Turkey
Hidro Dizayn – a successful member of the Lahmeyer Group
04 | New Faces at Lahmeyer International
   | VDI nachrichten Recruiting days
   | Trade Fair Calendar

05 | Turkey: Hidro Dizayn – a Successful New Member of the Lahmeyer Group

06 | Saudi-Arabia: “Fast Track Project” for Reliable Electricity Supply
07 | Indonesia: Lahmeyer Assures Quality for 3 x 330 MW Power Plants
08 | Egypt: Renewable Energy Master Plan for Egypt
09 | Trade Fair Reviews
10 | Germany: CAPEX Analysis for Offshore Wind Farms
11 | Uganda: Grid Extension Development Project in Uganda

12 | Switzerland: Engineering Design and Planning for the 1,050 MW Lagobianco Pumped Storage Plant
15 | Sudan: Remote Sensing and Spatial Analyses for the Planning of Irrigation Projects
16 | Turkey: Turkey Making Increasing Use of Hydropower
17 | Northern-Germany: Flood Protection for the Baltic Coast
18 | Germany: Training of Engineers from Developing Countries
19 | Palestine: New Wastewater Treatment Plant in Nablus for Improved Living Conditions
20 | Pakistan: High-Head Hydropower Project on Harpo River
21 | Looking Back: HYDRO 2011 in Prague / 2nd German-Arab Energy Forum of Ghorfa / UN Climate Conference in Durban

21 | Europe: Opening of the Nord-Stream Pipeline through the Baltic Sea
22 | Germany: Project Studies for Easier Decisions
23 | Germany: Qualified for the German Railways

Imprint:
Lahmeyer International’s magazine “aktuell” is published twice a year in German and English. Reproduction and electronic dissemination, even excerpts, are only possible upon approval of the editors.

Cover page
Hidro Dizayn – a successful new member of the Lahmeyer Group. In Turkey, Hidro Dizayn is already one of the most prominent engineering companies in the hydropower sector. This is proven by experience on hundreds of projects successfully performed, such as the Yedigöze Dam and Hydropower Plant.

Editor
Lahmeyer International GmbH
Friedberger Str. 173, 61118 Bad Vilbel, Germany

Responsible: Sabine Wulf, Lahmeyer International

Artwork and lithography
magenta Kommunikation, Design und Neue Medien GmbH & Co. KG, Mannheim, Germany

Print
Ottweiler Druckerei und Verlag GmbH, Ottweiler, Germany

© Lahmeyer International GmbH 1/2012
Ladies and Gentlemen,

“Water is Life” – today, this sentence is increasingly challenging for us in combating the persistent world-wide water scarcity.

Forecasts predict that, in 2025, approximately 16% of the steadily growing world population will suffer from an extreme lack of water, which would be more than treble the number of people suffering in 2000. Additionally, with a share of 38%, the number of people for whom an adequate water supply probably cannot be guaranteed any longer will double. In many countries, such as the Arab states and certain countries of Africa, the situation has dramatically deteriorated for years.

The disastrous food crisis in Somalia in 2011 showed the extent of this suffering. The catastrophe highlights the bitter consequences of the extreme water scarcity prevailing in many parts of Africa. In these countries, irrigation is insufficient to compensate the long dry periods, caused by global climate change, in order to sustain agricultural production. This situation is expected to deteriorate further in the next years.

Under these circumstances, today it is a matter of achieving a secure water supply in these countries by means of targeted action. Besides enhancing the efficiency of existing infrastructure, reducing network losses or optimizing water consumption for food production and industries, the focus is on forward-looking civil engineering projects which will start by enabling large-scale water storage.

For decades, Lahmeyer has been at the forefront with unbounded expertise and diverse sector-specific experience in the construction of multi-purpose dam projects and highly efficient plants for the desalination of seawater. For countries having an access to the sea, desalination plants can offer a viable solution for the production of drinking and process water for agricultural and industrial applications.

In most countries, however, large dam projects provide feasible and innovative solutions for large-scale agricultural irrigation and sustainable water supply, whilst also generating hydropower. In this way, positive effects for a sustainable food production and adequate water supply and also for the development of local industries can be exploited. It is nevertheless inevitable that complex infrastructure projects interfere with nature and with human settlements. Therefore, it is necessary to strike a balance between the long-term benefits of an infrastructure project and the disadvantages for the environment and the human population concerned - appropriate mitigation measures have to be taken.

In view of the flood disaster in autumn of 2011 in Thailand, it is pertinent that dams make a significant contribution to the attenuation of peak flows in river basins and thus to flood protection.

In this issue of our magazine “aktuell” we give an insight into our on-going work and present more of our interesting projects, with which we are today creating the basis for sustainable water and energy supply in the future.

We hope that you will enjoy reading our current issue and wish you a successful 2012.

Sincerely,

Dr. Bernd Kordes
New Faces at Lahmeyer International

On October 1st 2011 Mr. Markus Auer joined the board of directors of Lahmeyer Holding as Chief Financial Officer (CFO) for the entire Lahmeyer Group. He succeeded Mr. Burkhard Neumann who, as managing director of Lahmeyer International, will concentrate on commercial management of the main company within the Lahmeyer Group.

Markus Auer has long-standing experience in the sector. He held various management and consultant positions in the fields of accounting, internal audit and corporate controlling for 15 years – seven of these with the GKW Group in Mannheim and its successor, Pöyry. In 2003 he became managing director of the former GKW Group. After GKW was taken over by the Finnish consulting and engineering enterprise Pöyry, he was responsible for commercial management of the worldwide water and environmental business.

VDI nachrichten Recruiting Days

On February 2nd 2012, Lahmeyer International will be attending the recruiting day in the Kongresszentrum Westfalenhalle in Dortmund where we look forward to meeting potential new employees, establishing numerous contacts, and holding in-depth discussions.

On March 15th 2012, LI will again be attending the recruiting day at the Hanau Congress Park as an exhibitor. Here, too, we look forward to holding in-depth discussions with potential new employees about opportunities to start a career at Lahmeyer.

