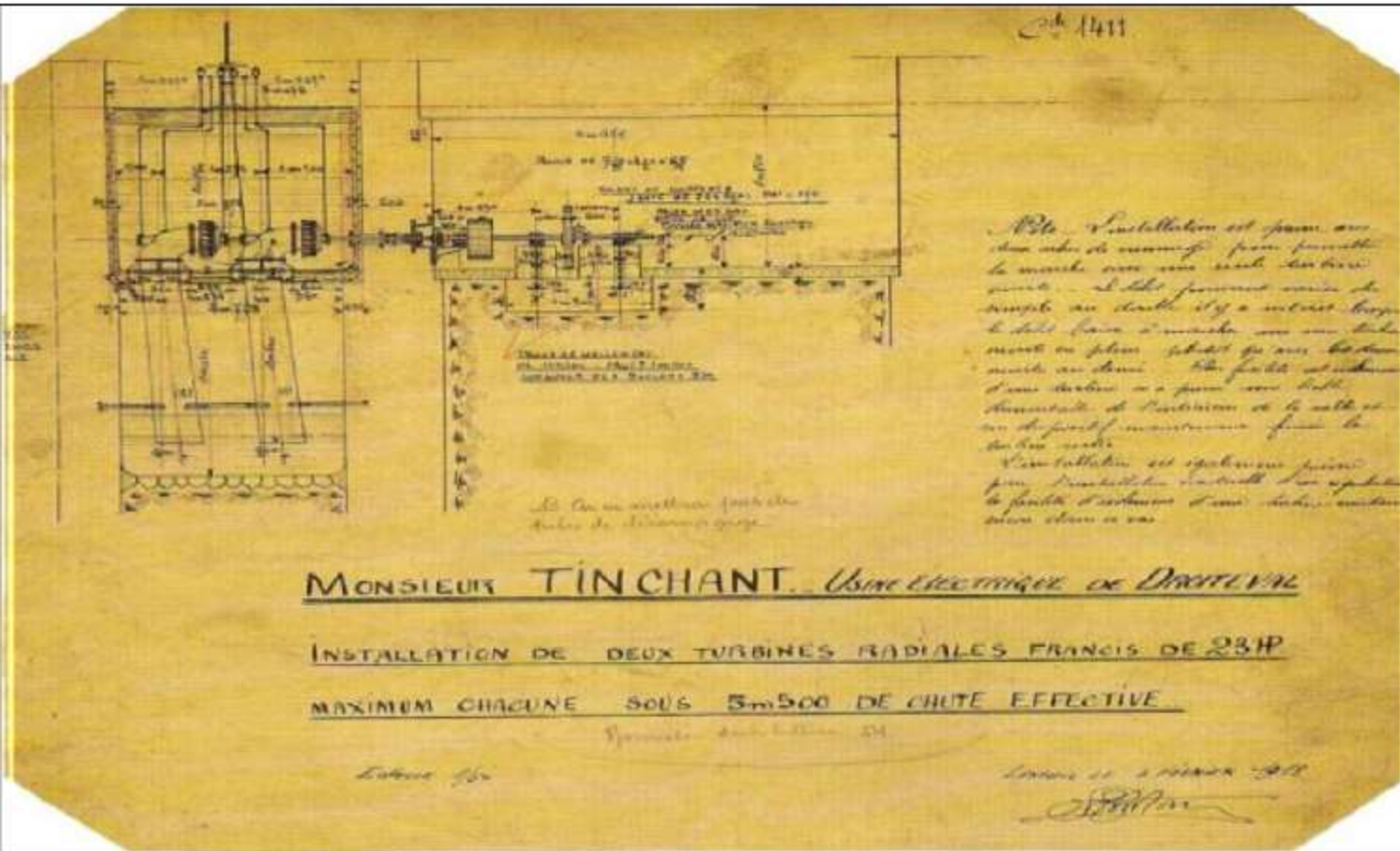


Design and realization of turnkey power plants
Range 200 kW to 15000 kW



www.hydropowerplant.com

More than 100 years of experience



Original drawing (1918) done by Louis Tinchant,
grandfather of Patrice Pisterman

HPP Key Figures

- ✓ **106** years of history
- ✓ **250** power station installed in **30** countries
- ✓ **500** MW of generation installed or designed
- ✓ Permanent team of **15** people **100%** Engineers
- ✓ **22** country representatives
- ✓ **3** factory partnerships
- ✓ **5 to 8** project per year
- ✓ Income of **10m€**, growth superior to **10%** per annum
- ✓ **100 %** Hydro expert

HPP Organization



Commercial office



Turbines factory



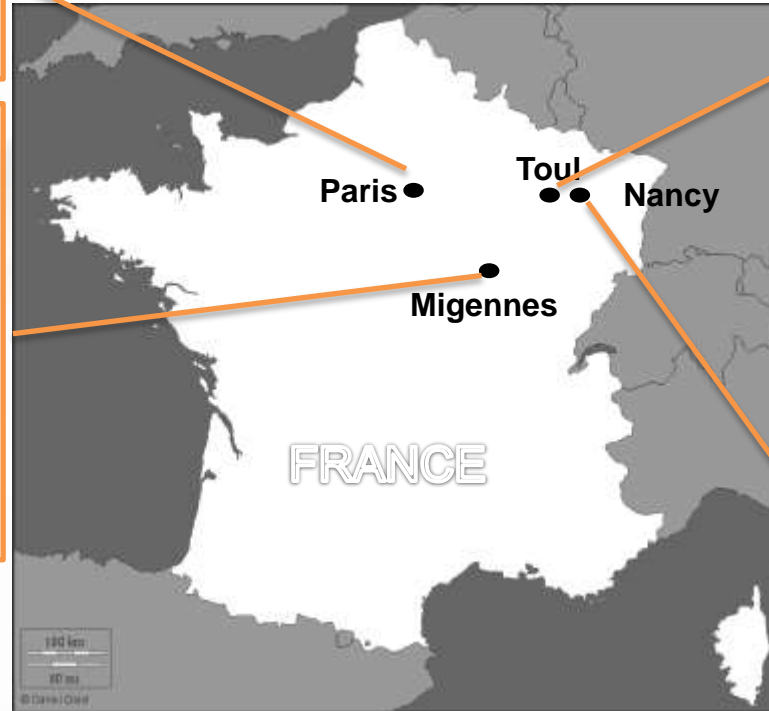
Large mechanical parts factory



Electrical factory



Design office

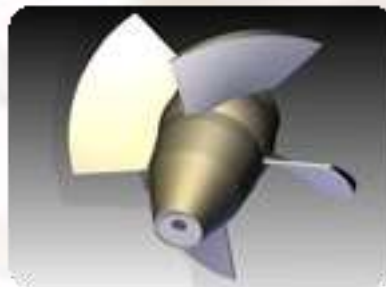


SOUTH AFRICA

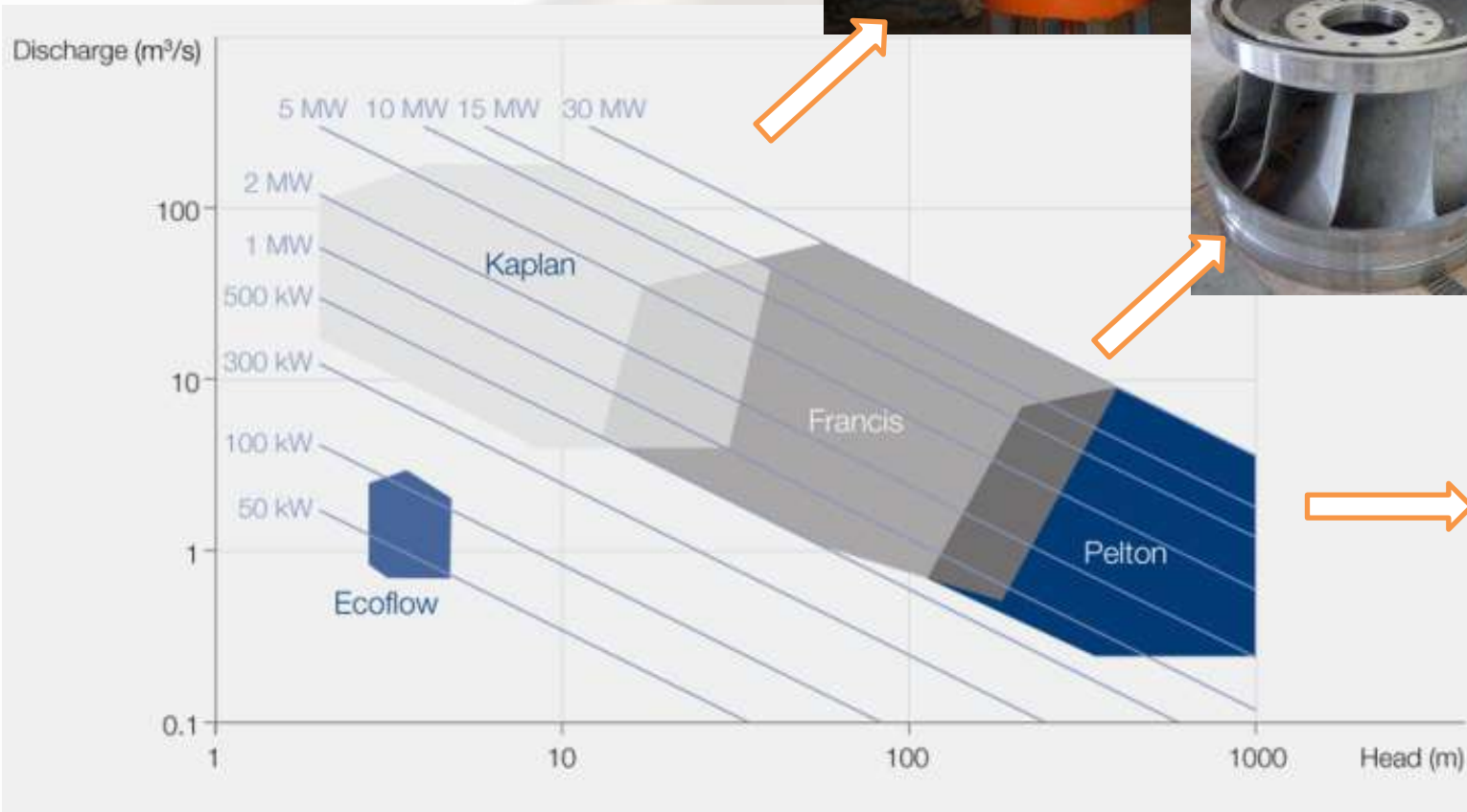
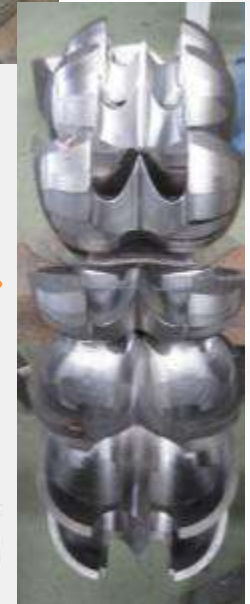


HPP Expertise

- HPP designs and manufacture hydro power plants from **200kW to 15 MW per unit**
- Since **1972**, more than **250** plants and studies have been achieved all over the world in more than **30** different countries
- All types of turbines are in the HPP know how :



