RAFTEIKNING HF
RÁÐGJAFARVERKFRÆÐINGAR
CONSULTING ENGINEERS

RT News

Februar 2007

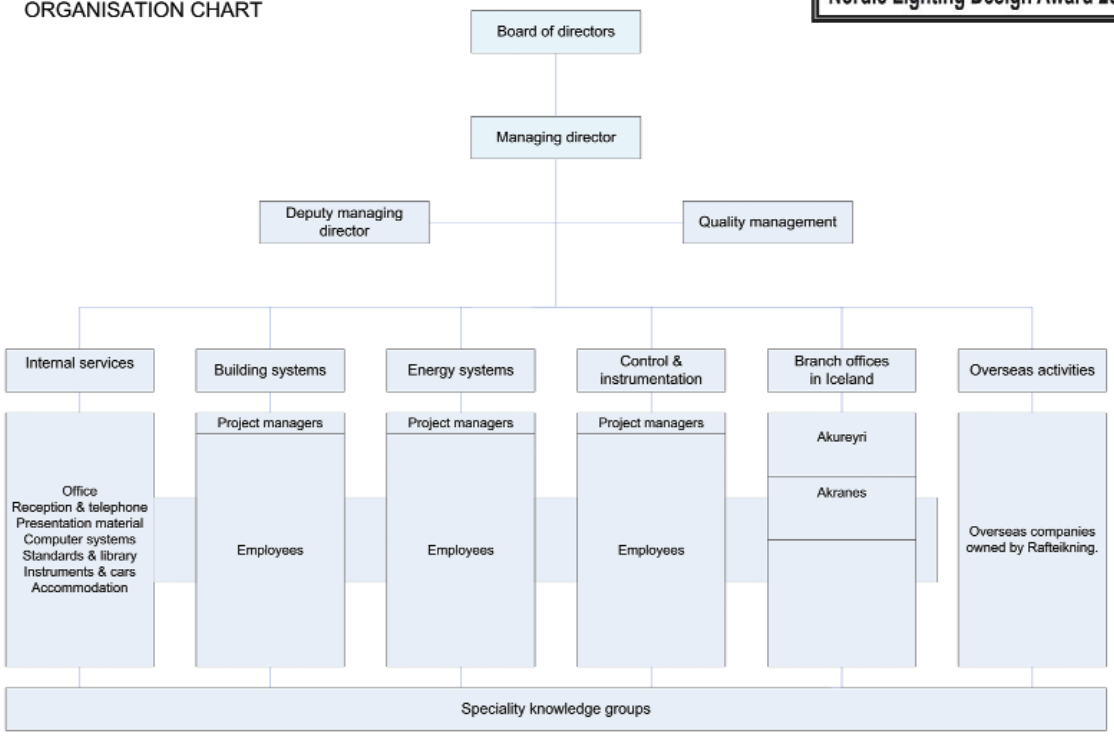
New organisational structure for Rafteikning hf

The year 2006 was a good year for the company.
The number of employees increased by fifteen and is now 60. The turnover went up from 450 M IKR in 2005 to 650 M IKR in 2006, or 7 M EUR.
To meet these increasing activities it was necessary to strengthen the management system. This was done by adding a new management level in the organisation structure as shown on the new organisation chart. Six new divisions were established, three for the main activities Buildings, Power and Control, one division for the Subsidiaries, one for Foreign affairs and one dealing with Internal matters.
The names describe the main activities, bearing in mind that the company is an electrical consulting company.

Rafteikning has two subsidiaries in Iceland, in Akureyri and in Akranes, as well as agents in Vestmanna Island and in Höfn. Rafteikning also owns an independent company in Bulgaria.
As mentioned elsewhere in this newsletter the company received ISO 9001 certification from British Standards Institution in 2006.
Last year Rafteikning was the first Icelandic company to receive the Nordic Lighting Design Award for lighting design for the Blue Lagoon in Iceland.

