NARVAN ARRA
Committed to Environmental Issues

Marun Dam and Power Plant

Rexroth
Bosch Group
Sales & Service Partner

Scott Wilson

Energy & Environment
Oil & Gas
Drive & Control

Marun Dam and Power Plant

Marun Dam & Hydroelectric Power Plant

Marun dam is located in South East of Khuzestan province, 20 Km away from the ancient city of Behbahan.

Marun I hydroelectric power plant has a design installed capacity of 150 MW that is designed to accommodate the sudden increase of electricity demand during peak time.

Marun I HEPP has achieved the highest reliability factor for synchronizing to the grid and producing electricity in Khuzestan Province a fact acknowledged by Khuzestan Water and Power Authority, the Owner which belongs to the Ministry of Energy.

Khuzestan Water & Power Authority

- First Joint and Several Contract in Ministry of Energy between General Electric, Siemens and Iranian Company, Neyrperse.
- First Hydro Power Plant after the Revolution in Iran based on complete Western-European technology with the highest reliability.
- First Hydro Power Plant implemented by EPC group Contractors out of Ministry of Energy affiliated companies.

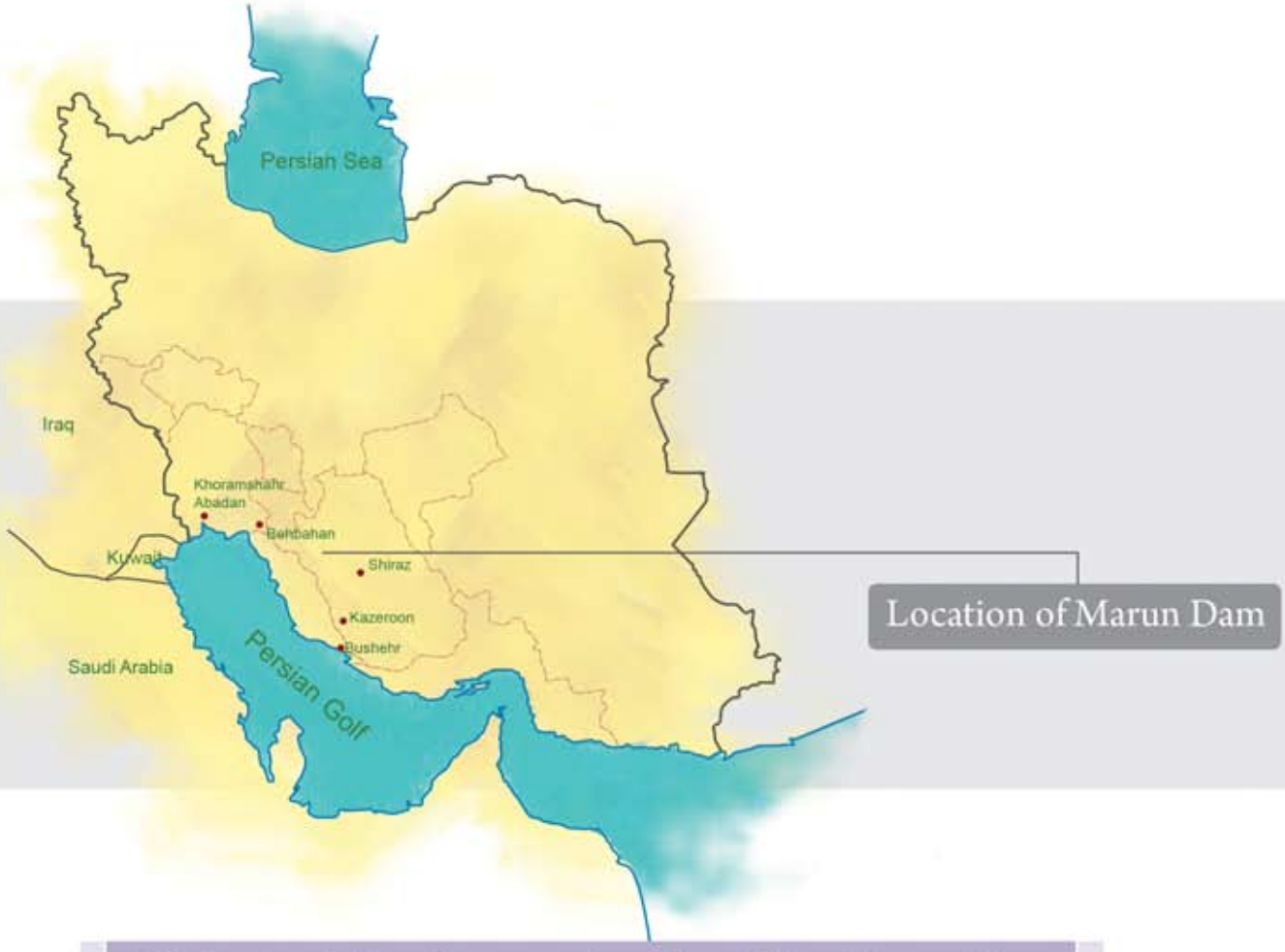
Projects Highlights

The project has been executed on EPC basis covering design, procurement and manufacturing, erection and commissioning and warranty services; financed through Export Credit Agencies (ECA) by Hermes of Germany and CESCE of Spain.

It was the first Joint and Several arrangement made within Iran Ministry of Energy for hydropower development between Iranian and Western companies.

The Project has been Directed by **Dr. Farhad Izadjoo** in Khuzestan Water and Power Authority, Marun I HEPP is the first hydroelectric power plant since the 1979 Islamic Revolution in Iran with complete Western-European technology.