Turbines distribution



HPP realized or designed more than 250 power stations throughout the world

Ref	Site	Country	Year	Type	Hn	Qn	Nb of units	Ø	Power / Unit	Total Power	HPP contribution
13	Mereville	France	1987	Kaplan	4,8	35	2	2720	1400 kW	2800 kW	Design
15	Droneiro	Italy	1997	Francis	6,3	2	3	800	100 kW	300 kW	Refurbishment
16	Borgo San Dalmas	Italy	1988	Francis	11	4,3	2	1000	400 kW	800 kW	Turnkey
109	Gros moulins	France	1986	Kaplan	4,75	7,8	1	1450	290 kW	290 kW	Refurbishment
123	Chettipetta	India	1991	Kaplan	2,7	25	2	2720	550 kW	1100 kW	Turnkey
133	Ashgrove-1	Ireland	1990	Francis	12,5	2,5	1	830	260 kW	260 kW	Turnkey
133	Ashgrove-2	Ireland	1990	Francis	12,5	3,5	1	940	360 kW	360 kW	Turnkey
158	Calma	Portugal	1994	Kaplan	6,7	6,2	1	1200	340 kW	340 kW	Turnkey
185	Alforfa-1	Portugal	1994	Pelton	210	0,5	1	960	830 kW	830 kW	Refurbishment
185	Alforfa-2	Portugal	1994	Pelton	210	1	1	770	1660 kW	1660 kW	Refurbishment
187	Pedro da Figueira	Portugal	1993	Pelton	285	1,02	1	670	2400 kW	2400 kW	Turnkey
192	SM1	Canada	1988	Francis	17	55	1	3400	8000 kW	8000 kW	Design
202	St Claude Martinet	France	1991	Francis	9	1,9	1	800	140 kW	140 kW	Turnkey
227	Covao de Nave-1	Portugal	1994	Pelton	210,0	0,3	1	650	600 kW	600 kW	Turnkey
227	Covao de Nave-2	Portugal	1994	Pelton	210	0,6	1	650	1200 kW	1200 kW	Turnkey
236	Grands moulins	France	1992	Kaplan	4,25	27,5	1	1450	965 kW	965 kW	Refurbishment
245	Montsapey	France	1995	Pelton	285	0,4	3	900	900 kW	2700 kW	Refurbishment
245	Montsapey	France	1995	Pelton	400,0	0,45	1	900	1500 kW	1500 kW	Refurbishment
257	Chaudeney	France	1992	Kaplan	4,7	45	2	2380	1400 kW	2800 kW	Design
258	Véreux	France	1996	Kaplan	1,8	12	2	2000	170 kW	340 kW	Turnkey
259	Villemur	France	1999	Kaplan	2,5	100	7		296 kW	2073 kW	Refurbishment
264	Saint Pourçain	France	1994	Kaplan	2,3	23	1	2500	425 kW	425 kW	Turnkey
265	Traverses	France	1994	Pelton	400	0,6	1	1075	2000 kW	2000 kW	Design + Runner
283	Pradonova	Spain	1993	Pelton	270	1	1	870	2350 kW	2350 kW	Design
298	Guinea	Guinea	1996	Francis	48	14	2	1000	5500 kW	11000 kW	Design
325	Addanki-1	India	1997	Kaplan	6,3	23	2	2300	1200 kW	2400 kW	Turnkey
325	Addanki-2	India	1997	Kaplan	4,65	23	2	2300	874 kW	1748 kW	Turnkey
325	Addanki-3	India	1997	Kaplan	7,3	23	2	2300	1380 kW	2760 kW	Turnkey
338	Jayalakshmi	India	2001	Kaplan	6,1	21	4	2300	1100 kW	4400 kW	Turnkey
383	Vijayalakshmi-1	India	2001	Kaplan	9,0	11	1	1700	900 kW	900 kW	Turnkey
383	Vijayalakshmi-2	India	2001	Kaplan	10,0	12	1	1700	1000 kW	1000 kW	Turnkey
358	SKJ	India	2000	Kaplan	7,5	13	2	1700	830 kW	1660 kW	Turnkey
360	Trident	India	2000	Kaplan	6,3	23	4	2300	1100 kW	4400 kW	Turnkey
363	Espar Pak I	India	1999	Kaplan	12	14	1	2000	1400 kW	1400 kW	Turnkey
364	Espar Pak II	India	1999	Kaplan	3,6	20	1	2300	560 kW	560 kW	Turnkey
365	Shivani	India	2001	Kaplan	5,6	17	1	2000	800 kW	800 kW	Turnkey
371	St Claude EDF	France	1996	Francis	30	5,5	1	962	1350 kW	1350 kW	Design + Runner
385	Janapadu	India	2002	Kaplan	6,5	20	1	2000	1100 kW	1100 kW	Turnkey
386	Kabini	India	2002	Kaplan	7	38,5	2	2900	2250 kW	4500 kW	Turnkey
391	la hutte	France	2004	Pelton	44	0,25	1	430	90 kW	90 kW	Turnkey
452	SPEA	France	2004	Pelton	380	0,36	1	760	1140 kW	1140 kW	Design + Runner
500	Sanquhar	Sri Lanka	2003	Francis	87,0	2,35	1	650	1750 kW	1750 kW	Turnkey
505	Hydro dynamics	Sri Lanka	2002	Pelton	95,0	1,4	1	780	1080 kW	1080 kW	Turnkey
508	Oudenaarde	Belgique	2001	Kaplan	1,6	22,5	2	2900	300 kW	600 kW	Design
522	Pesmes	France	2002	Kaplan	3,2	10	3	1700	250 kW	750 kW	Turnkey
545	Delta	Sri Lanka	2005	Pelton	200	1,1	1	750	1950 kW	1950 kW	Turnkey
551	Vahiria	Tahiti	2003	Francis	163	1,2	1	460	1620 kW	1620 kW	Refurbishment
564	Birahiganga	India	Under installation	Francis	54,5	6	2	960	2681 kW	5362 kW	Turnkey
583	Somavathi	India	2009	Francis	109	3,85	2	780	3450 kW	6900 kW	Turnkey
586	Rishiganga	India	Under installation	Francis	52,0	7,75	2	1080	3340 kW	6680 kW	Turnkey
588	Koswatta-1	Sri Lanka	2006	Francis	22,8	9	1	1380	1800 kW	1800 kW	Turnkey
588	Koswatta-2	Sri Lanka	2006	Francis	22,8	4,8	1	962	900 kW	900 kW	Turnkey
599	Madkini	India	Under installation	Francis	195	3,55	4	800	5750 kW	23000 kW	Turnkey
600	Mornimont	France	2008	Kaplan	4,3	5	1	1200	180 kW	180 kW	Turnkey
601	IPCL	India	2008	Francis	35,0	8,62	2	1180	2500 kW	5000 kW	Turnkey
621	Sonna	India	Under installation	Kaplan	11,0	43,7	3	2900	4000 kW	12000 kW	Turnkey
634	Wimsome	India	Under installation	Kaplan	2,5	39,9	1	3600	831 kW	831 kW	Turnkey

Ref	Site	Country	Year	Type	Hn	Qn	Nb of units	Ø	Power / Unit	Total Power	HPP contribution
671	Kolagave	India	Under installation	Pelton	190	1,65	1	1096	2728 kW	2728 kW	Turnkey
690	Roanne	France	Under installation	Kaplan	3,3	26,6	3	2900	850 kW	2550 kW	Design
704	Yennehole	India	Under installation	Kaplan	12	54	3	3100	5650 kW	16950 kW	Turnkey
737	Gurhan	India	2010	Pelton	215	1,04	1	971	1950 kW	1950 kW	Turnkey
757-II	Chikka	India	Under Study	Kaplan	12,0	70	4	3625	7500 kW	30000 kW	Design
757-I	Rangana	India	Under Study	Kaplan	14,3	49	2	2900	5000 kW	10000 kW	Design
757-III	Nandikiere	India	Under Study	Kaplan	11,8	70	4	3625	6000 kW	24000 kW	Design
792	TSZ	Madagascar	2010	Francis	31	10	2	1380	3000 kW	6000 kW	Turnkey
842	Terkiana	India	Under installation	Kaplan	7,0	14,5	1	1800	863 kW	863 kW	Turnkey
346	Rajapur	India	Under installation	Kaplan	4,3	11,55	2	1800	410 kW	820 kW	Turnkey
761	Dummagudem	India	Under Study	Kaplan	5,0	100	6	4800	4000 kW	24000 kW	Design
803	Calinesti	Romania	Under Study	Kaplan	6,95	17,2	1	2000	965 kW	965 kW	Turnkey
815-1	Suha Mare	Romania	Under installation	Francis	53,6	0,8	1	400	289 kW	289 kW	Turnkey
815-2	Valeni	Romania	2011	Pelton	90	0,35	1	500	256 kW	256 kW	Turnkey
815-3	Marului	Romania	Under installation	Francis	62	1,1	1	450	565 kW	565 kW	Turnkey
815-4	Malini	Romania	Under installation	Francis	35,3	0,85	1	450	250 kW	250 kW	Turnkey
815-5	Gainesti	Romania	2011	Pelton	64,6	0,23	1	425	122 kW	122 kW	Turnkey
815-6	Slatina	Romania	Under installation	Francis	63,3	1,05	1	450	563 kW	563 kW	Turnkey
826	Roche au Moine	France	Under Study	Francis	16,0	6	1	500	805 kW	805 kW	Turnkey
836	Sechi	India	Under installation	Francis	134	2,61	2	750	2500 kW	5000 kW	Turnkey
847	N'Zoro	RDC	Under installation	Francis	18	5,5	1	1000	820 kW	820 kW	Turnkey
862	Yadgiri	India	Under installation	Kaplan	6	62	3	3600	3000 kW	9000 kW	Turnkey
875	Katsina	Nigeria	Under Study	Francis	14,5	5	2	1100	600 kW	1200 kW	Turnkey
877	MBL II	India	Under installation	Kaplan	7,0	60	2	3350	3000 kW	6000 kW	Turnkey
878	MBL III	India	Under installation	Kaplan	4,8	60	2	3600	2000 kW	4000 kW	Turnkey
886	Agkolu	Turkey	Under installation	Francis	46,76	6,4	2	960	2300 kW	4600 kW	Turnkey
889	N'Zoro II	RDC	Under installation	Francis	58,0	11	4	920	5400 kW	21600 kW	Turnkey
917	Arakli	Turkey	Under installation	Pelton	220	0,4	1	590	726 kW	726 kW	Turnkey
926-1	Zagra 1	Romania	Under installation	Pelton	118,6	0,42	1	570	418 kW	418 kW	Turnkey
926-2	Zagra 2	Romania	Under installation	Pelton	68,3	0,6	1	648	344 kW	344 kW	Turnkey
926-3	Zagra 3	Romania	Under installation	Pelton	130,5	0,6	1	590	657 kW	657 kW	Turnkey
931	Nod de Presiune	Romania	Under installation	Francis	53	1,8	1	510	926 kW	926 kW	Refurbishment
946	Sainte Héliène	France	Under installation	Pelton	68	0,65	1	655	385 kW	385 kW	Turbine
960	Chastelonnnette	France	Under installation	Pelton	194	0,45	1	735	730 kW	730 kW	Turbine
974-1	Cugir 1	Romania	2012	Pelton	111,15	1,018	1	700	928 kW	928 kW	Turnkey
974-2	Cugir 2	Romania	2012	Pelton	87,65	0,98	1	745	729 kW	729 kW	Turnkey
889	Nzoro 2	RDC	Under installation	Double Francis	58	4x11	4	920	5400 kW	21600 kW	Turnkey
962-1	Sesenge	RDC	Under Study	Francis	28,16	11	2	1380	2650 kW	5300 kW	Turnkey
962-2	Ambarau	RDC	Under installation	Kaplan	13,7	45	2	2900	5320 kW	10640 kW	Turnkey
962-3	Azambi	RDC	Under installation	Kaplan	11,03	53	2	2900	5047 kW	10094 kW	Turnkey
1041	Villebois	France	Under installation	Kaplan	8	20	1	2060	1200 kW	1200 kW	Refurbishment
1048	Daval	France	Under installation	Francis	20	1,5	1	600	250 kW	250 kW	Refurbishment
1063	Pasochoa	Ecuador	Under installation	Pelton	190,7	1,495	1	1200	2390 kW	2390 kW	Refurbishment
982	Neusberg	South Africa	Under installation	Kaplan	15,34	30	3	2500	4010 kW	12030 kW	Turnkey
1027	Ashgrove	Ireland	2013	Francis	15	2,5+3,5	2	830+940	250+350kW	600 kW	Refurbishment
1054	Laprade	France	Under installation	Kaplan	9	12	1	1600	850 kW	850 kW	Turnkey
1095	Peyrebrune	France	Under installation	Kaplan	13,7	4	1	940	>425kW	>425kW	Turnkey
1111	Dulom	India	Under installation	Pelton	280	0,104	2	450	200 kW	400 kW	Turnkey
1137	Yembung	India	Under installation	Francis	50	1,5	2	510	500 kW	1000 kW	Turnkey

