Technology Transfer

for local production of electro-mechanical equipment

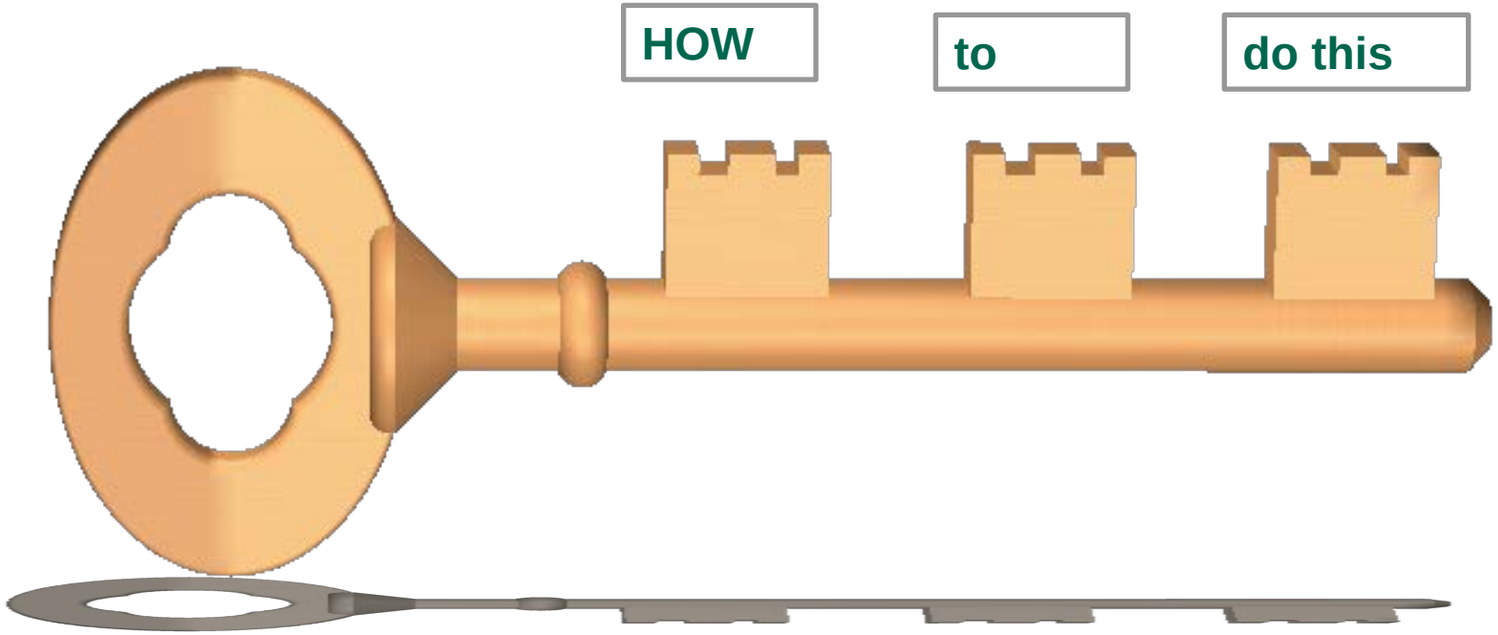
Case studies of technically and commercially viable mini hydro development in Indonesia and dissemination of achievements