<table>
<thead>
<tr>
<th>Trade Fair and Exhibition Participation</th>
<th>Location</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>WETEX 2012</td>
<td>Dubai, UAE</td>
<td>13.–15.3.2012</td>
</tr>
</tbody>
</table>
Hidro Dizayn – a Successful New Member of the Lahmeyer Group

“Never compromise on quality.” Following this maxim, Hidro Dizayn was founded in 1998. Today, in the hydropower sector, Hidro Dizayn is one of the fastest growing engineering companies in Turkey – a true success story.

The engineering and consulting services of Hidro Dizayn cover the fields of hydropower, irrigation, flood protection, and municipal infrastructure projects. A total of 250 employees render these services at the head office in Ankara as well as on project sites.

Across National Boundaries
In Turkey, Hidro Dizayn’s proven experience on hundreds of successful projects in Turkey and neighbouring countries such as Georgia, northern Iraq, in the Turk region and in the Balkan countries identify it as one of the most prominent domestic engineering companies in the hydropower sector. An office in Erbil, Iraq, strengthens its regional representation. Once new opportunities arise, more offices will be opened in several countries.

Market leadership in Turkey and increasing expansion of its business activities internationally are key objectives. In order to meet these ambitious objectives, Hidro Dizayn launched a comprehensive suite of measures, including bundling of resources with strong partners and long-term cooperation playing a key role.

Competent Partners
Hidro Dizayn joined the Lahmeyer Group in 2011 in order to realize synergies – for instance on hydropower projects – with Lahmeyer International and Hydroprojekt Ingenieurgesellschaft, both headquartered in Germany. In addition, there are efficient cooperation arrangements and long-term partnerships with Linergy Energy Engineering and Consultancy, Georgia as well as SU-YAPI Engineering & Consulting und EN-SU Engineering and Consultancy, both in Ankara.


Interdisciplinary Cooperation
Another element to secure its position internationally is to cooperate with other organisations and universities. This allows enhanced project solutions using state-of-the-art technologies and standards. Hidro Dizayn is also certified according to DIN EN ISO 9001:2008, ISO 14001:2004 as well as following the principles and strategies for safety, health and environment, OHSAS 18001.

In Turkey, Hidro Dizayn is one of the most prominent engineering companies on the hydropower sector. This is proven by the experience of hundreds of projects having been successfully performed, as for example the Yedigöze Dam and Hydropower Project.

Good Prospects
The founders of the company, Messrs. Aldonat Köksal, Hakan Okuyucu and Denizhan Bütün, established a sound basis for continued successful development of their company and its access to the international market.

Success within a strong group has been a watchword of the founders of the company since their common engineering studies at the Middle East Technical University (METU) in Ankara.

Hidro Dizayn broadens the competence and capacity of the Lahmeyer Group, especially of the hydropower division. World-wide, water is the key element of the 21st century – as a source of renewable energy, for irrigation purposes, and indispensable for growing food.

Jutta Kaufmann

The founders of Hidro Dizayn:
Denizhan Bütün, Aldonat Köksal and Hakan Okuyucu (from left to right).
As EPC contractor, the Alfanar Construction Co. will construct the “Reinforcement of Hail 2 Power Plant – Expansion III” project on behalf of the semi-national Saudi Electricity Company. In May 2011, Lahmeyer commenced with the overall planning of the new plant being located about 600 km northwest of the capital, Riyadh. The new generating unit will go on stream in mid-2012.

The planning covers all relevant disciplines the plant needs for operation: process/design, construction works, mechanical components and systems, and electrical / instrumentation and control equipment. Lahmeyer is designing the gas turbine block with all ancillary systems as well as their integration into the existing plant.

Swiftly on Stream

In the first project stage, the new power plant unit will be constructed as an open cycle gas turbine power plant. Four crude oil-fired Siemens gas turbines of the SGT6-PAC 2000E type with a total capacity of about 280 MW will be used. The tight time frame for the so-called “fast-track” project is a constant challenge. Owing to the size, complexity and tight deadlines, Lahmeyer International India and the Saudi engineers of the client were involved from the very beginning. Lahmeyer’s experts from the Kolkata office assist the client with coordination on site. Lahmeyer is also assisting the client throughout the tendering and award of the contract for the project.

Richard Wilhelm

Consortium agreement sealed by a handshake: (from the left) Richard Wilhelm, Lahmeyer Overall Project Manager, and Raj Kumar Mukherjee, Project Manager and Vice President of Lahmeyer International India, Kolkata office.

The existing power plant is expanded for better energy supply in the Hail province.
Lahmeyer Assures Quality for 3 x 330 MW Power Plants

In order to contribute to further development of the local power supply, the government of Indonesia instigated the so-called 10,000 MW Fast-Track Programme in 2006. Under the leadership of Lahmeyer International, a consortium took over the quality assurance and quality control for three out of ten power plants planned. The first project – under the direction of Lahmeyer – celebrated its commissioning in October 2011.

The programme consists of a total of ten power plants with a capacity of 1,000 MW each, fired with domestic coal. As a turn-key contractor to the state utility PT PLN (Persero), a Chinese firm is constructing the power plants at different sites on Java Island.

Lahmeyer International leads a consortium which also includes AECOM Ltd., Connusa Energindo and PT Amythas EA. The consortium is responsible for the quality assurance and quality control (QA/QC) for three power plants of the Fast-Track Programme with an installed capacity of about 3,000 MW together.

First Power Plant Handed Over to the Client

The PLTU 1 Jawa Barat-INDRAMAYU 3 x 300 MW Power Plant (see photos) is one of the first power plants which has been completed. It is built on a site of 83 hectares in the village of Sumur Adem, Sukra Sub-District, Indramayu Regency, West Java Province in north-west Java Island, approximately 180 km east of Jakarta.