HPP realized or designed more than 250 power stations throughout the world

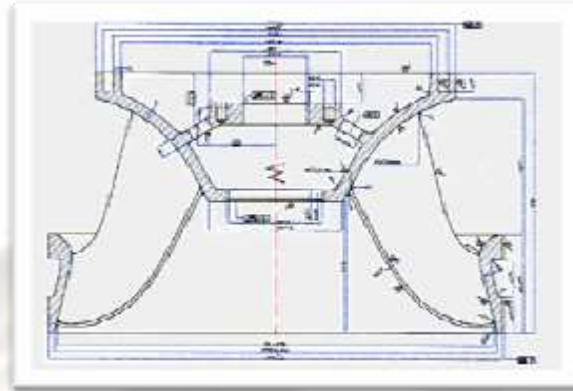
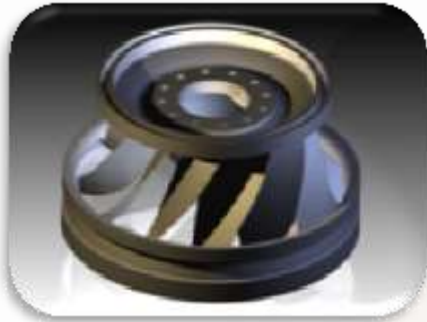


HPP : The Hydro Expert

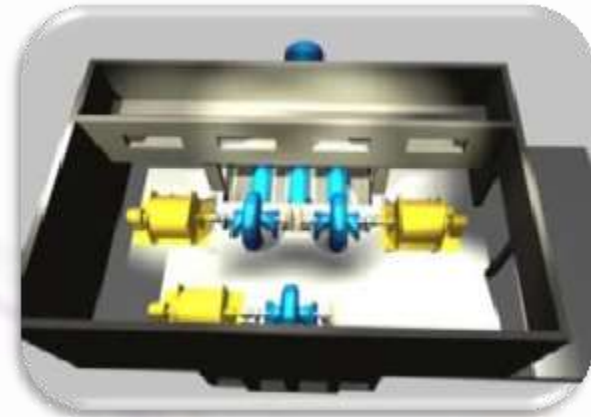
- More than 100 years of Hydro tradition
- A successful business story since 1972
- Patrice Pisterman is appointed as an adversarial expert in the French courts
- HPP know how is recognized among the hydro experts
- HPP provides also consulting services for :
 - Your existing equipment for improvement or refurbishment
 - Your potential site for feasibility
 - ***Any technical expertise for hydro up to 50 MW***



FRANCIS Expertise



TURBINE DESIGN PHASE



CIVIL WORKS DESIGN PHASE



COMMISIONNING

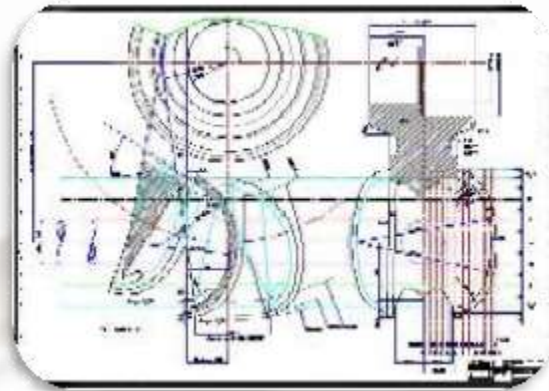


PLANT Installation FOLLOW UP



MANUFACTURING FOLLOW UP

PELTON Expertise



TURBINE DESIGN PHASE



CIVIL WORKS DESIGN PHASE



COMMISIONNING

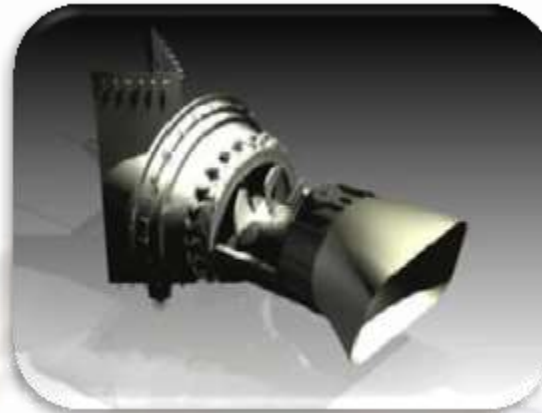
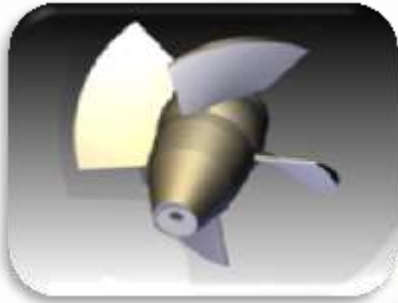


PLANT Installation FOLLOW UP



MANUFACTURING FOLLOW UP

KAPLAN Expertise



TURBINE DESIGN PHASE



CIVIL WORKS DESIGN PHASE



COMMISIONNING



PLANT Installation FOLLOW UP



MANUFACTURING FOLLOW UP

HPP capabilities

Site
Appraisal

Plant
Concept

Civil Works
appraisal

Turbine
design

Electrical
and control
design

Equipment
Supply

Installation
supervision

HPP deliverables

Feasibility
study

Most
relevant
site
concept

Civil Works
general
drawings

Detailed
drawings

Electrical
schemes
Control
Software

Manufactu
ring follow
up

Permanent
technical
Assistance

NZORO 2 project (DRC)

From site appraisal to commissioning

Double Francis
Runner diameter = 920mm
Net head = 58m
Discharge = 4 x 11m ³ /s
Capacity = 4 x 5400 kW
UNDER INSTALLATION
Order: 07/2011 All equipments at site: 10 to 12/2012 Commissioning: 04/2013

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NZORO 2 project – Identification

HPP CONCEPT



NZORO 2 project – Cost savings and project improvement.

	Initial Study	HPP
Gross Head	51,1 m	62m
Net Head	49 m	58-59m
Design Discharge	48,3 m ³ /s	44 m ³ /s
Net Electrical Power (at station)	19,85 MW	22,12 MW
Canal Length	5900 m	4100 m
Penstock Length	1800 m	1182 m
Direct Cost Investment	39,4 m\$	34,6 m\$
Cost / KW	1985 \$ / kW	1560 \$ / KW

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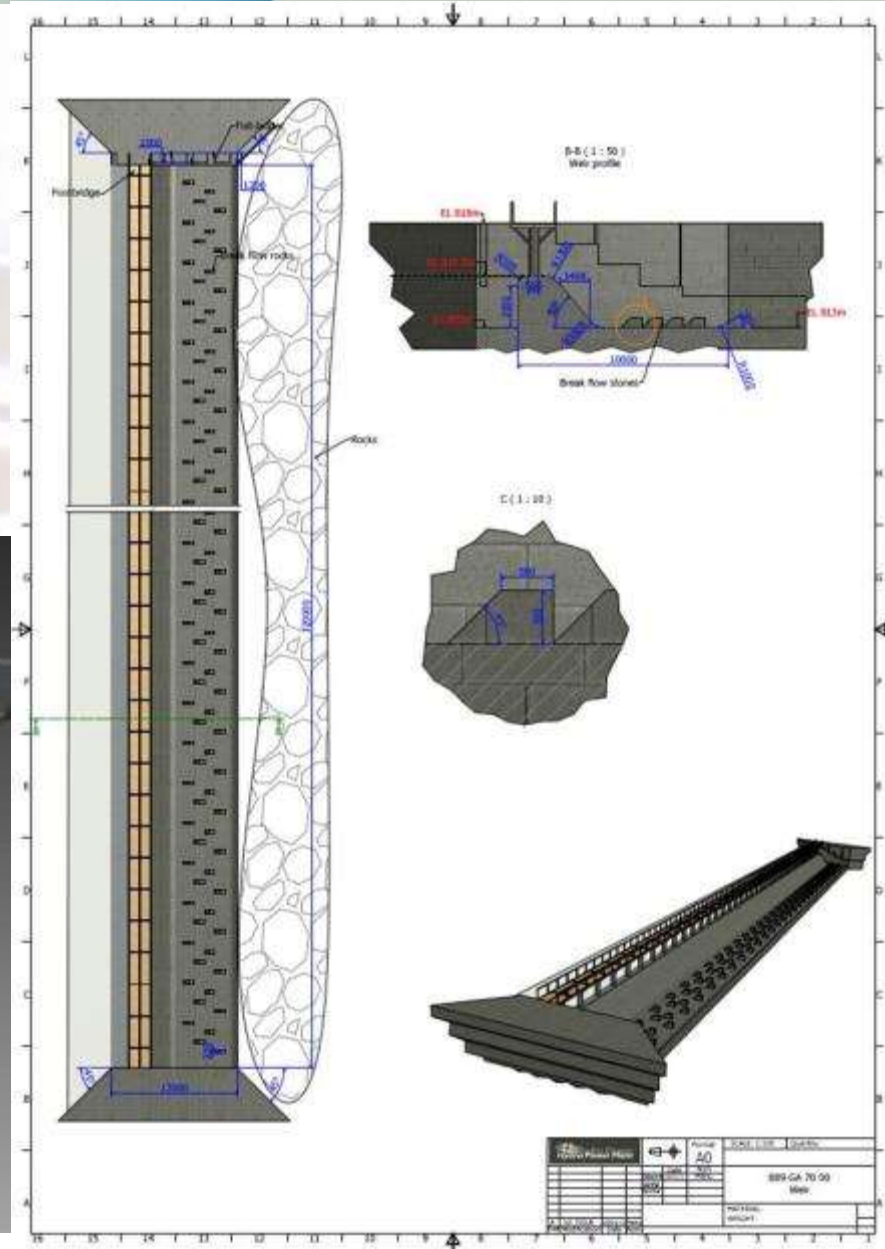
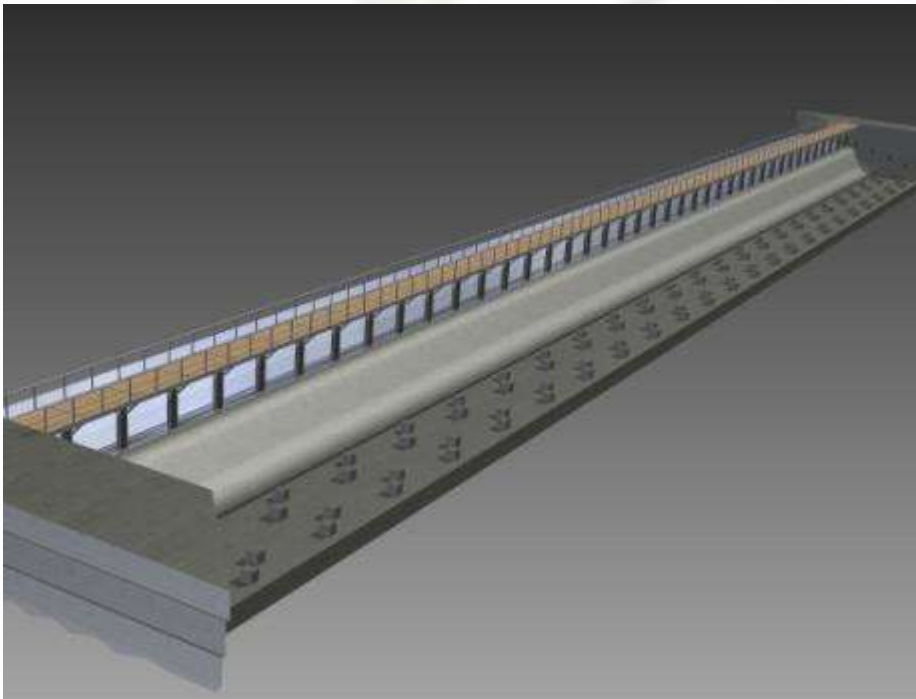
NZORO 2 project – Site survey