MHP Technology Supporting Rural Development



Hydro Power Technology Transfer



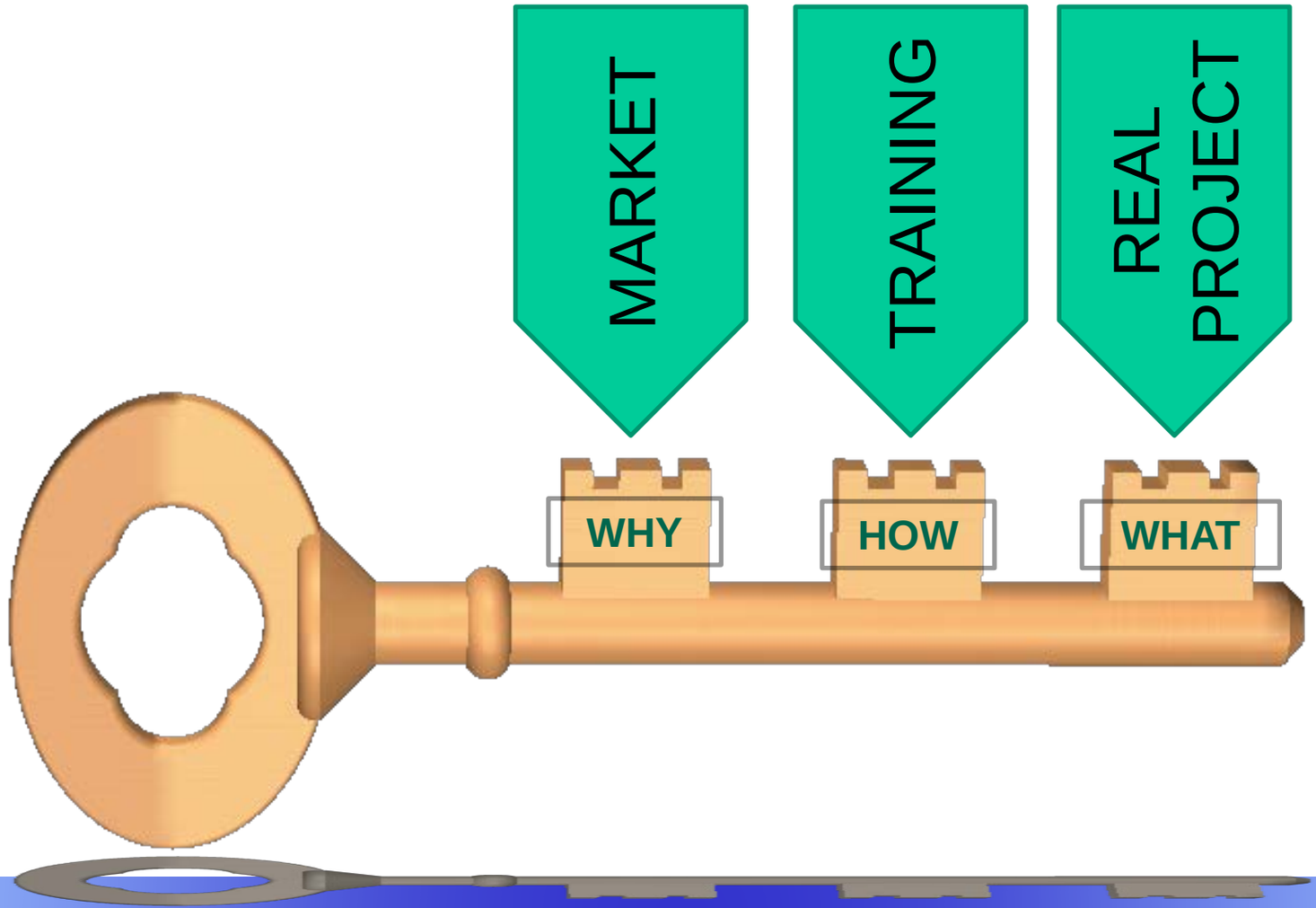
Bottom up approach of building up MHP Capacity in the private sector

Technology Transfer

Successful technology transfer requires a sustained input to achieve tangible impacts

Learning by doing

The key for the sustainable introduction of a technology is:



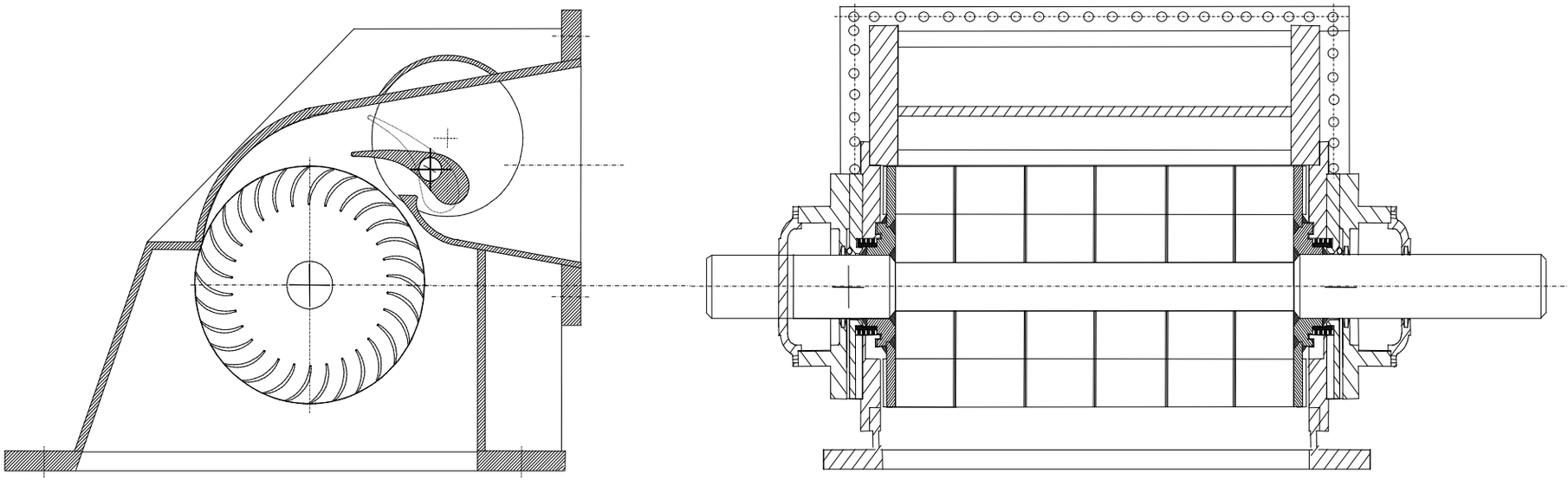
Technology Transfer: Activities in Indonesia

Activities:

1. **Turbine** technology transfer (Cross flow, propeller,….) in design, manufacturing, installation & commissioning
2. Development and introduction of standardized **civil** structure designs
3. Development of **Control** Technology (DTC, ELC, IGC…)
4. Various appropriate technology for **productive end-use** activities
5. **Institutional aspects**


Cross Flow Turbine Manufacturing
Enhancing local content in the Mini Hydro Sector