NEYRPERSE



Historical Background of the Plant Location

In the winter of 330 BC, Ariobarzanes led a last stand of the Persian forces against Alexander's forces and successfully held the Macedonian army at bay for 30 days.

After the conquest of Susa, Alexander split the Macedonian army into two parts. Alexander's general, Parmenion, took one half along the Royal Road, and Alexander himself took the route towards Persis. Passing into Persis required traversing the Persian Gates, a narrow mountain pass that lent itself easily to ambush.

According to historian Arrian, Ariobarzanes had a force of 700 men who faced a much larger Macedonian force of 10,000.

Ariobarzanes - 330 BC

The Persian Gate was only a couple of meters wide at the point of ambush. Once the Macedonian army had advanced sufficiently into the narrow pass, the Iranians rained down boulders on them from the northern slopes. From the southern slope, Persian archers and catapults launched their projectiles. Alexander's army initially suffered heavy casualties, losing entire platoons at a time. The Macedonians attempted to withdraw, but the terrain and their still-advancing rear guard made an orderly retreat impossible.

Ariobarzanes held the pass for a month, but Alexander succeeded in encircling the Persian army in a pincer attack with Philotas, and broke through the Persian defences. Accounts of how he did so vary widely. Curtius and Arrian both report that prisoners of war led Alexander through the mountains to the rear of the Persian position, while a token force remained in the Macedonian camp under the command of Craterus.