NZORO 2 project - Design

WEIR WITH FISH LADDER

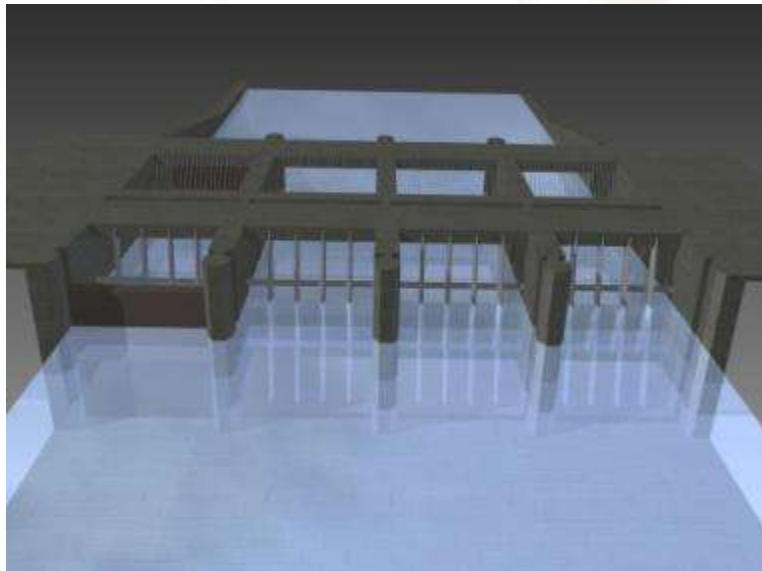
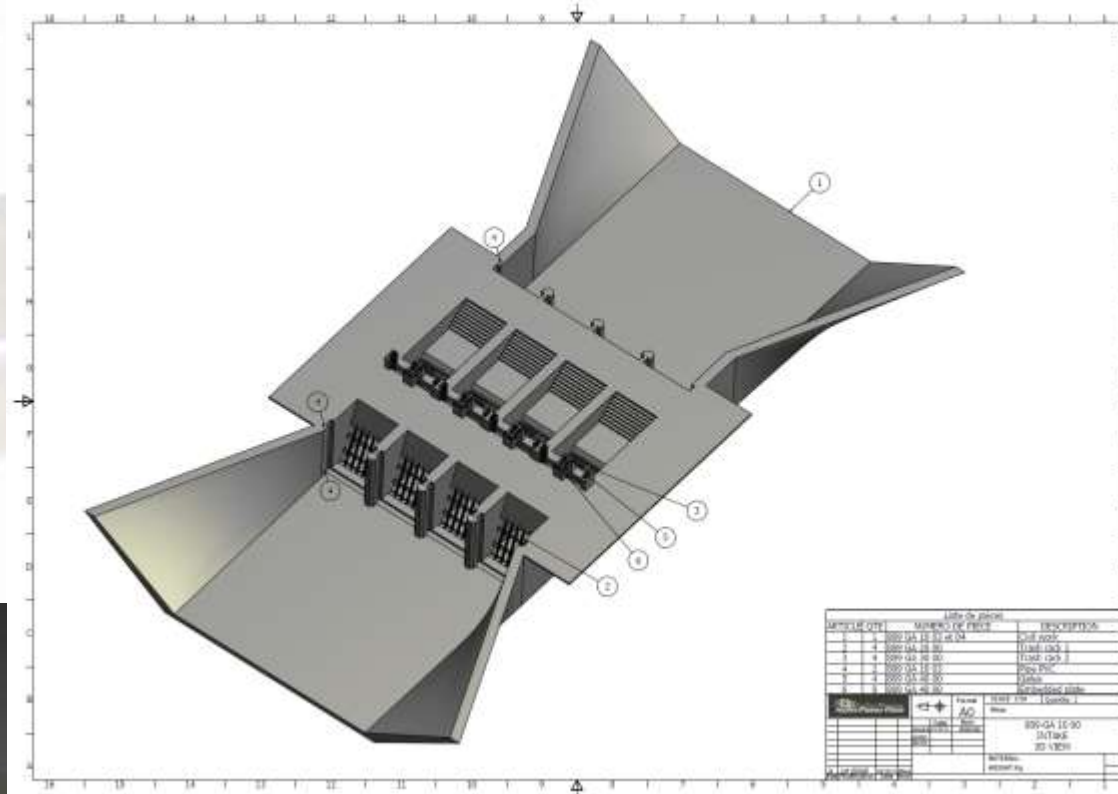
Maximum discharge capacity 1000m³/s



NZORO 2 project - Design

INTAKE

- Vertical guillotine gates
- Double pre-trash rack system
- 4 channels
- Full discharge guaranteed with 3 channels



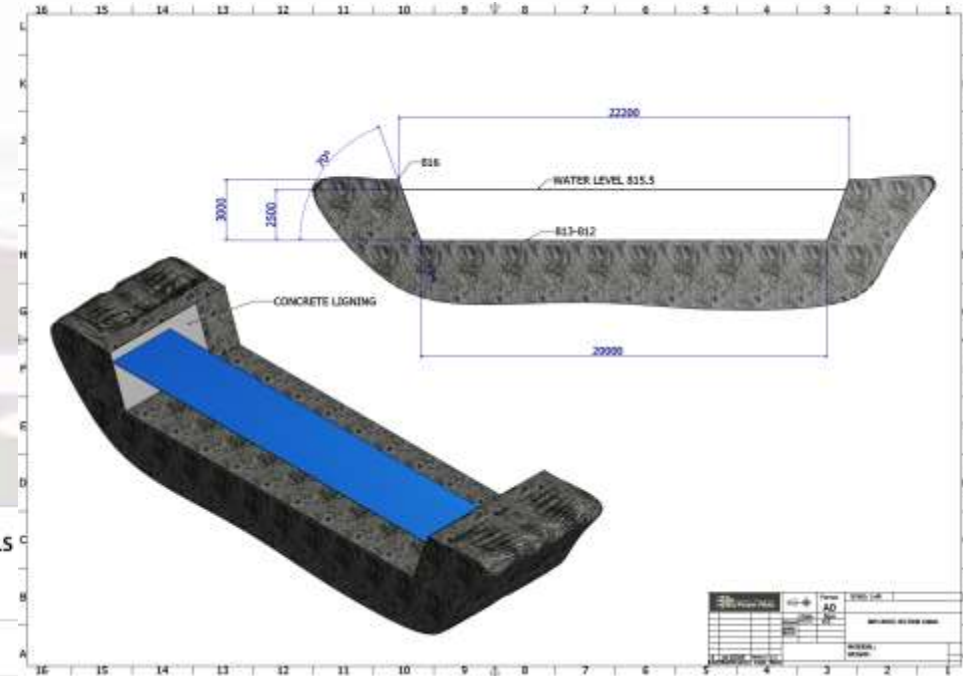
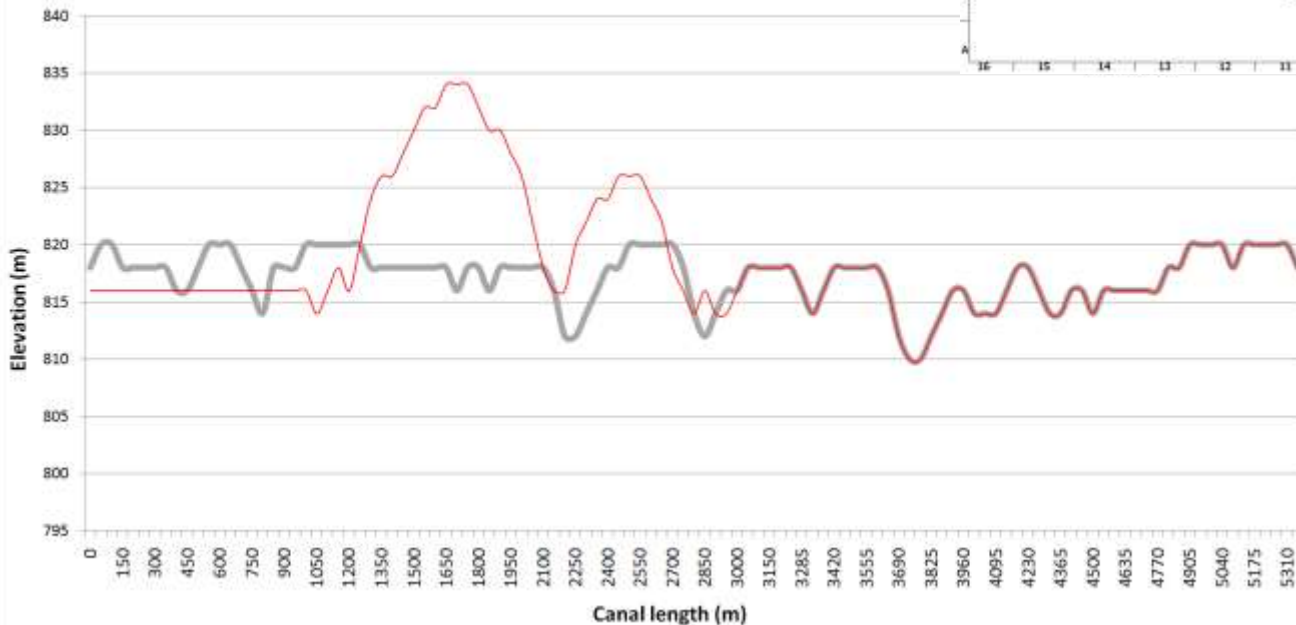
NZORO 2 project - Design