Nordlys
Sammanslutning av de nordiska belysningsorganisationerna
Nordic Lighting Design Award 2006

ORGANISATION CHART



Gunnar Ingi Gunnarsson
Executive manager

Facts about Iceland

Size: 103 thousand square km
Population: 300.000
Government: Republic, parliamentary system
Religion: Luthern (95%)
Capital: Reykjavik (115 thousand)
Language: Icelandic
Mean temp. in Reykjavik: January -1 deg., July 12 deg.
Energy use:
70% from sustainable energy source (hydro and geothermal)
30% oil (used only by cars and ships)

Rafteikning´s newletter

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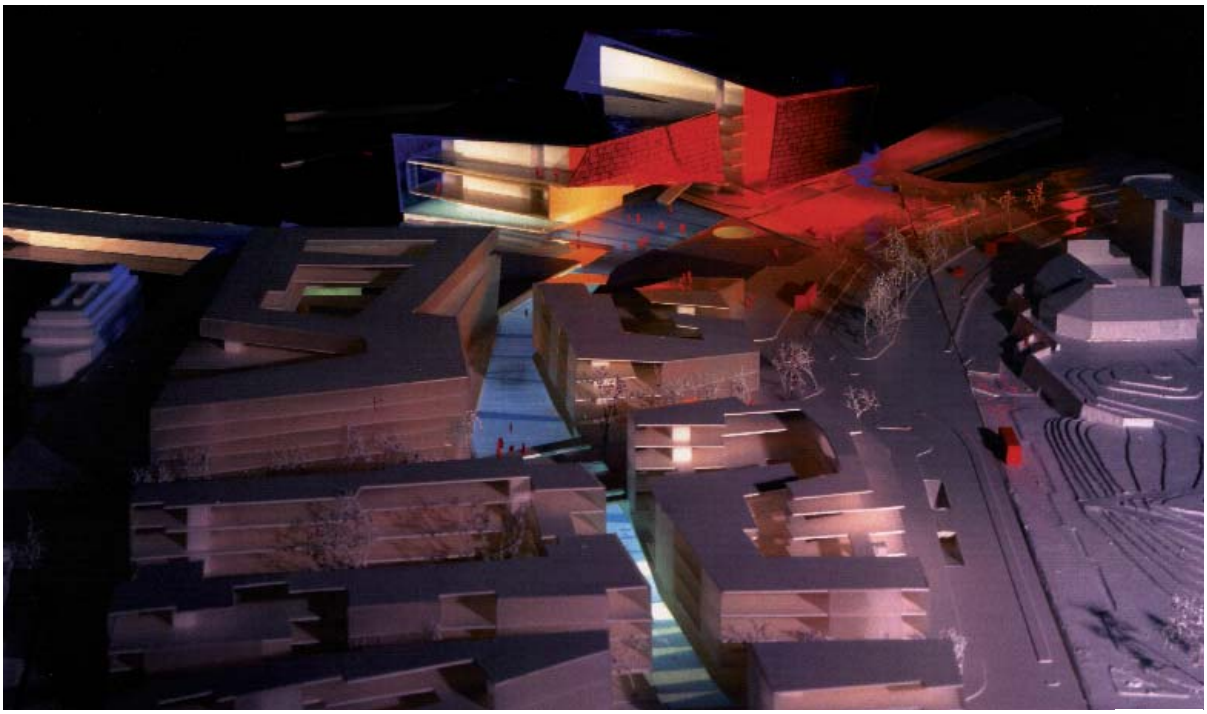
East Harbour

power distribution system



Panorama

Ambitious planning has been done for revolutional changes of the east harbour in Reykjavik. The plans are grand on the icelandic scale. An area, which consisted of warehouses and old used buildings, has now been cleared of buildings. These buildings served trawlers, freight ships and the Icelandic coast guard. New construction has already begun. Currently there is a gigantic hole in the ground, where once these buildings stood. A wall of steel plates fences off the see water from pouring into to the area. The plans for the area call for a new music and conference center, which will stand out at the harbour entrance, with high visability. Headquarters of Landsbankinn, which is one of the major banks in Iceland, will also be built in the area. A large hotel will be built, as well as office building and shopping building. A huge car parking building reaching two levels down in the ground will be built underneath all these building, except for the music and conference center. The parking area will be able to house 1600 vehicles. The total constructed building area at the site will be little more than