A Joint Operation (SCP JO), consisting of three companies - China National Machinery Industry Co., Ltd (SINO-MACH), China National Electric Engineering Co., Ltd (CNEEC) and PT - constructed the project. On March 12th, 2007 Penta Adi Samudera signed the contract with the owner PT. PLN (Persero).

This turn-key project includes engineering, equipment procurement, and construction works.

Assembly, inspection, commissioning, operation and training are also in the turn-key contractor's scope of work. On July 28th 2010, the team also took over the synchronisation of the first unit with the grid. On September 16th 2011, the plant successfully passed the performance test.

Important for the Region

The project is financed 85 % by a loan from a consortium of 18 foreign banks led by the Bank of China. The remaining 15 % is PLN equity.

Coordinating Economic Minister Hatta Rajasa personally attended the inauguration celebration and said: “This new power plant will play a very strategic role in supporting people’s lives as well as boosting the growth of the industrial sector. Around 45 % of manufacturing industry is located in West Java; that’s why continuous power supply is extremely vital”.

Peter Roth

PLTU 1 Jawa Barat-Indramayu is one of the first power plants which has been finalised on Java Island within the scope of des the 10,000 MW project of the Indonesian government issued in 2006.

QA / QC Consultant’s Services:

• Design review
• Acceptance of the main power plant components supplied by Chinese manufacturers
• Supervision and monitoring of project construction and commissioning
• Home office back-up services
• Site assistance and support during guarantee period
Renewable Energy Master Plan for Egypt

Egypt looks back on a glorious past, which is not only limited to the time of the Pharaohs. Already in 1913 probably the world’s first solar power plant was built in Meadi by the American pioneer and inventor Frank Shuman. Present efforts to develop renewable energies in this sunny country follow this tradition with Lahmeyer International preparing the masterplan.

In August 2011 Lahmeyer International commenced work on the Combined Renewable Energy Master Plan (CREMP) for Egypt. Funded by the Neighbourhood Investment Facility (NIF) of the European Union via the German KfW Bankengruppe, this study is the first of its kind in Egypt. The study is being prepared for Egypt’s New and Renewable Energy Authority (NREA) under cooperation with the renowned Fraunhofer Institutes for Solar Energy Systems (ISE) and for System and Innovation Research (ISI) as well as with the Energy Research Centre of the Cairo University.

Development of Wind and Solar Energy

The project will be carried out over a period of 18 months. It consists of two major parts: first, the drafting of a renewable energy framework for Egypt with a focus on wind and solar energy; and second, a feasibility study for a large-scale CSP plant at Kom Ombo in Upper Egypt. The first part of the project will help to provide an adequate framework for the development of wind and solar energy in Egypt.

A detailed roadmap of recommended policies and actions shall pave the way for effective and efficient utilization of Egypt’s abundant wind and solar resources.

At the outset, the project team will estimate the economic potential for wind and solar energy in Egypt. Various renewable energy development scenarios will be evaluated with regard to their potential costs and benefits. The evaluation will be based on a comprehensive quantitative analysis of the Egyptian electricity system and will consider, inter alia, the future development of fuel availability and prices, trends in electricity demand and energy efficiency developments, and the evolution of conventional thermal power production in Egypt. A comprehensive assessment of economic and social impacts will complement the analysis of the Egyptian power system. The different scenarios will be evaluated regarding their impact on employment, local and sectoral value added, and potential trade-offs with other policies. The scenario analysis addresses detailed short to medium term effects (up to the year 2025) but also provides an outlook on the long term evolution of wind and solar energy (to the year 2050).

Access to Grid and Market

Grid and market integration is generally a crucial prerequisite for the successful development of renewable energies. Based on the scenario analysis and the estimation of economic potential for wind and solar energy, the project team will assess the technical requirements necessary to integrate renewable energy production into the Egyptian electricity grid. The project will investigate the necessary grid expansion, estimate the volume of investment required and recommend principles for grid access. Besides the grid analysis, the master plan will suggest approaches to facilitate market access for wind and solar energy in Egypt. In addition, appropriate promotion schemes will be discussed and recommended.

The master plan will also address the boundary conditions for financing renewable energy projects in Egypt. The study will thus help to create a financing framework policy through which the government establishes the conditions precedent for public, private and PPP investment initiatives. Possible financing strategies as well as possible financing products, tools, sources and conditions of investment will be investigated.
**Assistance in Technology Policy**

An important part of the project will be devoted to the Egyptian renewable energy technology policy. The country’s framework for renewable energy technology development will be assessed. Comprehensive analyses of the status-quo of R&D activities in the public and private sectors and the links between them will be carried out. The effectiveness of governmental support for the development of domestic wind and solar industries in Egypt will be evaluated. The analysis will result in the identification of development needs and recommendations for each sector. A comprehensive technology policy and an action plan will be developed to strengthen the domestic manufacturing capabilities for wind and solar technologies.

Finally, the study will investigate the role of public institutions in Egypt regarding the successful development of wind and solar energies and identify the most appropriate set-up for institutional support for wind and solar development. This part of the project is of particular interest, since adequate institutional support for renewable energies is crucial for the development of renewable energy capacities and also for the successful realization of the benefits that such a development could generate.

**Kom Ombo Power Station**

Currently the feasibility study for a large scale CSP plant in Kom Ombo – the second major part of the master plan study – is being carried out. Far from Egypt’s famous history being limited to the times of the ancient Pharaohs, what was probably the world’s first CSP plant was built in Meadi in 1913 by the American pioneer and inventor Frank Shuman (see photo). Drawing on the experience from a pre-feasibility study prepared by Lahmeyer International within the framework of the EMPower Program (see: http://www.empower-ph2.com), where 13 potential sites in Egypt were inspected, several design options are being investigated. A site visit to Kom Ombo (about 50 km north of Aswan) in September 2011 confirmed the adequacy of the site. The feasibility study is expected to be finalized early in 2012.

The challenging project combines the in-depth knowledge of Lahmeyer International’s experts in the fields of renewable energies, power transmission and distribution as well as economics. Li’s Economics and Energy Efficiency department is in charge of project organization and management.