CANAL

Course and section study

- Length 4100m
- Discharge 44m³/s
- Bottom width 20m

VARIATION OF ELEVATION ALONG THE CANALS



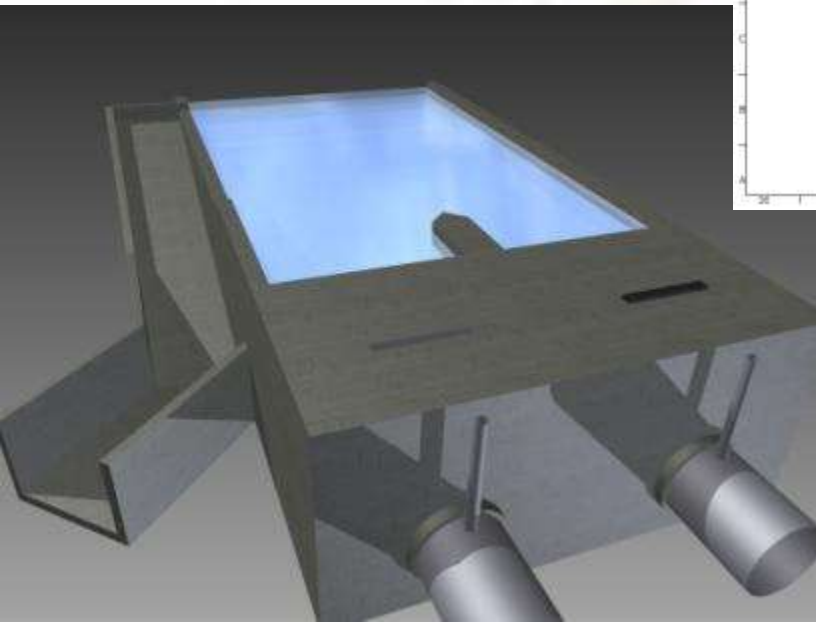
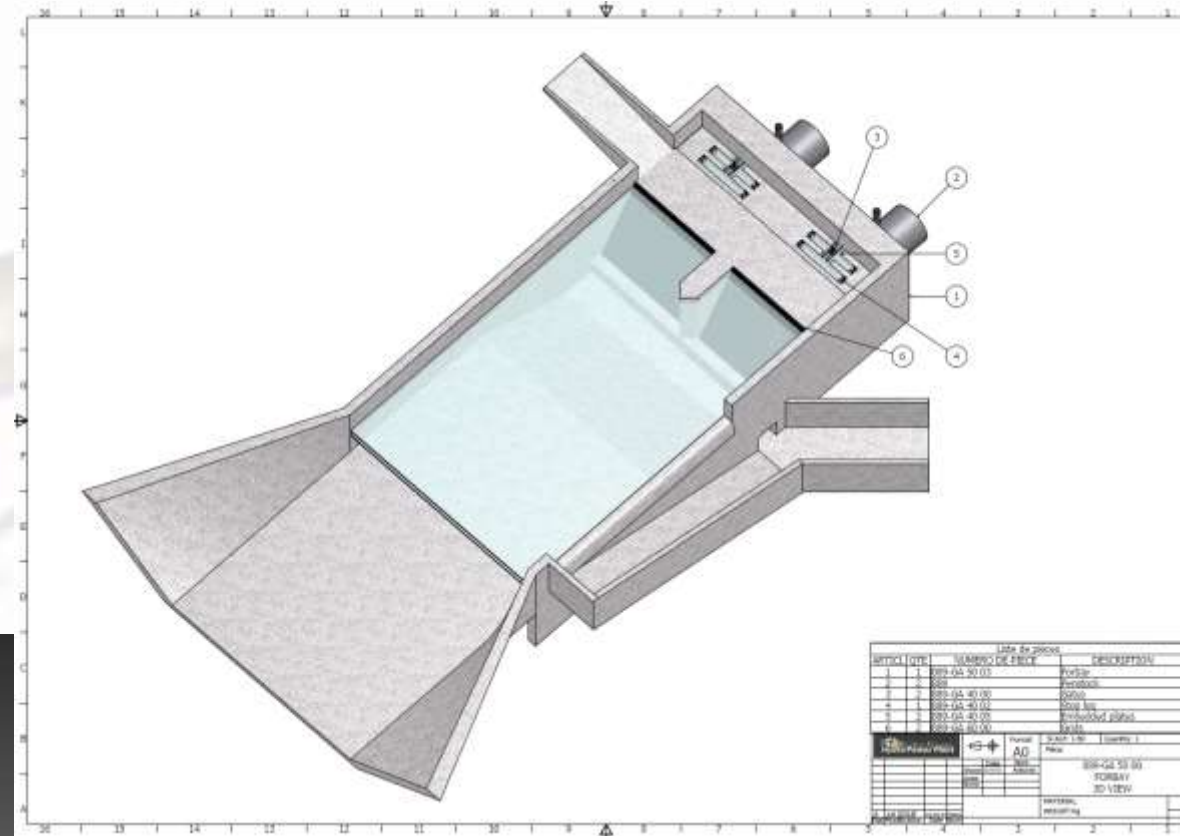
NZORO 2 project - Design

FOREBAY

Sand trap and de-sandification gate

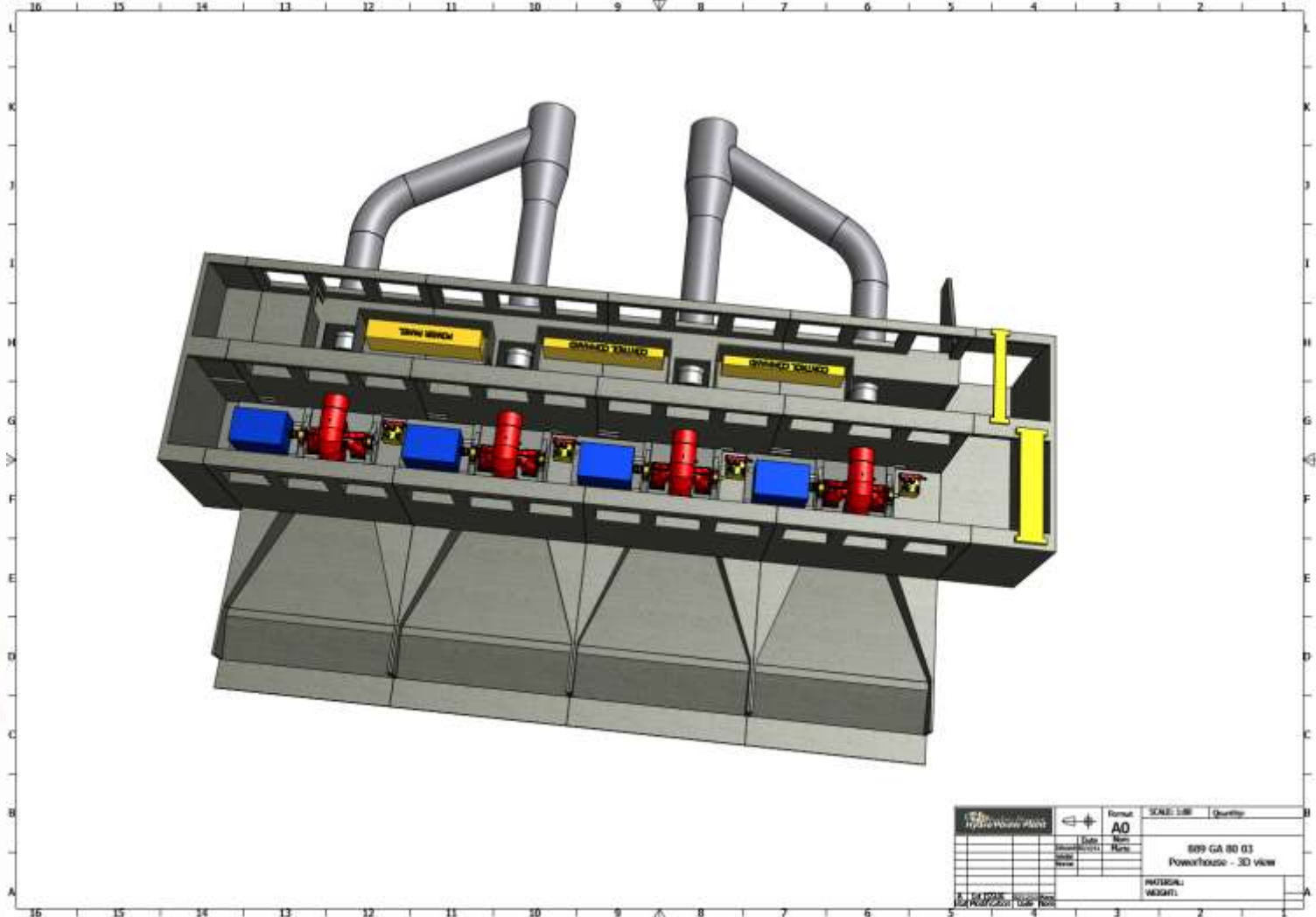
Penstocks :

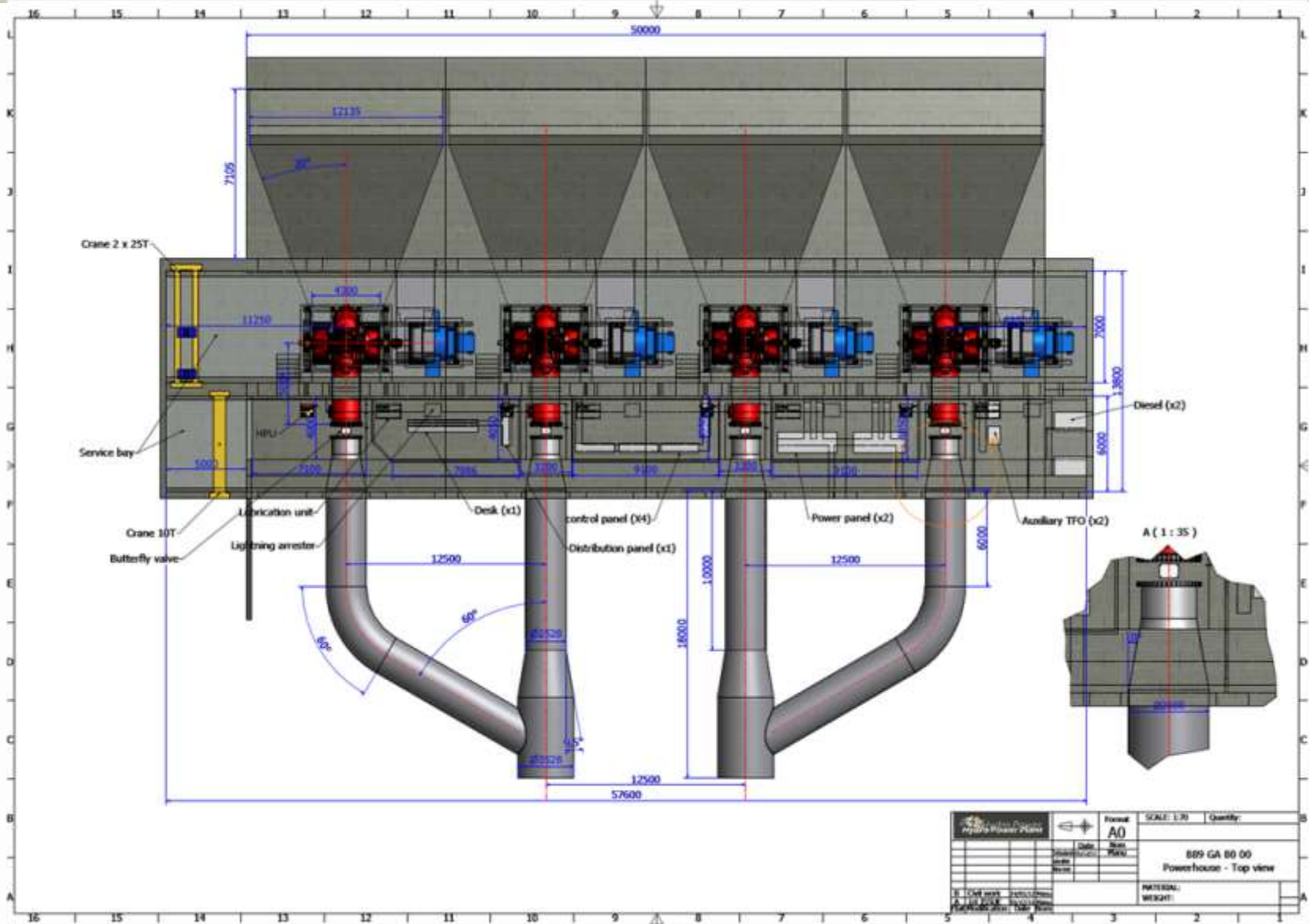
- Diameter 2 x 3500mm
- Thickness 12mm
- Length 1200m