Dam Lake at Persian Gate

Project Organization

Client
Khuzestan Water & Power Authority

Moshanir (Iran)
Client`s Consultant Engineer

GE Energy UK
Turbine & Accessories Overhead Cranes

Siemens AG
Generatore, Transformer & Excitation System

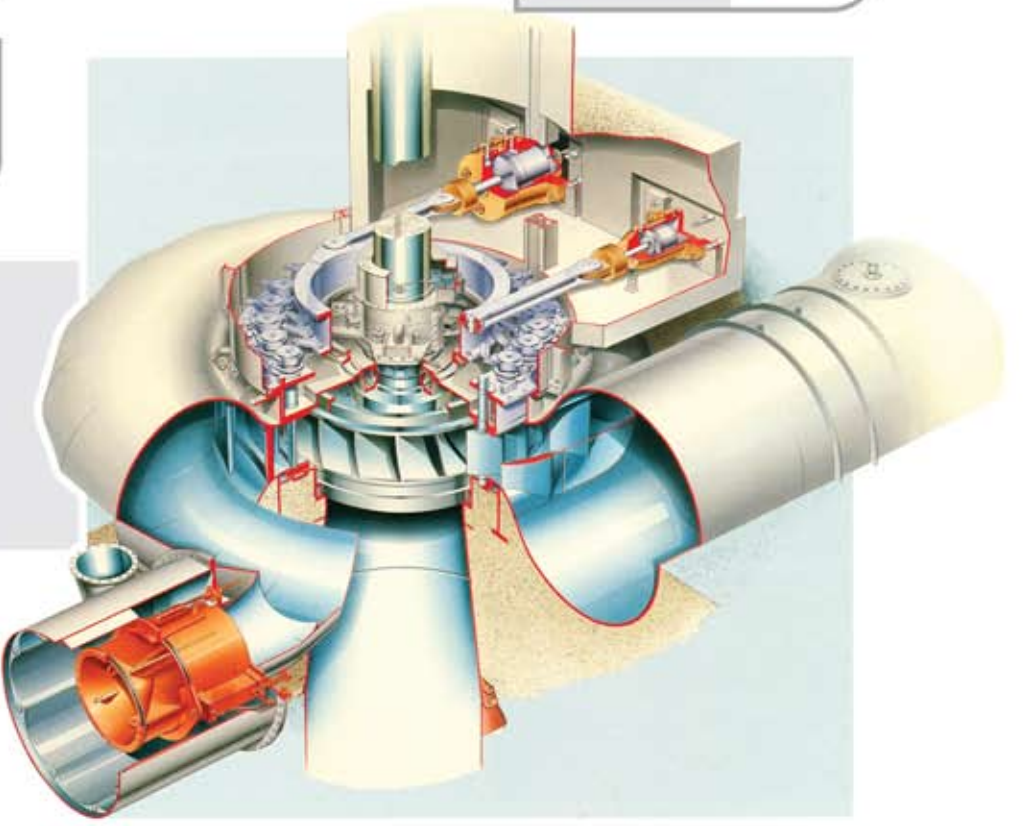
Neyrperse (Iran)
Balance of Plant Erection & Commissioning

Join and Several

Narvan Arra
Project Management Technichal & Engineering

Scott Wilson (UK)
Consultant to Neyeperse & Project Manager

Bosch Rexroth
Hydrolic Motion & control System for all Dam Gates



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Narvan Arra

Narvan Arra have a wealth of knowledge and expertise in facilitation and coordination of projects, from design to implementation and have managed many infrastructure projects in the energy and water sectors in collaboration with our local and international partners.

Narvan Arra`s scope of services included the following:

- Technical and Engineering liasion
- Contractual and Commerical support
- Local project management
- Procurement of equipment and services localy
- Co-ordination of local sub-contracts and service providers
- Logistical support
- Administration
- Co-ordination of training

Narvan Arra was the first company in Iran to align with international standards, and the first Iranian service company to be granted ISO9001 quality management and assurance system (version 2000), acknowledged by SGS.

SGS United Kingdom Ltd
Yarsley International Certification Services

Certificate Number

Q56804

This is to certify that the Quality Management systems of

Narvan Arra Co.

Iran

have been assessed and registered as meeting the requirements of ISO 9001

The scope of registration is detailed on the Assessment Schedule bearing this certificate number.

SGS Yarsley International Certification Services
Signed by

25 September 2002 25 September 2002

TÜV CERT

CERTIFICATE

The TÜV CERT Certification Body
of TÜV Saarland e.V.

certifies in accordance with TÜV CERT procedures that

Narvan Arra Co.
IR- Tehran/Iran

has established and applies
a quality management system for

support services to customers, on business and management consultancy & activities auxiliary to projects handling

An audit was performed, Report No. B 328/02.