A view over the main concert hall

100.000 square meters, not including the the car parking celler. The icelandic architect and artist Ólafur Elíasson has played a major role in designing the exterior look of the music and conference center and how the building construction blends into the nearest surrounding. Rafteikning hf. was entrusted to do preliminary estimates for the electrical energy usage and the coincident demand for the area. Later Rafteikning did a research on, which was the most economial way to purchase electrical energy for the buildings in the area, based upon the energy usage and the coincedent demand factor for the buildings. The feasibility of two options were investigated. One option was to have a common electrical distribution system and each building served at 400 V from the Reykjavik municipality. The other option was to buy at 11 kV from the utility power company and distribute the power at 11 kV for the area. The later option turned out to be more economical. Rafteikning has now been commended to do a preliminary plan for the final power distribution system in the area. The plan from Rafteikning will include preliminary strategy for the power connection to the power grid of the Reykjavik municipality at 11 kV. Also will Rafteikning plan for location and sizes of power cables and transformer stations needed with regards to location and load of the different facilities in the construction area. Later Rafteikning will design in detail the electrical distribution system and assist in selecting the material needed for the system. The plan calls for advanced computerized electrical energy and power measurements for the energy users. Rafteikning will also be of technical service and support to the owner as well as the management for the facilities, when it comes to build up neccessary professional knowledge to control and run the power distribution system.

Steinar Jónsson
Electrical Engineer, MS

Concert building

Kárahnjúkar Hydroelectric Project, 6x115 MW - Project status

Powerstation

Helgi Þór Helgason
Electrical Engineer, MS

At this moment, in the beginning of the year 2007, the installation work of electromechanical equipment in the new 690 MW Kárahnjúkar power station is progressing well. The station is owned by Landsvirkjun, the biggest power company in Iceland. Generating units 1 and 2 in the power-station in Fljótsdalur valley are fully assembled and ready for commissioning tests. The other four units are in different stages of assembly. The common station equipment in the powerstation have been mostly installed and tested.
The power transformers for the three first units have been installed and connected via IPB busbars to the generators and via 1 km long 245 kV cables to the Substation Fljótsdalur in the valley. All six sets of the 245 kV cables from the unit transformers have been installed and connected to the 245 kV switchgear in the substation.
Dry-testing (i.e. testing without water on the turbine) of the first generating units started in January 2007 and the functionality of every equipment will be tested as far as possible without water pressure and rotating the units.

The construction of the service and staff building for the power station in Fljótsdalur valley has been completed and was handed over by the project manager, Mr. Guðmundur Pétursson, to the station manager, Georg Pálsson, in December 2006. The building was the first structure that was handed over from Landsvirkjun's engineering and construction division to the company's energy division.

Staff building

The filling of the 2,1 Gl main reservoir, Hálslón, started last autumn. Before the filling started the high head bottom outlet gates had been installed under the 198 m high Kárahnjúkar dam along with the associated hydraulic equipment, power and control systems in the bottom outlet gate chamber. The equipment was fully tested in the late autumn by opening the gates and spilling water to the downstream canyon. The intake gates and the associated hydraulic equipment, power and control systems have also been installed in the power intake house at the start of the 40 km long headrace tunnel at Hálslón reservoir.

As the water availability from the reservoir to the power station will be later than planned, the end user will be provided power by connection to other parts of the national grid to begin with. The first unit will be commissioned without water! It will be operated in socalled condenser mode to keep the voltage up in the transmission system in Fljótsdalur and thereby increasing the transmission capacity to the area. This is achieved by disconnecting the hydro turbine from the generator, accelerating the generator to nominal speed by speed controller, excite and synchronize it to the network and produce reactive power to the grid. By this arrangement it will be possible to deliver energy to Fjarðaál aluminium smelter in April 2007 to enable commissioning of limited number of pots in the smelter.

Rafteikning is responsible for all consulting work, tender design and design review for all electrical equipment in the power station, within the consulting group KEJV. Detail design of equipment and systems is done by contractors but final design of electrical installations in buildings is done by Rafteikning.

Power transformer

The Hellisheiði Geothermal Power Plant - safety and security

The role and task of a security engineer is constantly changing and has been redefined many times over the past years, due to - among other things, increase in crime rate and infinite changes in threats. Designing against crime and vandalism consist in, among other things, evaluating companies' threats and vulnerabilities. The task of a security designer is to evaluate tangible and intangible assets that are to be protected. Usually these assets are considered a mixture of properties and resources. Assets of an energy company are normally defined as an investment in people (e.g. users, customers and employees), information (e.g. data, drawings, experience and sales processes) and property (e.g. buildings, vehicles, power stations and substations). Threats are the potential for losses of properties and losses of lives, and vulnerabilities are the weaknesses, shortcomings or perception of risk of an attack by apperceive of crime, vandalism or terrorism.