NZORO 2 project – Design

POWER HOUSE





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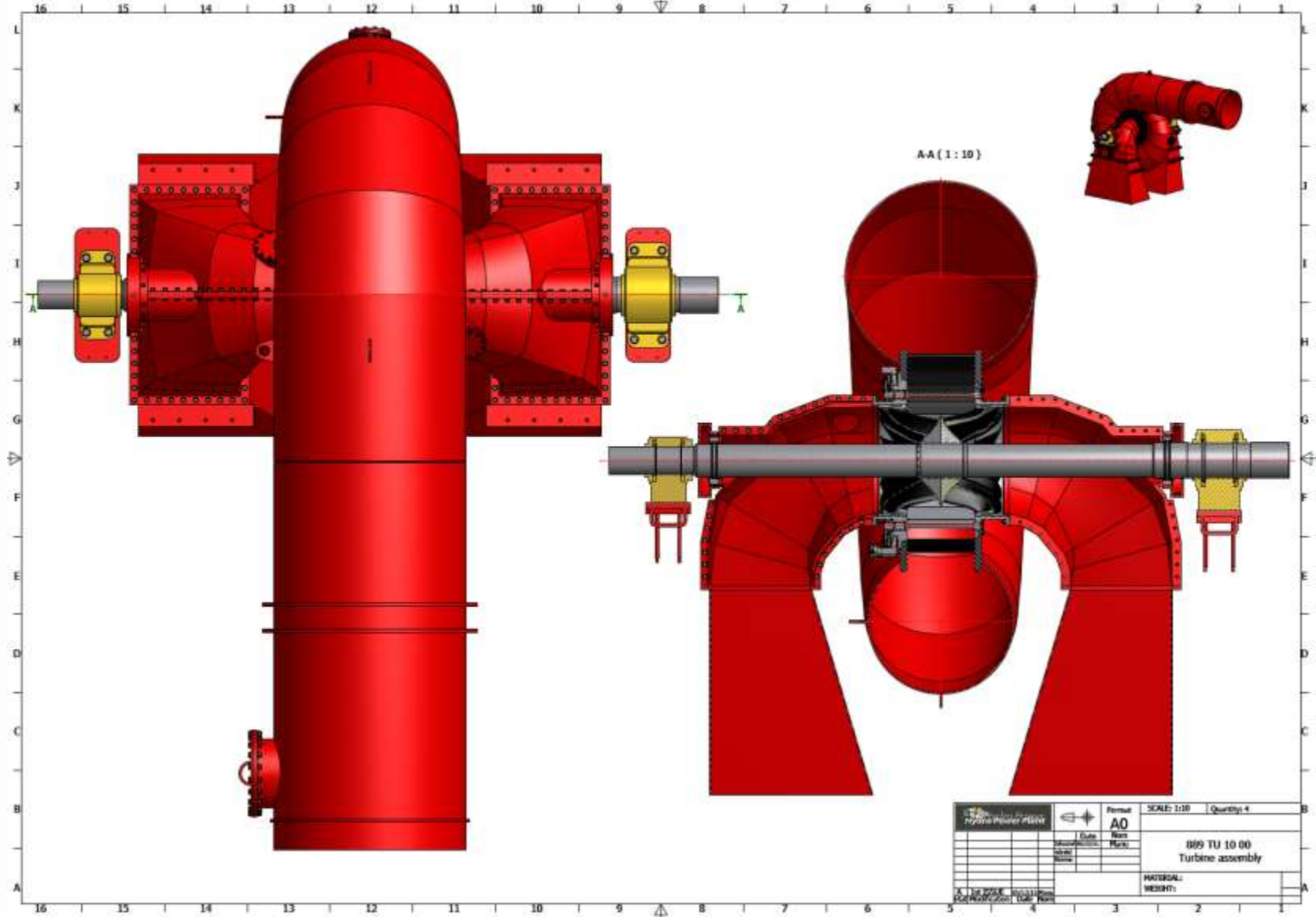
Detailed
drawings

Electrical
schemes
Control
Software

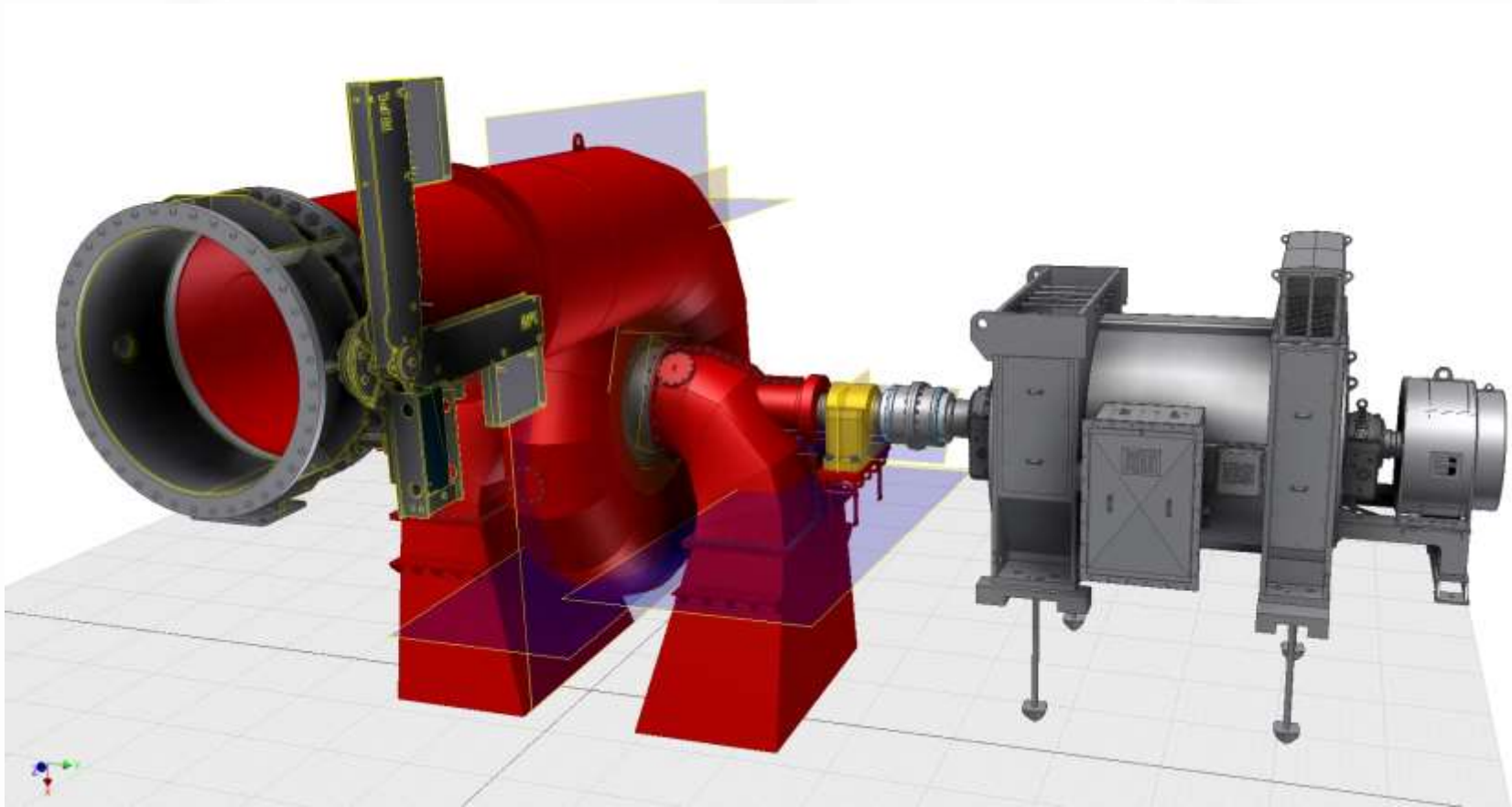
Manufactu
ring follow
up

Permanent
technical
Assistance

NZORO 2 project – Design – TURBINE ASSEMBLY



DOUBLE FRANCIS TURBINE



HPP capabilities

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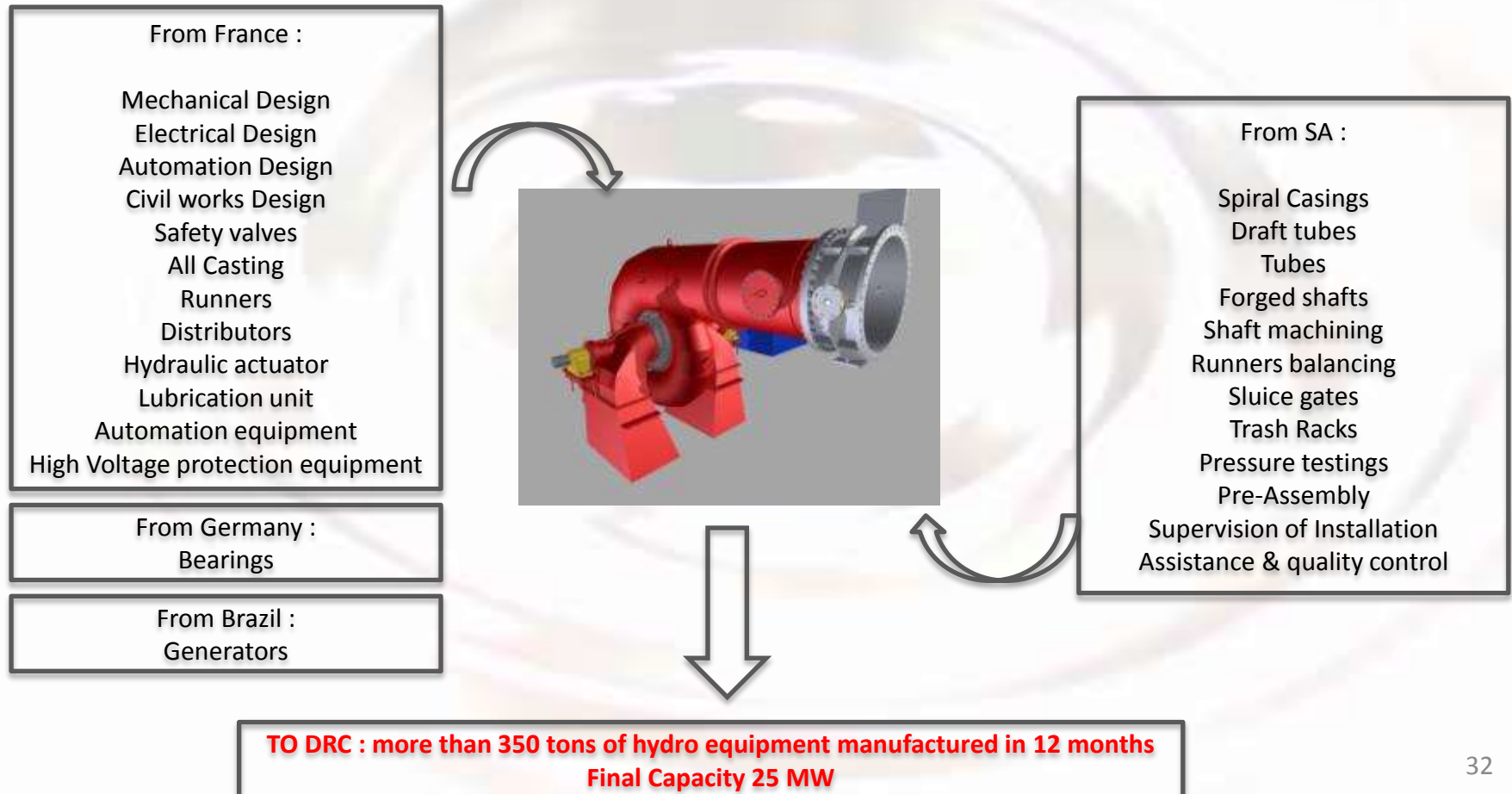
Electrical
schemes
Control
Software