Cross-flow turbine entec T-15



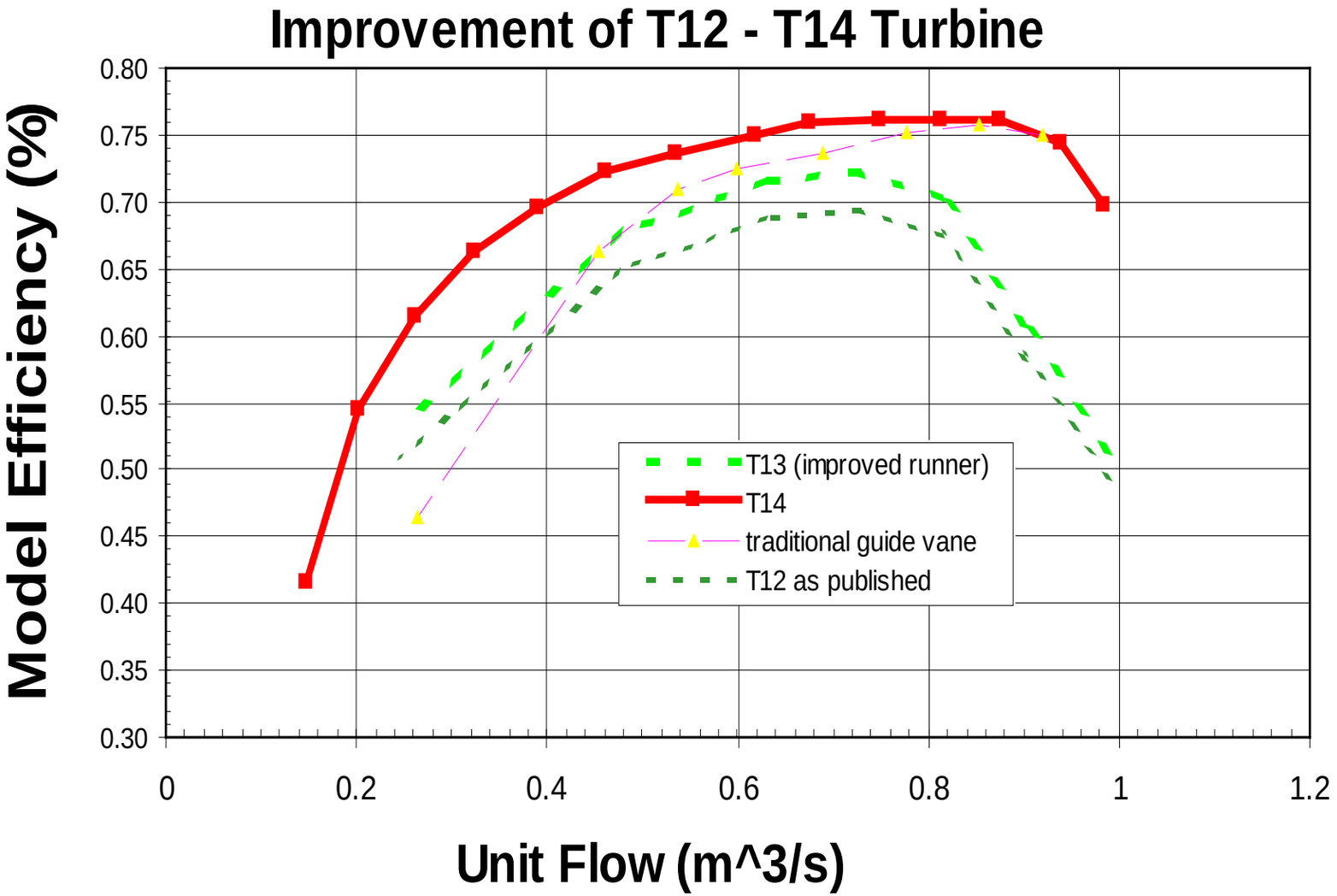
- T3, T8 and T12 turbines were developed, tested and built in Indonesia, Nepal, Thailand, Argentina and other countries.
- The T-15 is the latest in the range and has very high efficiency, reliability & performance characteristics.
- The T15 represents the culmination of efforts in cross flow turbine development from GTZ, ENTEC AG and the Institute fuer Stroemungsmechanik und Hydraulische Maschinen, University of Stuttgart and a number of local manufacturers in Indonesia.

Research Work

- The new **hydraulic profile** of the runner and guide vane made a full re-design of the T12 Turbine necessary.
- It was decided 1998 to introduce an improved turbine design (**T-14**) as a component of the MHPP Project.
- The **T-14** design was improved analysing the feedback from the field and is now known as **T-15 crossFlow Turbine**.

Performance of T-14 / T-15

- improved Peak and Part load efficiency
- Part load efficiency is better than the traditional design



Technology Transfer 2000 - 2004

Turbines can now be produced locally covering a wide range of sizes suitable for a variety of projects (stand alone, captive, grid connected)

Standard Crossflow Turbine T14/15-300

Output range 5-150kW

Applications:

- Village electrification
- Industrial power supply
- Grid-connection

Seloliman 30kW village electrification

DEWATA tea plantation (captive power)

2x125kW

replacing 330,000 ltr Diesel fuel and 1000 ton of CO2 per Year

Cost versus Quality

Cost versus Quality

Everything is possible and better than nothing

What is cheap?