Security camera

Control room

Security and safety measures are more than just installing systems for intrusion detection or video surveillance. An effective security system will carefully integrate electronic security with deterrence measures, the utility's operations, the personnel who work in the facility, the utility's security policies and procedures, and other pertinent factors. In the case of Hellisheiði Geothermal Power Plant it is the management, the employees, the security procedures and policies of Reykjavik Energy that forms successful security measures with other important elements in the security management operation.

Security measures for the Hellisheiði Power Plant are no different in nature from other important preventing measures against crime, vandalism or terrorism. Endeavour to secure the safety and security of employees and visitors at the power plant area and at the same time safeguard the assets of its owners, Reykjavik Energy.

The Power Plant started

Security system design is based on a detailed risk assessment of the facilities to be protected. The assessment work will include site inspections, interviews of operation and management personnel. The goal is to gain necessary understanding of the conditions and the operation of the power plant. The information will provide the basis for:

- Conducting a Vulnerability Analysis for each facility.
- Establishing a Threat definition and developing a Design Basis Threat.
- Establishing a Target definition for each facility to be protected.
- Performing a Consequence Analysis.
- Performing optimum vulnerability mitigation for the facilities.
- Evaluating of the procedures and infrastructures on the response plan in an emergency situation.
- Developing methods in assessing an emergency situation.
- Developing specific objectives and measurable goals.

Eiríkur K. Þorbjörnsson
Electrical Engineer with a master degree in Security and Risk Management

Entrance to the presentation part

Security affairs of an energy company is a large and a growing field but hasn't gained the highest priority in the past, in the discussions about security and safety matters within the energy sector. The 9-11 attacks in 2001 on the Twin Towers in New York changed the world and the sentiment as well of the public and the companies to security matters. This increased concern for protection of critical infrastructure arrived from these terrorist acts. Security of facilities against attacks by thieves, vandals, disgruntled employees and other malefactors is vital to all companies if they are to ensure reliability and effectively managed risk. By managing risk in a systematic and efficient way the utilities and the energy companies can gain there goals in security and safety matters, and at the same time decrease their operation cost.

ISO 9001:2000

certification from

BSI

officially granted the ISO 9001:2000 certification from BSI. The certification has not led to big changes as the company had already adopted many processes from ISO 9001. The main change is that the quality circle is now more formal

Viewing conference

than before. Audits are performed regularly and non conformities are registered, discussed and corrective actions decided and executed in a more formal manner than before. By this it is ensured that the company is always improving, which is the main idea behind the ISO 9001 ideology.

Acceptance of the certificat

Rafteikning was one of the first engineering firms in Iceland to adopt processes from the ISO 9001 standard.
The company's first encounter with the standard was in 1993 and it has been used for guidance ever since.
In the spring 2005 the company's board of directors made the decision to get certification. The main reason was pressure from the market as the number of ISO 9001 certified national engineering firms had increased rapidly the last months before. It was clear that an increasing number of clients was starting to look in the direction of ISO 9001 or even thinking of requiring it. British Standards Institution (BSI) was selected as a certification provider. They conducted a pre-assessment in September 2005 followed with an initial assessment in the beginning of April 2006. The 11th of April 2006 Rafteikning was

Eggert Þorgrímsson
Electrical Engineer, MS

Acceptance of the certificat

Designing electrical systems for precast concrete buildings

The tradition in Iceland has been to build a cast in place concrete buildings and has been the prevailing building method to the turn of the century. Slowly but surely have precast concrete building units been gaining market share. Today a large proportion of the new dwelling houses are precast concrete buildings.
The first buildings built of precast units in Iceland were just single storied villas. Now precast concrete units are used for all types of buildings, like large apartment houses, office buildings, factories and villas as before. Much more accuracy must inevitably be used in designing buildings of precast units than for cast in place buildings. With the emerge of computerized drafting software after the year 1990 did change greatly the precision in the design of the precast units.

Decisive advantage

The advantage of buildings made of precast units are various. The construction time is only half, construction management is more simple, fewer subcontractors and less equipment is needed for construction compared to the cast in place concrete buildings.
Much of the electrical work for a facility is done at the factory site, when precast unit buildings are built. The structural engineer designs the precast units based upon the architectural drawings, including the exterior and interior wall units. The electrical engineer receives the drawings of the precast units and implements the electrical system for the precast units in accordance with the general electrical design of the building.
Forms are made for the precast units in the factory based upon the drawings of the units from the structural and electrical engineers. Forms are made for each precast unit. The employees of the factory lay conduits, wire mesh, insulating material, wire mesh connectors, brackets fasteners and various other material needed before the concrete is poured into the forms.