Manufactu
ring follow
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Permanent
technical
Assistance

General Procurement structure :

- All sensitive or security equipment are coming from France
- All big « boilmaker » parts are done in South Africa (parts hard to transport)
- Generators from West Europe or Brazil



NZORO 2 project – Suppliers

Design



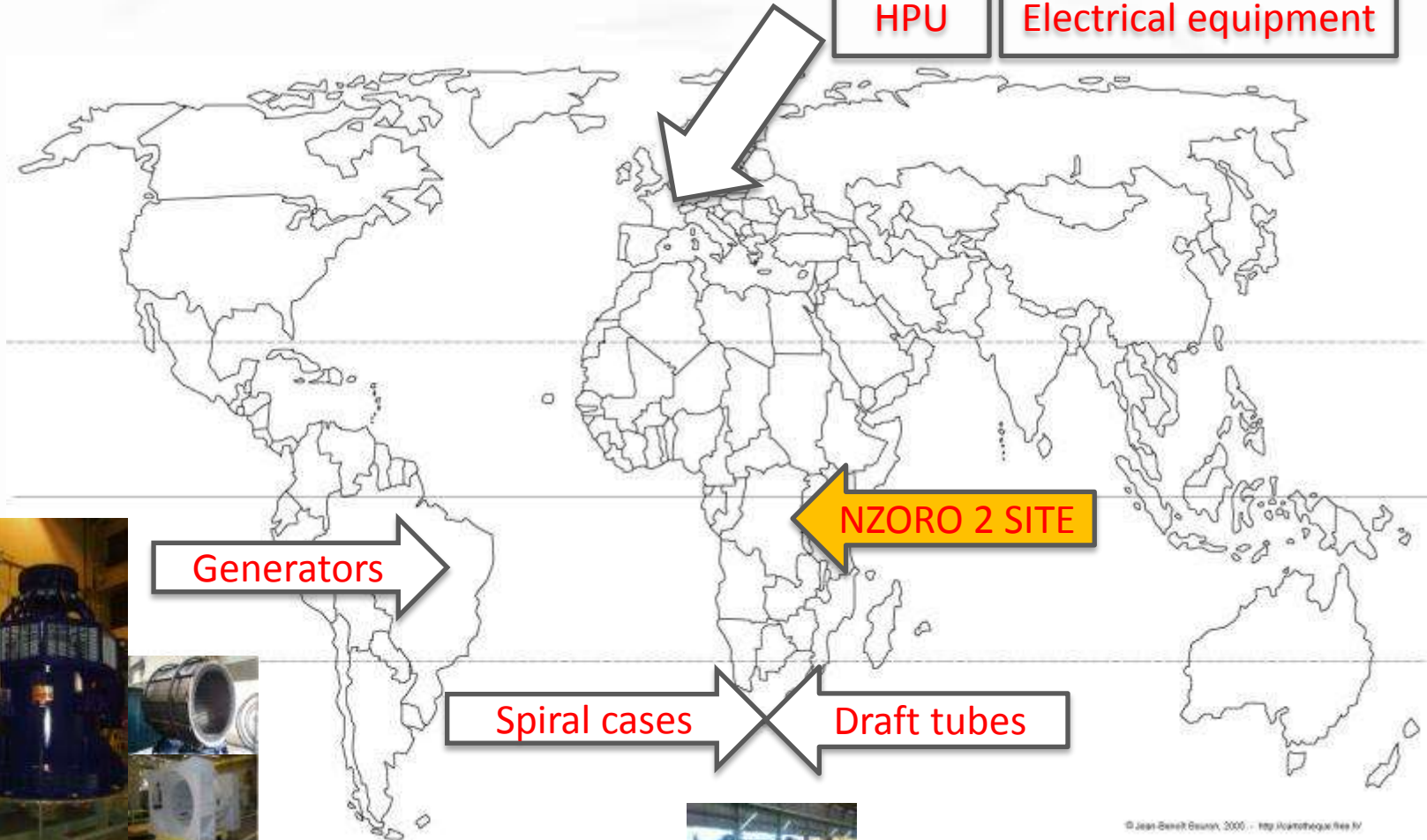
Runners



Distributors

HPU

Electrical equipment



Generators

NZORO 2 SITE

Spiral cases

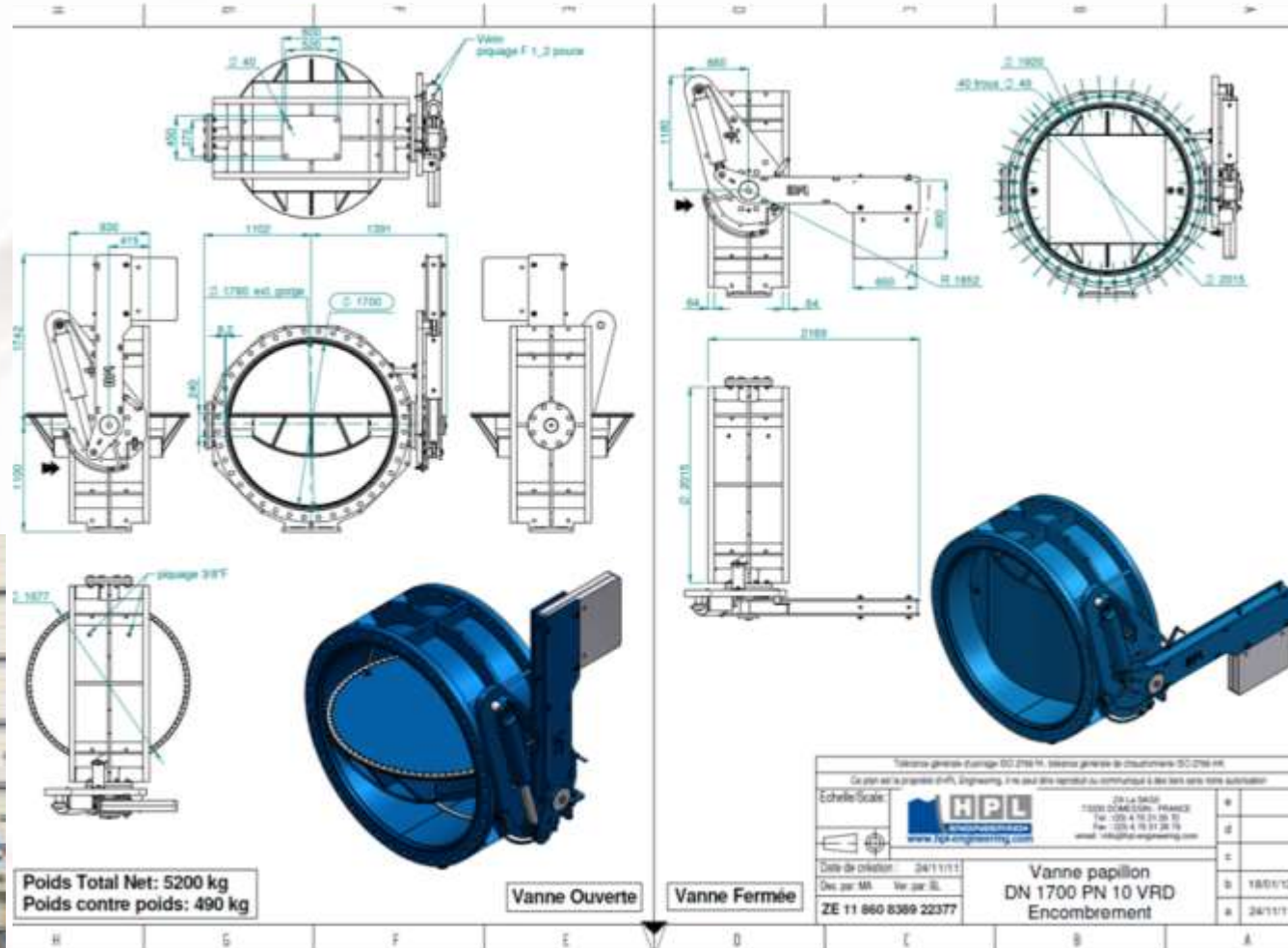
Draft tubes



NZORO 2 project – Manufacture

BUTTERFLY VALVE

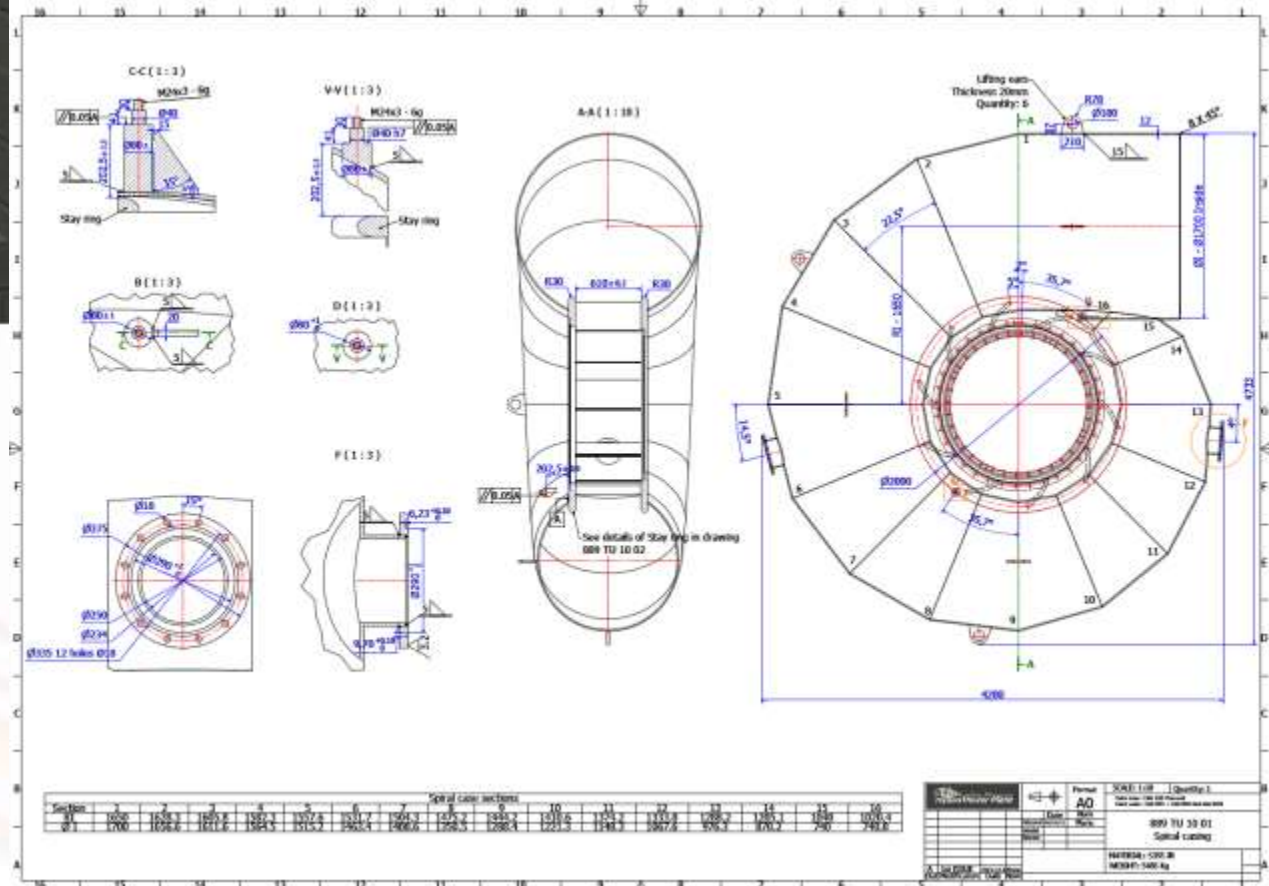
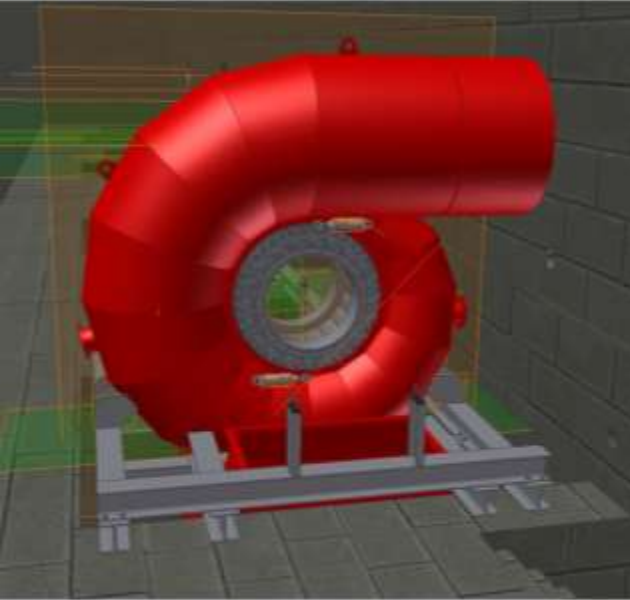
- Diameter 1700mm
- Pressure class 10
- Quantity 4



NZORO 2 project – Manufacture - **DISTRIBUTORS**



NZORO 2 project – Manufacture – SPIRAL CASES



NZORO 2 project – Manufacture – **SPIRAL CASES**



NZORO 2 project – Manufacture – **SPIRAL CASES**



NZORO 2 project – Manufacture – **DRAFT TUBES**



NZORO 2 project – Manufacture – **SHAFTS AND BEARINGS**



NZORO 2 project – Manufacture – **SHAFTS AND BEARINGS**



NZORO 2 project – FINAL ASSEMBLY AND TESTS



NZORO 2 project – FINAL ASSEMBLY AND TESTS



NZORO 2 project – Manufacture - **GENERATORS**



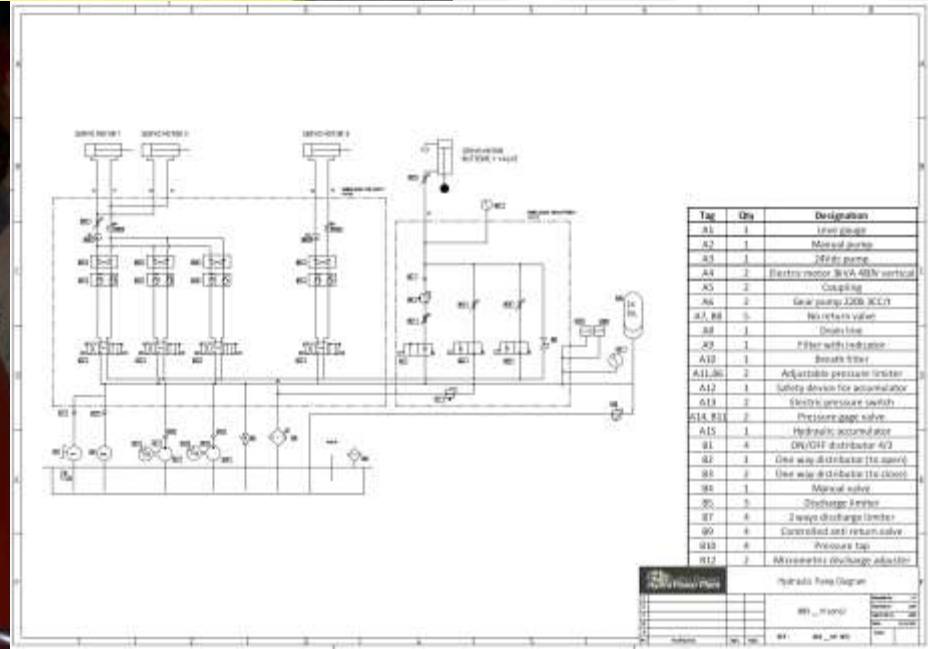
NZORO 2 project – Manufacture - **GENERATORS**



NZORO 2 Project – Manufacture – LUBRICATION UNITS



NZORO 2 project – Manufacture - HYDRAULIC POWER PACKS



HPP capabilities

Site
Appraisal

Plant
Concept

Civil Works
appraisal

Turbine
design