*Dr. Tim Hoffmann, Dr. Matthias Hampel*

---

**Already in 1913 the American pioneer and inventor Frank Shuman probably built the world’s first CSP plant.**

---

**Energy Congress in Johannesburg**

In November 2011, the SOUTHERN AFRICAN ENERGY EFFICIENCY CONVENTION met in Johannesburg. As keynote speaker for the renewable energies sector, Mr. Thomas Kraneis, member of the board of directors of Lahmeyer International, lectured on the chances of renewable energies as a vision for the African continent and, in particular, for the Republic of South Africa.

**VGB Congress 2011**

The annual meeting of the Technical Association of Major Power Station Operators (Vereinigung Großkraftwerksbetreiber - VGB), “Power Plants 2011”, took place in autumn 2011 in Bern, Switzerland. Numerous exhibitors from the energy business attended under the slogan “European generation mix – high demands on flexibility and storage”. The German energy turnaround after Fukushima was a focal point. Dr. Andreas Wiese, Head of the Energy Division of Lahmeyer International, lectured on the question: “Will African Electricity from Renewable Resources Contribute to Sufficiently High Reliability of Supply in the European Power System?” Intense discussion after the event confirmed the high level of interest in the topic.

**Wind Energy and Photovoltaics at the Expo Eolica in Rome**

In mid-September, Lahmeyer International participated as an exhibitor at Expo Eolica Mediterranean in Rome. The exhibition took place during Zero Emission Rome 2011, Italy’s most prominent fair for renewable energies. With more than 200 wind energy projects implemented since 2000 as well as 45 photovoltaic projects since 2007 in Italy, Lahmeyer International has an enviable track record in view of renewable energy projects in the Mediterranean area.
CAPEX Analysis for Offshore Wind Farms

Although the offshore wind industry has undergone rapid development in the recent years, it is still considered to be at the beginning of its learning curve. Further, the characteristics of future projects will differ significantly from the limited number of offshore wind parks existing or under construction today. This applies to several key factors such as the overall project size, number and size of the individual wind turbines, distances from the shore, water depths at the project site, as well as transport and installation concepts, to name but a few such aspects. With regard to these aspects, Lahmeyer International (LI) was contracted by a renowned construction conglomerate to conduct a probabilistic analysis of the overall capital expenditures (CAPEX) for a large offshore wind farm.

During the course of the probabilistic CAPEX analysis, methodologies and tools have been applied which take due account of the special characteristics of an offshore wind farm. Besides market-related uncertainties, an important source of uncertainty for the CAPEX of any offshore wind energy project results from the actual offshore operations. All offshore operations depend on weather conditions being below certain limits, with some operations being more weather sensitive than others. Past project experience has shown that delays and cost overruns of offshore wind projects are often caused by inadequate consideration of meteorological constraints. Special attention was therefore given to this aspect in the analysis. Hence, the complexity of an offshore wind farm and its construction is deemed too multidimensional to allocate only single point estimates to each cost parameter. Moreover, in the planning phase a lot of parameters are not yet fully defined so that inherent uncertainty remains. Parameters such as investment cost for each item, quantities and the construction time have to be estimated based on expected, rather than exact, values.

Transferable Methodology

The application of a Monte Carlo simulation is thus an appropriate approach in this context. Within a Monte Carlo simulation, numerous scenarios of a model are calculated by repeatedly selecting values from the probability distribution for uncertain variables and considering those as random input parameters for each scenario. Whereas single point estimates produce estimates which are possible, Monte Carlo simulations cover results which are probable.

This approach adopted by LI in the present instance is also applicable to other complex energy sector projects. Moreover, sensitivity analysis provides a better understanding of potential bottlenecks and risks. Coupling this approach with a detailed financial model provides insight into the overall economic viability. Generally speaking, Monte Carlo simulation is an important tool of risk analysis which is applicable, for example, to large and complex infrastructure projects such as offshore wind farms.

Raya Che Peterson, Julia Hoepp
The car trip from the capital, Kampala, to the West Nile project region takes some seven hours. Since 2008, the region has been recovering from the battles between rebels and the army. As an economic centre, the region hosts refugees from the Sudan and the Democratic Republic of the Congo so that it is also an ideal location for several non-governmental organisations. Neighbouring countries such as Congo and Sudan purchase many goods there.

**Insolated Low-Voltage Distribution Networks as an Innovation**

The local utility, UEDCL-WENRECO, operates a 33 kV isolated electrical network with two power plants, a diesel power station (1.8 MW) and by the end of 2011 also a hydropower plant (4 MW). Within the scope of the project, the electrical power supply, which is currently concentrated on the district capital of Arua, will be extended to other regions. A grid extension by about 450 km of 33 kV wooden pole lines and sixty low-voltage distribution networks is the declared aim.

The introduction of insolated low-voltage distribution networks and a pre-paid metering system will be innovations there. Compared to distribution by bare copper wires and conventional mechanical metering systems, these two measures will enhance operational reliability and will also combat power theft.

The operation of this 33 kV network, serving both transmission and distribution, is nevertheless difficult and the reliability of supply is not comparable to that in Europe as both power stations are about 120 km apart and are connected by two approx. 100 km 33 kV lines. This results in a weak coupling and has a strong influence on the electrical network’s dynamic behaviour. Moreover, there is a large disparity between the maximum load (100 %) in the evening and the minimum load (10 %) before noon in rural areas. This causes problems of voltage stability as well as power oscillations between both synchronized power plants.

**Optimum Line Survey**

Within the scope of an earlier project, Lahmeyer International prepared a feasibility study which is now serving as a sound basis for the new project. Based on this study, Lahmeyer has now prepared the preliminary line survey for the 450 km lines and planned sixty low-voltage distribution networks in the project area. The task at hand was to find the economically optimum route. In the first step, all available geographical data and information on the planned overhead lines were recorded and analysed by means of a geographical information system (ArcGIS). This was followed by a site visit, where further data were gathered by GPS and existing data verified. The data collected on site were then cross-checked and the route alignment assessed accordingly.