Electricity in ground plate

Precast concrete buildings

Precast concrete ceiling slab units

The precast ceiling slab units have not been on the market as long as the precast concrete wall units. Today the so called filegran slabs are commonly used. These slabs are only one third of the final thickness of the final precast ceiling slab. Precast ceiling slab units are manufactured in factories and at the site all junction boxes, including all perforation for electrical wiring embedded in the forms for the ceiling slab. All must be correctly located with precision, so the electrical conduits for the precast ceiling slab will match the continuing electrical conduits in the precast wall units.
At the construction site the erection of the precast wall and ceiling slab units is rather straightforward. For example the construction of precast single storey villa only takes about one day. This building method has therefore become popular and is rapidly gaining market share.

Vast experience

The engineering firm Rafteikning has vast knowledge and experience in designing electrical systems for buildings made of precast concrete units.
For example the branch manager for Rafteikning at Akranes, Mr. Bragi Þór Sigurdórsson, became familiar with the precast concrete unit method in the year 1984. That year he designed electrical wiring system for precast concrete unit buildings based upon structural design by Sveinn Ingólfsson, engineer, at Verkhönnun ehf. During the first years the precast concrete units were made by Loftorka, in Borgarnes, or by the firm Möl og sandur, in Akureyri, or by Brúná, at Egilsstaðir. In those days the units were only made for villas or terraced houses. Much has now changed since then. Nowadays also the largest apartment houses are built using the precast concrete method. In large buildings it is now common to use only precast concrete blocks for exterior walls, interior walls or ceiling slab. It needs to be mentioned that Bragi has mostly in his designing be using material precast concrete units from Loftorka in Borgarnes and Smellinn in Akranes. Bragi has been in charge of the overall building design, including designing the electrical systems for the precast concrete units. If needed he has completed and coordinated other electrical design drawings by other designers. In the last two years he has designed all electrical systems for precast concrete units used by the contractor Kambur, for the condominiums at Arnarneshæð in the town Garðarbær, and for five stories high condominiums and car parking garage at Helluvað in Reykjavík, and for numerous other condominiums and villas around Iceland.

Bragi Þór Sigurdórsson
Master Ectrician

Geothermal power plant in El Salvador

Entrance to the Power Plant

Rafteikning has from the year2005 been working on a designing a geothermal power plant in El Salvador. Rafteikning is a sub contractor for the company ENEX which undertook the construction of the power plant for the Salvadorian Geothermal Company LeGeo S.A.

The power plant is 9,3 MWe with one turbine and a 12,5MVA generator and will be connected to the national electrical network in El Salvador.
The generator's voltage is 13,8 kV and the connection the national network is via a 12,5 MVA

Steam separators

13,8/115kV transformer and a high voltage transmission line to a substation outside a neighbouring power plant.
LaGeo operates a steam power plant in the area with three 40 MW units.

Bjarni Bjarnason
Electrical Engineer, BSc

Substation

The water from the power plants steam separators will be used to heat up "isopentane" which has a boiling point at 30°C, and the steam is used to propel the turbine.

Rafteikning's scope of work is extensive and covers the design of the control system,
protection system, power distribution and high voltage system as well as assistance regarding equipment purchasing. Rafteikning also handles the programming of all control systems and the company's personnel will take part in testing and commissioning of the power plant.

Operation reliability was a big issue in the design work. The intention is to have no employees at site and operate the power plant from a nearby power plant. This means the power plant will be fully automatic when starting up, operating and stopping. Conditions are very different in El Salvador from the ones in Iceland and a special considera-tion was given to that in the design.

The power plants control system is the latest state-of-the-art design and gives a good overview of the plants operation cycle. There are two programmable logical controllers, so-called "hot-standby", which means that if one fails the other will take over the control. The power plant is connected via a fibre optic connection to the main control station, which also controls three other production units.

When the power plant has started operating the intention is to make servicing and diagnosing of the control system remotely from Iceland possible.

The power plant is scheduled to start operation in the first half of 2007.

Control room