Proof has been furnished that the requirements according to

DIN EN ISO 9001: 2000

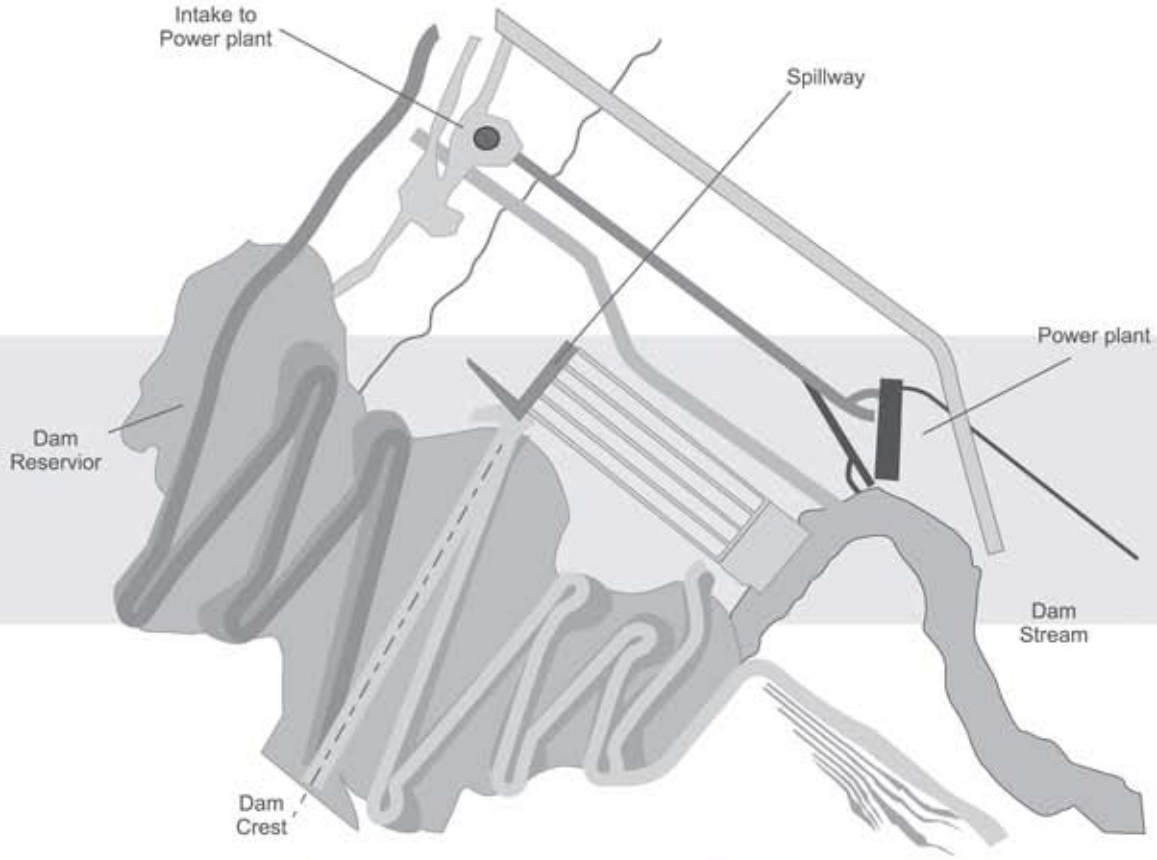
are fulfilled. The certificate is valid until May 2005.

Certificate Registration No. 71 100 C 069

Subbach, 21.05.2002

TÜV SAARLAND

Dam & HEPP Layout



Scott Wilson

Scott Wilson were responsible for project management, tender design, design coordinator -between all joint and several parties, factory inspections and site supervision of the hydropower plant.

Furthermore the whole process of erection and commissioning of the plant has been project managed on site by consultant staff based in Iran.

Andrew J C Thick – Scott Wilson Project Manager (right)
Reza Vojouhi – Narvan Arra Project Manager (left)

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Feasibility Study for Development

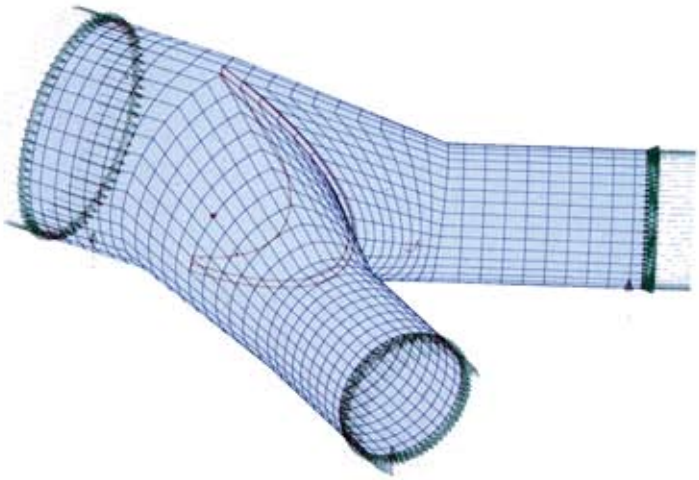
Marun dam was originaly 75 MW generating station, without the re-regulating dam.