Visualization of the 33 kV lines and low-voltage distribution networks, classification of the power poles and preparation of bills of quantities provided the basis for the further planning steps, such as design of the power poles, optimisation of the conductors and the preparation of tender documents. Tender evaluation and contract negotiations followed by site supervision during the two-year construction period are also within the scope of services of Lahmeyer’s energy experts.

Mathias Holweck

**Grid Extension Development Project in Uganda**

Construction works for extension of the national electricity grid in north-western Uganda will start in April 2012. This development project will help the region, which has long suffered from civil war, to stabilize itself. Lahmeyer International diligently prepared the implementation phase for this KfW-financed project.

The development project will help the region – which is affected by riots – to stabilize itself.
Engineering Design and Planning for the 1,050 MW Lagobianco Pumped Storage Plant

The Engineering Association Forza LAS

In December 2010, Lahmeyer International GmbH (LI) joined forces with the Swiss engineers Amberg Engineering AG and Stucky AG to form, under the technical leadership of LI, Forza LAS. In January 2011, the association submitted to the client - Repower AG with its head office in Poschiavo in Graubünden canton - a proposal for engineering design of the main structures of the Lagobianco pumped storage plant (PSP). The Italian word “Forza” means power or strength and thus reflects our commitment. Further, it recognises that such a technically and logistically challenging project as the Lagobianco PSP, which is situated in an ecologically sensitive area and has to be planned in a very short time, can only be handled successfully with the joint effort of competent and experienced companies.

A total of four national and international engineering groups competed for the project. In August 2011, following a fully transparent tendering and evaluation procedure, as is usual in Switzerland, the project development company Lagobianco SA, a full subsidiary of Repower AG, entrusted Forza LAS with the contract for the engineering design services.

After rehabilitation of the Hinterrhein Power Plants – described in LI Aktuell, December 2009 – and other projects, the Lagobianco PSP is yet another major project across the border in Switzerland, which has been entrusted to LI in the last five years.

Services and timeframe

Up to a total cost cap, the services – including optional items – are reimbursed on a cost-plus basis. The services include:

- Detailed design of the project to be completed by August 24th 2012, with the design for preliminary review being presented on April 20th 2012.
- Design for statutory approval of the project (June 29th 2012);
- Tendering and assistance in contract award (by August 30th 2013)

Optional contract components are final (construction) design, construction supervision and commissioning. Construction of the project is scheduled for 2013 to 2019. All services will be performed in accordance with the relevant Swiss standards and regulations (SIA).

Project Description and Key Data

The Lagobianco PSP utilizes the head between the two existing lakes Lago Bianco (upper reservoir, lake level between 2,207 and 2,239 masl) and Lago di Poschiavo (lower reservoir, lake level between 954 and 961.5 masl). The Lago Bianco is located directly on the Bernina Pass.

The Rhaetian Railway – classified as World Cultural Heritage in 2008 – runs from St. Moritz directly along the lakeside of Lago Bianco and winds down the valley to Poschiavo (Puschlav).

The main components of the Lagobianco PSP are as follows, with key data still subject to confirmation:

- Water intake at the Lago Bianco
- Headrace tunnel between the Lago Bianco and Motta da Torn, with a total length of approx. 18.8 km and a diameter of 5.7 m. It is envisaged that the headrace tunnel be excavated by a tunnel boring machine.
- Surge tank near Motta da Torn, consisting of lower and upper surge chambers and an inclined spiral-shaped tunnel which connects the two chambers.
- Steel-lined pressure shaft Motta da Torn - Camp Martin at the Lago di Poschiavo with a length of about 2.3 km and a diameter of 4.2 m.
- Power station at Camp Martin, consisting of separate machine- and transformer caverns. Six ternary units with a turbine capacity of 175 MW each (in total 1,050 MW) are planned, each consisting of a Pelton
turbine, a motor generator and a five-stage pump. The nominal flow rate per unit is 15.8 m³/s in turbine operation and 12.3 m³/s in pump mode, with a gross head (turbine) between 1,242 and 1,274 m (tentatively, as it depends on the required distance between turbine axis and tailwater level of the Pelton turbine) and a gross pumping head between 1,245.5 and 1,285 m.

Three machine groups each are connected to a tailrace system, each with a separate surge tank and a tailrace channel.

Water intake at the Lago di Poschiavo.

Open-air gas-insulated switchgear and grid connection at 380 kV.

Besides these main components there is a multitude of ancillary structures and temporary facilities to be planned, such as access and auxiliary tunnels, areas for site installation and stock-piling of materials, construction camps, cable-ways, access roads etc.

The distinctive alpine characteristics of the region, together with the often restricted space available, pose considerable challenges which include, for example:

- Special measures during winter time will be required for construction work scheduling and the provision of supporting facilities.
- Materials management is of particular importance. Here, it is sought to achieve as far as possible, a mass balance between excavated and re-used materials, to provide concrete aggregate in the required amount in due time, to minimize temporary and permanent stock-piling with respect to number and volume, and also to reduce the amount of road transport of materials.
- The limnological stratification of the Lago di Poschiavo should be disturbed as little as possible by the outflow and intake of the turbine and pump discharges, respectively. The water intake at Lago di Poschiavo is being designed in close cooperation with the Hydraulic Institute of the University of Lausanne, which – by means of three-dimensional computer models – is carrying out numerical simulations.
- The extraordinarily high gross head requires state-of-the art design and optimization of the steel lining of the pressure shaft with regard to the rock and steel parameters and with due consideration to assembly and welding services.
- Owing to the high gross head, ternary units with Pelton turbines are necessary, thereby resulting in a total shaft length of about 40 m between pump and turbine.

**Organisation**

Lagobianco SA leads and controls the project with its own project management team being assisted by an external engineering office assessing design decisions made by the planners and, as appropriate, giving a “second opinion”. For the purpose of comprehensive and smooth communication, Lagobianco SA has installed a so-called “virtual project office”, to which all project participants have access under clearly defined rules.
Forza LAS is assisted by two subconsultants specialised in materials management.

