken into use. The first phase includes two turbine-generator units powered by high-pressure geothermal steam, each of them 40 (45) MW and 50 MVA. The number in parenthesis is because the labelled power of the turbines is 40 MW, but they are built such that if the steam pressure is enhanced and several other measures taken, it is possible to increase the output from the turbines up to 45 MW. In fact since the generating units were taken into use in September and October 2006 their output has been 45 MW most of the time, as the steam output of the drilled steam wells has been slightly higher than was expected based upon earlier measurements before final connection.

The project was slightly behind schedule in the year 2006, for example most of the buildings were few months behind. The same can be said about the pipings and machinery, electrical equipment and control system. Around mid year 2006 it became evident it would be difficult to complete installation and testing on time. Most of the involved personnel responded by working much harder to catch up on earlier delays. This included the employees at Rafteikning and other consultants, as well as the owners staff and the staff of some of the main contractors. With a joint effort they managed to catch up on earlier delays and get both units into operation with only three weeks delay.

# The geoth

The operation of the generating units has been successful and quickly calculated it may be expected that the earlier mentioned increased energy production of the units will have made up for the delays in about six months. Early in August 2006 the substation at Kolvidarholl and unit number 1 were energized. A 245kV cable from generator 1 and to the power grid of Landsnet was energized at the same time. The cable is protected using differential relays and a so called "pilot wire", which in fact is a fiber optic cable. The distance between the power station and the substation is about 1 km. This is the first time this protection is used in Iceland, that is using a 245 kV transformer directly connected to a 245 kV cable and differential protection with a pilot wire. The same solution will also be used at the Karahnjúkar hydro power station to protect the cables, where the substation is connected via 1 km long 245 kV cables to the step-up transformers for each unit.

When the power station at Hellisheidi had been connected to the substation, it first became possible to power all the



Horft inn í vélasalinn

auxiliary equipment of unit 1, the power use of the equipment for each unit being nearly 2MW when all systems are running. Later the steam was let into the steam turbine and the unit driven at full speed. Several tests were made like no-load tests, short circuit tests, earth fault testetc. Unit 1 was synchronized to Landsnet's power grid for the first time the 14th of September and power generation



Base for the third phase

# Geothermal power plant at Hellisheidi



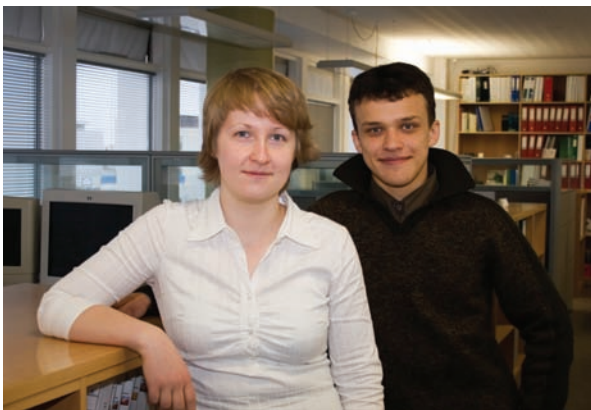
Basis for engine11

started few days later following some load-rejection testing. The final work for unit 2 was carried out parallel and it was commissioned one month later as was planned from the beginning. The power station was officially taken into use following a ceremony in October 2006.

Since the power production started, completion of several other items, which are not linked directly to power generation, has taken place. The construction of the building for the next unit is now in full progress and is scheduled to be completed in several weeks. The next unit is a bit special as it will be a 33 MW low pressure turbine, using energy from HP separated water which is flashed and separated into steam and water at lower pressure. The first part of the low pressure steam unit arrived in March 2007 and the main part

arrived in April. It is scheduled to complete installation early June and finish the connections and testing in August. Formal energy production is planned after the mid of September. The utilization scheme for the Hellisheidi geothermal area is in full progress and the construction of the third phase has already started. The third phase includes two new turbine-generator units for high pressure steam, the same as units 1 and 2. The construction of the building is scheduled to be completed in January 2008 and the units will arrive in the spring the same year. The production of hot water is planned in 2009 in the geothermal power station at Hellisheidi. The water will be piped into the owners storage tanks located at Grafarholt in Reykjavik, through a new waterpipe, in the same manner as the water from the geothermal power station at Nesjavellir. Further power generation using high pressure steam can be expected at the geothermal power station at Hellisheidi. However no final decisions have been made. Future planning depends heavily on several different items which are not known at the moment, like how the production of the steam will affect the geothermal reservoir at Hellisheidi and the outcome of the geothermal wells which are being drilled. Also the outcome of the study of the environmental impact for new geothermal power stations at Hellisheidi.

## Foreign employees at Rafteikning



Zinaida and Volodymyr

Zinaida Semenovskaya is from Ivanovo, a town near Moskva in Russia. She is an electrical engineer with Master degree from Ivanovo State Power University, since 2006. Her way to Iceland was through an exhibition in Moskva, where Rafteikning was among participants. So she came to us in August 2006 after receiving her Masters.

During her student years she also worked at the engineering company Electrocentronaladka in Russia.

She plans to be here at least one more year and who know what will happen after that.

Zinaida works here as an electrical engineer doing design work and review etc.

Volodymyr Pryvizentsev is from Donetsk in Ukraine and is a student doing his third year in Donetsk National Technical University and will finish his Bachelor degree next year.

Volodymyr came to us in March 2007 and will be here until September this year. Rafteikning was looking for a student either from Ukraine or Kazakhstan through AIESEC and he applied for the position. After a meeting with Gunnar Ingi in Kiev in November 2006 it was decided he would come to us. For Volodymyr it is a valuable experience, since he does not have a training opportunity like this in Ukraine.

Volodymyr has had general military training, and also training in AutoCAD. He is now doing design work in power engineering.

# Commissioning of four power plants simultaneously



Hellisheiði power plant

Rafrtekning consulting engineers have vast knowledge from extensive projects regarding design, tenders, site supervision and commissioning of all kind of electrical systems for power plants, factories and other buildings.

Apart from the traditional electrical installations in buildings there are often large and complicated high voltage systems, protection systems in power plants and power transmission systems, process controls in factories and power plants, extensive backup power systems, communication systems and safety systems of various kind.



Lagarfoss power plant



**Friðrik Alexandersson**  
Electrical engineer; BSc

Rafrtekning has at its disposal about 65 employees, half of them educated in electrical engineering. The experience and knowledge of these employees is massive, as many of them have been working on most of the largest projects in this field in Iceland for decades. With a lot of professional knowledge and experience we have developed a certain specialization in various fields and in diverse projects, including testing and commissioning of the various processes in hydro and geothermal power plants. A lot of the company's projects are related to hydro- and geothermal power plants, as mentioned before. Last fall it so happened that four of the power plants Rafrtekning was working on, i.e. Hellisheiði geothermal power plant, Hrauneyjafoss hydro power plant, Lagarfoss hydro power plant and Qorlortorsuaq hydro power plant in Greenland, needed personnel for testing and commissioning of units and



Qorlortorsuaq power plant in Greenland

their processes at the same time. In most of these cases Rafrtekning's employees supervised the testing and commissioning, as well as handling a part of the testing. In all cases it was also within Rafrtekning's scope to lead these projects even though they were done by others. We believe that this is an historical event for the company and we want to call attention to the fact that Rafrtekning has so many experienced technicians in the field of testing and commissioning of hydro and geothermal power plants that we can man four teams at the same time.



Hrauneyjafoss Power Plant