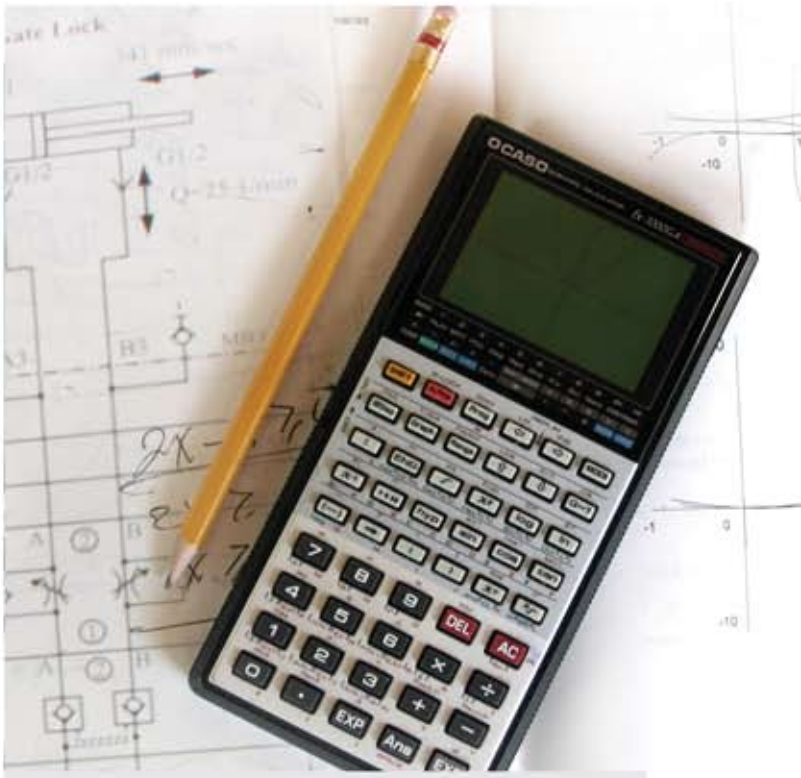
Scott Wilson undertook a plan to be executed with one feasibility study on which an informed decision can be made on whether or not to install the second 75 MW unit and requirements to implement a re-regulating dam with or without an integral powerhouse at Marun II.

The study also focuses on the development at Marun II, with particular emphasis on optimizing the engineering concept for re-regulating dam and the installed capacity of the powerhouse.

Scott Wilson has also undertaken design, design review and consultancy services for Marun Dam spillway radial gates implemental by Neyreprese.

- Detailed checking of all calculations for completeness and correctness including input and output of computer programs.
- Detailed checking of all general arrangement drawings.
- Detailed checking of transportation and installation / erection drawings.
- Approval of drawings and calculations.





Hydraulic Motion and Control Systems

Client	Neyrperse
Scope of Work	Design, System Engineering, Supply and Warranty Services
Completion	1999
Gate Type(s)	Bottom Outlet, Spillway Power House Intake

System Specifications

Hydraulic Cylinder for Power Intake	Strok:	6800 mm
	Capacity:	3500 kN
	Quantity:	1
Hydraulic Cylinder for Spillway	Strok:	11680 mm
	Capacity:	15350 kN
	Quantity:	8
Hydraulic Cylinder for Bottom Outlet	Strok:	7250 mm + 4200 mm
	Capacity:	3800 kN + 2500 kN
	Quantity:	1 + 1

Power units, Control & Measuring systems were Included

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Bosch Group
Sales & Service Partner

Power Plant Specifications

Francis Turbine GE Energy UK

Main Inlet Valve Test & Inspection

Gordon Taylor - General Electric Project Manager

Turbine:

- Type:	Vertical Francis
- Speed:	250 rpm
- Runner Discharge Diameter:	2.98 m
- Discharge:	70 m3/s

Governor:

- Type:	Electro Hydraulic
- Electronic Governor:	GE, TC100
- Oil Pressure:	120 Brg

Generator:

- Rated Voltage:	15750 V
- Rated Power:	75MW
- Stator Diameter:	7.42 m
- Frequency:	50 Hz

Main Inlet Valve:

- Type:	Lattice Butterfly Valve
- Diameter:	3.25m

Overhead Traveling Cranes:

- Quantity:	2
- Main Hook:	1250kN (x2)
- Auxiliary Hook:	320kN
- Electric Polly:	80kN

Auxiliary Installations:

- Drainage and Dewatering Pumping Station
- Compressed Air System
- Cooling Water System
- Bulk Oil Handling Systems
- Discharge Measuring Installations

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