One of these companies has already prepared concepts for materials management during the preliminary project phases, so that continuity of the planning process is guaranteed. This is especially important for the arrangements already agreed with the respective authorities and municipalities. A subcontractor from Graubünden canton will plan, amongst other things, the site installation areas. In order to guarantee effective cooperation within Forza LAS and with the client and other stakeholders, Forza LAS has established a permanent project office in Poschiavo.

The main external interfaces of Forza LAS with other planning participants are as follows:
- The Lagobianco SA not only as the client, but also as planner for the power evacuation between transformers and switchyard.
- The geological/hydrogeological office, which, amongst other things, is responsible for preparation of the borelogs of the ongoing drilling campaign and for mapping the exploratory tunnel to the powerhouse cavern.
- The surveying office whose activities are still ongoing.
- The environmental planner, responsible for all relevant concerns, especially for the preparation of the stages 1 and 2 environmental impact assessment reports (EIA).
- The Hydraulic Institute of the University of Lausanne.
- Diverse other parties, such as the designer for heightening of two existing dams of the upper reservoir.

Project Status
In recent years, Repower AG has performed comprehensive preparatory work for the Lagobianco PSP, which formed the basis for the concession project in 2010. In subsequent development of the project, two alternatives are presently being analysed: construction of a cavern power station instead of a shaft power plant, and modification of the location of the surge tank and, as a consequence, the alignment of the downstream section of the pressure tunnel and the pressure shaft. These alternatives were already described in the foregoing, even though a final decision has yet to be made.

Application for approval of the concession (including stage 1 EIA report) was submitted in 2011. The environmental planning (stage 2 EIA report), being part of the project approval process, is under preparation.

Outlook
In all respects, the Lagobianco PSP is an exceptional challenge for all participants. Besides the technically perfect and timely provision of services, comprehensive and intense communication between all project stakeholders and regular "milestone"-decision meetings are essential for successful project implementation. The necessary prerequisites have been established by Lagobianco SA. In due time, we will inform you in future editions of LI Aktuell about progress of the project.

Rolf Wigand

The Lago Bianco and the Rhaetian Railway.
Remote Sensing and Spatial Analyses for the Planning of Irrigation Projects

With a length of 6,650 km the Nile is the world’s longest river. Its catchment covers one tenth of Africa. On its way from its source to the Mediterranean, the river passes through eleven riparian nations and its water is used by some 400 million people – a number which will probably double by 2025. The largest part of the Nile is in Sudan whose population of almost 40 million depends on water from the Nile.

Since the early 1990s, Lahmeyer International has been involved in the planning of irrigation projects in Sudan. The area of the projects being planned at present, is comparable with the total area of Belgium. They are amongst the largest agricultural development projects in the world and will serve hunger alleviation and poverty reduction in the Sudan and neighbouring countries.

Methods and Processes
During the planning of these irrigation projects spatial analysis methods and remote sensing processes are extensively employed. This concerns all issues with spatially related data e.g. soil analysis, environmental aspects, land use, geotechnical properties, hydrology, hydraulics and canal alignment.

Spatial Analyses
The basic information comes from high-resolution ortho-photos with 0.25 m contour lines, digital elevation models with 10 m grid width and geo-databases with land use data.

In the preliminary design phase working maps also are prepared for the specialist departments and for presentation and documentation purposes. Satellite imagery or terrain models derived from SRTM data (Shuttle Radar Topographic Mission) serve as map background in this phase.

Land use data are evaluated using a database that links the attribute data sets spatially via common coordinates.

Rainfall data are essential for project design. Using geo-statistical analysis the rainfall data can be presented as thematic maps showing variability.

Important Aids in Decision Support
Issues such as optimization of canal alignments, determination of reservoir volume and surface area curves, delineation of watersheds, location of pump stations, cut and fill volumes are determined using three-dimensional digital elevation models (DEM). The resultant products are cross sections, reservoir curves, 3D-visualisations, vector data and optimized gradient models which support decision-making for further project development.

An additional application of remote sensing is used for land use classification within the scope of environmental and social impact assessments, or for long-term studies of river morphology. The team made use of LANDSAT satellite imagery for this purpose.

Spatial analyses and remote sensing applications have proven their worth in versatile and effective applications and have thus become indispensable for Lahmeyer International as standard tools for the planning of large irrigation projects.

Leonhard Weinper
Turkey Making Increasing Use of Hydropower

Turkey’s diverse landscape offers vast potential for energy generation from renewable sources. As “Lender’s Engineer” a joint venture of Lahmeyer International and its subsidiary Hidro Dizayn is monitoring design and construction of twenty new hydropower plants. Known as “Akfen 20 HEPP”, the project will run until 2012.

Akfen is a private Turkish investment company which has secured a loan from a consortium of banks for realization of the project. The involvement of an international consultant with vast experience in hydropower was required as Lender’s Engineer during project implementation. Lahmeyer International and Hidro Dizayn meet these requirements and are monitoring the project whose capital investment is some 450 million Euro.

The initial main tasks of the joint venture, active since August 2008 under the leadership of Lahmeyer, are the “Due Diligence” of the projects based on the feasibility studies and “Design Review” based on the tender design. During the construction phase, technical problems and progress are analysed, risks identified and cash flows monitored.

In addition, the LI-HD joint venture provides assistance for the provisional handing-over and start of operation of the plants as well as for their final acceptance after one year of operation. The team – mainly consisting of civil, geotechnical, geological, mechanical and electrical experts – prepares interim and final reports.

Powerful Hydropower Plants

The project sites are located in Anatolia, in the coastal mountains at the Black Sea, and in the Taurus mountains at the Mediterranean Sea. These different locations exhibit diverse climatic and hydrological conditions. Most of the projects are diversion-type run-of-river power plants.