Electrical
and control
design

Equipment
Supply

Installation
supervision

HPP deliverables

Feasibility
study

Most
relevant
site
concept

Civil Works
general
drawings

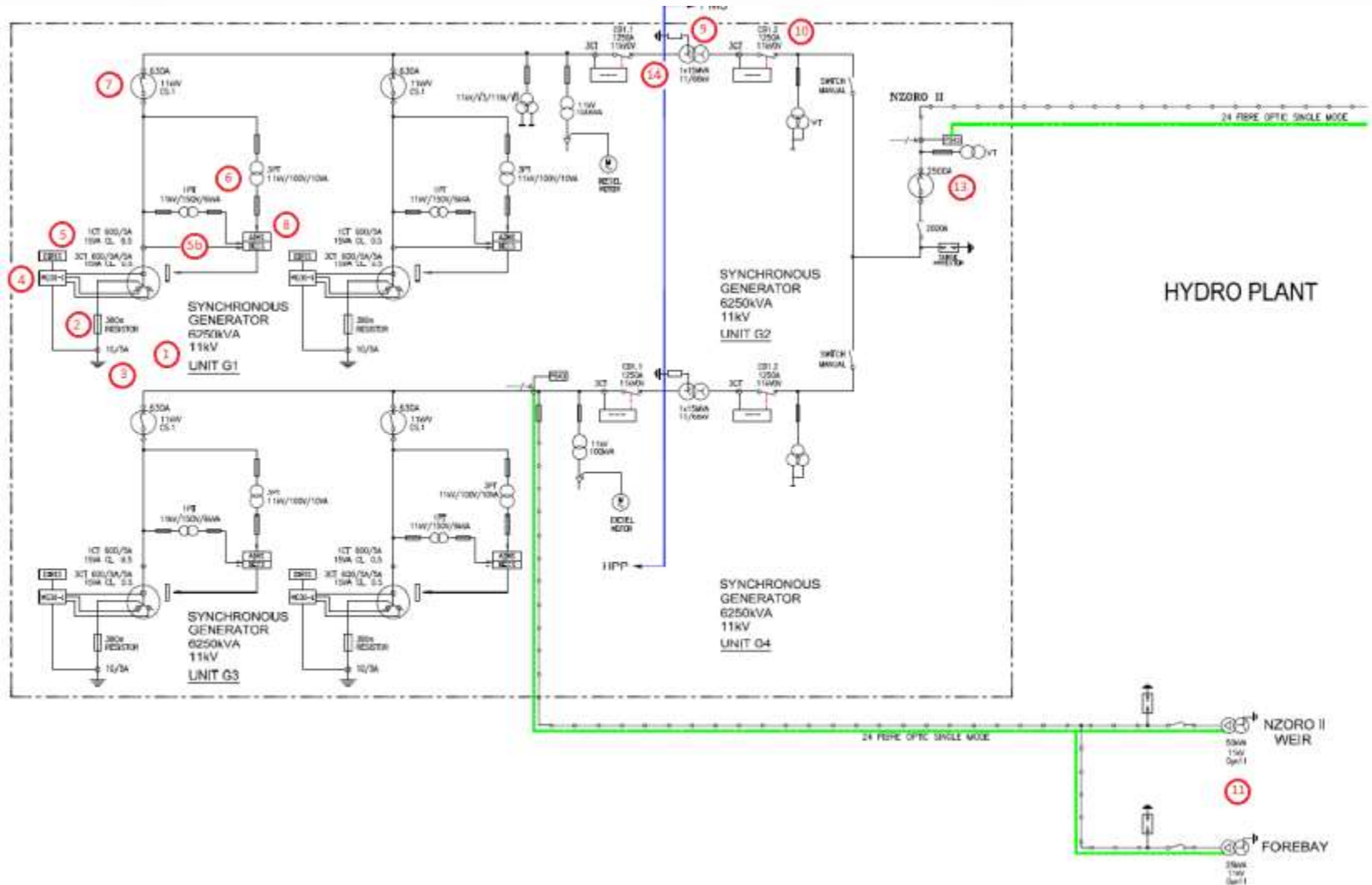
Detailed
drawings

Electrical
schemes
Control
Software

Manufactu
ring follow
up

Permanent
technical
Assistance

NZORO 2 project – Electrical studies



NZORO 2 project – Manufacture – **CONTROL AND POWER PANELS**



NZORO 2 project – Manufacture – **LIGHTNING ARRESTER PANELS**



NZORO 2 project – Manufacture – **CONTROL DESKS**



NZORO 2 project – Manufacture – **AUXILIARY TRANSFORMERS DISTRIBUTION PANEL**



HPP capabilities

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Control
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Manufactu
ring follow
up

Permanent
technical
Assistance

NZORO project – Installation

- Local teams
- HPP assistance



MADAGASCAR project – Installation



•Capacity :	6 MW
•Total project cost:	8 M€

NZORO 2 project – Installation



NZORO 2 project – Installation



NZORO 2 project – Installation



Commissioning





On going projects

Country	Turbine	Capacity
France	Vertical Kaplan	425kW
France	Vertical Kaplan	850kW
South Africa	Horizontal Kaplan	3 x 4010kW
Ecuador	Horizontal Pelton	2390kW
RDC	Horizontal Kaplan	2 x 5320kW
RDC	Horizontal Kaplan	2 x 5047kW
RDC	Double Francis	4 x 5400kW
Turkey	Horizontal Pelton	726kW
Romania	Horizontal Francis	926kW
India	Horizontal Francis	2 x 500kW
India	Horizontal Pelton	2 x 200kW



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