The twenty projects comprise a total of 24 hydropower plants with an installed capacity of 271 MW and feature the entire range of heads: high-head, medium-head and low-head. Ten plants have already been successfully commissioned. For the remaining plants, construction is in progress with further start-ups scheduled for the beginning of 2012.

Especially during the phases of design review and construction supervision Lahmeyer International and Hidro Dizayn substantially contributed to successful implementation of the project to date. Therefore, in this project, the role of the Lender’s Engineer is often that of active assistance and is not limited to passive controlling and reporting only. (More information on Lahmeyer International and Hidro Dizayn is given in the article on page 5).

Werner Burkler

Weir, intake structure and settling basin of the Böguntu Project.
Flood Protection for the Baltic Coast

Situated on Mecklenburg-Vorpommern’s Baltic coast, the town of Greifswald is endangered by storm surges. In future, a barrage will provide better protection against storm surges. The structure in the harbour entrance should be completed by the summer of 2013. In a consortium with Hypro Paulu & Lettner Ingenieurgesellschaft, the Lahmeyer subsidiary Hydrolprojekt Ingenieurgesellschaft has been involved in the project throughout all stages of construction.

The consortium has been contracted by the Western Pommeranian State Office for Agriculture and Environment (StALU-VP) to provide project management, site management and construction supervision. After several years of preparation, Ed. Züblin AG started construction in December 2010. Completion is scheduled for summer 2013.

Sophisticated Concept

The barrage is located where the Ryck River enters the sea on Denmark’s Wieck and connects to the existing system of dikes. Design solutions were sought which integrate the structure into the sensitive urban area and combine safety, functionality, urban planning aspects and cost optimization.

The main closure of the barrage consists of a rotating segment guaranteeing a passage width of 21 m. The lateral openings will be protected by sliding gates on either side with a span of 17 m.

Demanding Foundation

Before the end of 2011, all works relating to demolition and protection of embankments, dredging and bottom reinforcement will be completed, as well as construction of the watertight excavation pit, the retaining walls and the vertical drainage.

Due to firm marl foundations and a layer of rocky deposits, drilling and pile-driving are difficult and time-consuming. Construction unveiled old port fastenings and wooden sheet piles which dated back to about 1250 – according to the State Office for Culture and the Preservation of Historical Monuments which is present on site during all earthworks.

Working on the barrage with on-going traffic by ships and boats requires a high level of coordination. Thanks to the good working relationship between all participants, construction is progressing on schedule. Concrete works in the excavation pit are supposed to commence in March 2012.

Walter Cihar
Training of Engineers from Developing Countries

In order to get a view behind the scenes of dam operation, seven Sudanese engineers visited Germany where they participated in a hydraulic engineering excursion led by Lahmeyer International.

Far from being a sightseeing tour, the focus of the trip was to obtain an insight into the operation of various dams, starting from assuring their structural stability through regular dam maintenance to reservoir operation and catchment management.

The first stop was a dam owned by the State of Bavaria, the Sylvenstein Dam, on the upper reaches of the Isar River south of Munich. Constructed in 1954-5, this fill dam with a height of some 50 m has undergone repeated modification in past years and has proven its capacity under large floods.

The Leibis-Lichte Dam in Thuringia was the next port of call. With a height of 102.5 m it is both the second highest and the newest dam in Germany. This concrete gravity dam was of particular interest to the visitors because the dam instrumentation for the Merowe Dam in Sudan is based on experience at Leibis-Lichte. This part of the excursion was led by Dipl.-Ing. Jens Peters who has represented the owner of the dam during its construction.

The journey then continued on to Saxony under the leadership of Dipl.-Ing. Eberhard Jungel from the state dam authority, visiting the Eibenstock and Pöhl dams, both of which are also concrete gravity dams.

Practical Experience

The excursion came to an end on 20th November 2011 after a journey of almost 2000 km across Germany. It provided the young engineers with intimate insights to the operation and maintenance of dams which would not have been possible with classroom theory only.

This experience will be applied in future at the Merowe Hydropower Plant in Sudan. The plant, with an installed capacity of 1,250 MW, started generating approximately 2.5 years ago and presently supplies more than 60% of the national demand. Since its commissioning, engineers from Lahmeyer International support the owner of the hydropower power plant and its appurtenant structures.
New Wastewater Treatment Plant in Nablus for Improved Living Conditions

The Palestinian city of Nablus is the second biggest in the West Bank and is situated approx. 60 km north of Jerusalem. In order to achieve a sustainable improvement of the living conditions of about 130,000 inhabitants, KfW Development Bank is financing the implementation of the “Nablus West Sewerage Project”. In a joint venture, Lahmeyer is now responsible for site supervision.

The project is divided into three phases and aims to collect and dispose wastewater. Already in 2007 the municipality of Nablus entrusted the joint venture under the leadership of Lahmeyer International with the first phase of the project. In cooperation with the joint venture partners Schneider & Partner Ingenieur-GmbH (Germany) und Hijawi Engineering Center (Palestine), Lahmeyer International is presently supervising the first construction phase which includes a new wastewater treatment plant with a capacity of 150,000 population equivalents (PE) as well as the construction of a trunk sewer and some branch sewers of 1400 mm to 800 mm diameter over a total length of approx. 10 km.

Three Project Phases

From 2007 to 2009, Lahmeyer International reviewed the existing feasibility studies and preliminary designs and completed the collection of data on population and raw water quality and quantity. Subsequently, Lahmeyer International developed a concept resulting from detailed comparison of alternatives. The focus was on different treatment processes – namely the activated sludge method and trickling filtration - in order to meet the new legal Israeli-Palestinian requirements.

On this basis, detailed design of the wastewater treatment plant and tender documents according to the standards of the International Federation of Consulting Engineers (FIDIC), including technical operation management, were prepared for the whole plant. Moreover, the joint venture prepared prequalification documents and evaluated the international applications for prequalification. Similarly, tenders subsequently submitted were evaluated and the contract was negotiated, culminating in finalisation of the construction contract.

The on-going second project phase started in 2010 and is scheduled for completion in the fourth quarter of 2012. It comprises the full site supervision and commissioning of the plant. The future third project phase (2013 to 2014) includes supervision of the two-year defects notification period. In parallel, operational assistance to be provided by the contractor himself will be monitored. The operational assistance for the local personnel serves to establish best practice for sustainable and autonomous operation of the wastewater treatment plant through practically oriented qualification programmes. Lahmeyer International was responsible for the development and further integration of this concept into the overall programme.

Reinhard Vogt

Present construction phase – activated sludge tanks.

3d-simulation of the wastewater treatment plant.
High-Head Hydropower Project on the Harpo River

Life in the north Pakistani Gilgit-Baltistan province is predominantly rural and the living standard in the mountainous Himalayan regions is significantly lower than the national average. In order to contribute to an economic upturn for the population, the joint venture consisting of Lahmeyer International and three Pakistani partners revised a feasibility study originating from 2002 for a high-head hydropower plant on the Harpo River, a tributary of the Indus River.

In close cooperation with the client, the Water and Power Development Authority of Pakistan (WAPDA), and the KfW Bankengruppe as financier, the joint venture reviewed the existing feasibility study and updated the project’s basic parameters. Specification, tendering and supervision of the geotechnical and geophysical investigations were also in the team’s scope of work.

Three Alternatives Investigated

Based on the results of the investigations, designs were prepared for three alternatives for the hydropower plant with 700 m rated head. Preliminary designs and approximate cost estimates were prepared for all alternatives. These resulted in a recommendation to the client in order to further optimize the favoured alternative.

Elements Optimized

Subsequently all components of the favoured alternative were optimized both technically and economically. The main components of the hydropower plant are: a Tyrolean weir, a covered headrace canal with side spilling weir for an automatic regulation of the discharge, a double-chamber sand trap and a forebay to meet the daily peak demand. Additionally, there is a partly embedded steel pipeline (1,300 mm diameter) of approx. 3,000 m length, a surface powerhouse with two Pelton units, transformers and gas-insulated switchgear as well as a tailrace channel.

Quick Results

Already halfway through the nine-months project duration – in July 2011 – Lahmeyer identified to the client the favoured alternative, which was accepted by the client. Results of the optimization process provided an important basis for decision-making for subsequent development of the project. Construction of the hydropower plant would be of crucial importance for the region.

Rüdiger Siebel
Opening of the Nord-Stream Pipeline through the Baltic Sea

Since a few weeks now, Russian natural gas has been flowing directly to Germany through the new Nord-Stream pipeline, making a decisive contribution to Europe’s energy supply.

The heads of the state jointly got their hands on the ceremonial opening of the Nord-Stream Pipeline: (from the left in the first row) the French Prime Minister François Fillon, the German Chancellor Angela Merkel, the Dutch Prime Minister Mark Rutte, the Russian President Dmitry Medvedev and the EU Commissar for Energy, Günther Öttinger.

One of the largest current infrastructure projects in the EU went into operation in November 2011. Lahmeyer Rhein-Main and Roland Berger Strategy Consultants jointly developed the concept for the Nord-Stream operating company and structured the project which will enhance the reliability of energy supplies to Europe. Their duties included the structuring of processes and workflows and the preparation of functional descriptions as well as of guidelines for the development of the new form of organization. As an integrated all-in solution, they designed and implemented the communication and information systems. Further, establishment of the project organization has been in the hands of the team consisting of experienced engineers and business economists.

Since 2007, Lahmeyer Rhein-Main has advised the project’s owners with regard to scheduling and progress control, statutory approval procedures, logistics planning, development and implementation of project-specific document management systems and reporting.

The Nord-Stream pipeline transports Siberian natural gas from Wyborg to Lubmin in the north-east of Mecklenburg-Vorpommern over a length of 1,224 kilometers. Some 27.5 billion cubic meters of gas will flow annually to Germany through the first pipeline which is now in operation. From the end of 2012, 55 billion cubic meters of gas will flow through twin pipelines each year. An important part of this infrastructure measure is linking it up to the rest of the European gas network via the OPAL and NEL pipelines.

Charlotte Baumann-Lotz
Upon the basis of the project study performed by Lahmeyer the city of Paderborn can decide on the future of its administrative buildings.
In order to achieve continuous improvement in quality, Deutsche Bahn - DB (German Railways) trust in reliable and competent companies like Lahmeyer Munich.

Deutsche Bahn has developed a comprehensive prequalification system as the major element for management of contractors and quality in order to select suitable business partners. Every two years, consulting engineers are required to prove their administrative, legal and economic status on the basis of documentary evidence and, in addition, to verify their technical competence by means of recent reference projects.

Moreover, DB verifies the implementation of the “common guidelines for contractors and clients relating to engineering and architectural services” agreed in 2003 between the German Association of Consulting Engineers (VBI) and DB.

As Lahmeyer is member of the VBI, we conformed to these guidelines, containing quality criteria as well as a code of conduct, from the very beginning. In addition, the Lahmeyer Group – as one of the first engineering companies in Germany – has implemented a comprehensive Compliance Policy and runs a Compliance Management System since 2007.

Lahmeyer Munich as a Competent Partner

Being a subsidiary of Lahmeyer International, Lahmeyer Munich introduced the Compliance Policy at the same time. Not least because of this reason Lahmeyer Munich has once again reached its aim of being entered in the “list of prequalified companies” of Deutsche Bahn AG.

This list applies to work for engineering structures, such as, for example, railway and road bridges, pedestrian under- and overpasses, platform roofs as well as for specialist engineering works. A competency certificate for structural design has also been issued.

In addition, Lahmeyer Munich successfully passed the prequalification procedure for traffic facilities which includes the planning of railway crossings, station platforms, railway track superstructures as well as road planning. Therefore, Lahmeyer Munich is a proven competent partner of Deutsche Bahn for any infrastructure projects.

Konrad Daxenberger, Ines Langer