75W incandescent bulb

0,5 US$

10W(=75W) LED bulb

6.9 USD

Reliable and up to date technology looks expensive, but is in reality cheap

		Glow bulb (incandescent bulb)	LED lamp
watt (effective)		75	10
livetime	h	2,000	15,000
buying costs	**USD**	**0.5**	**6.9**
replacement cost	15000 h	3.8	-
electricity cost	10cent/kwh	112.5	15
real costs		117	22
cost saving 15 years (USD)			**95**

“ We are too poor to buy cheap shoes “

BUT

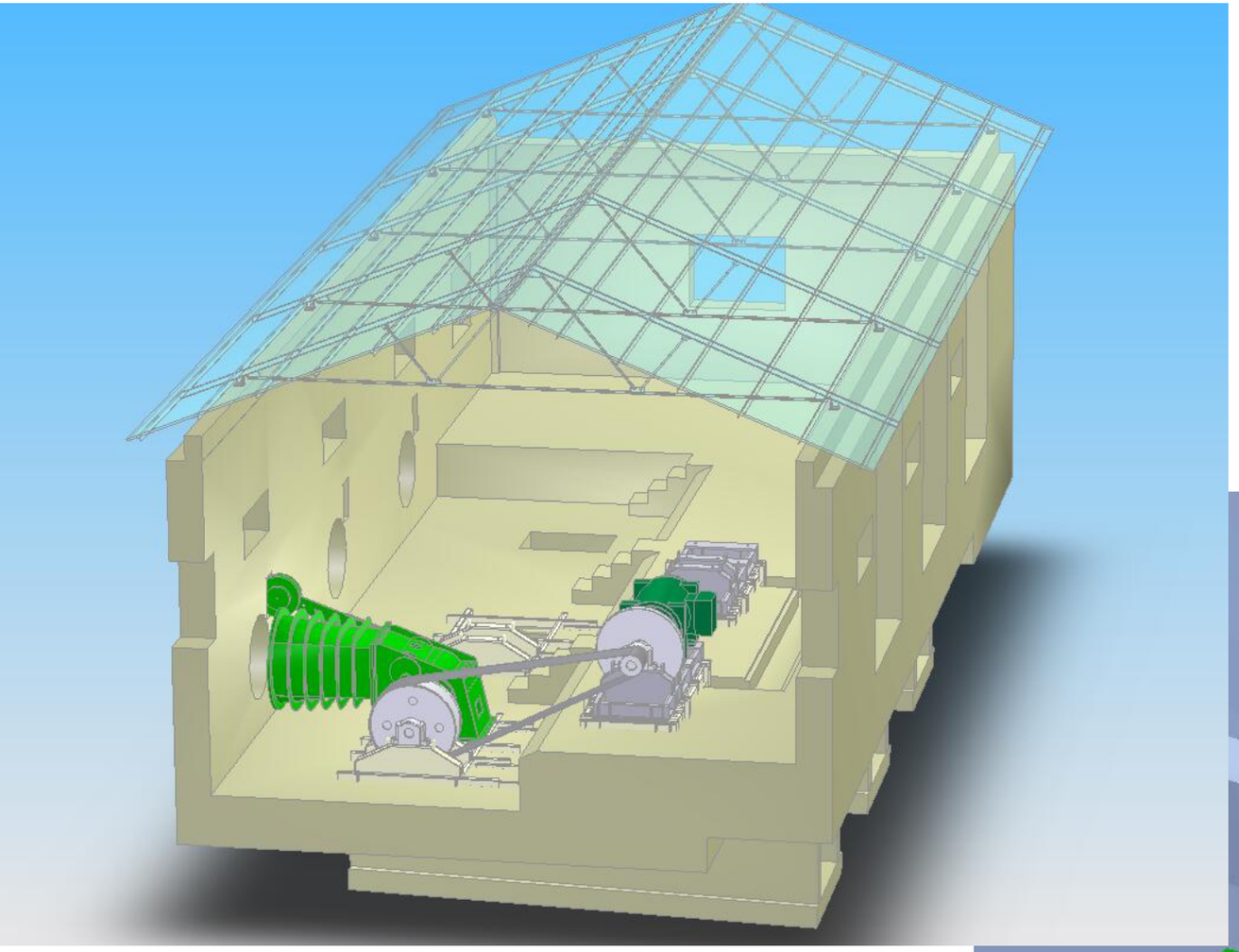
"The most expensive shoe must not be the best"

Technology Transfer must improve Quality!

In 2002 a 2 x 125 kW MHP was commissioned featuring 2 x T-14 turbines with 300mm runner diameters

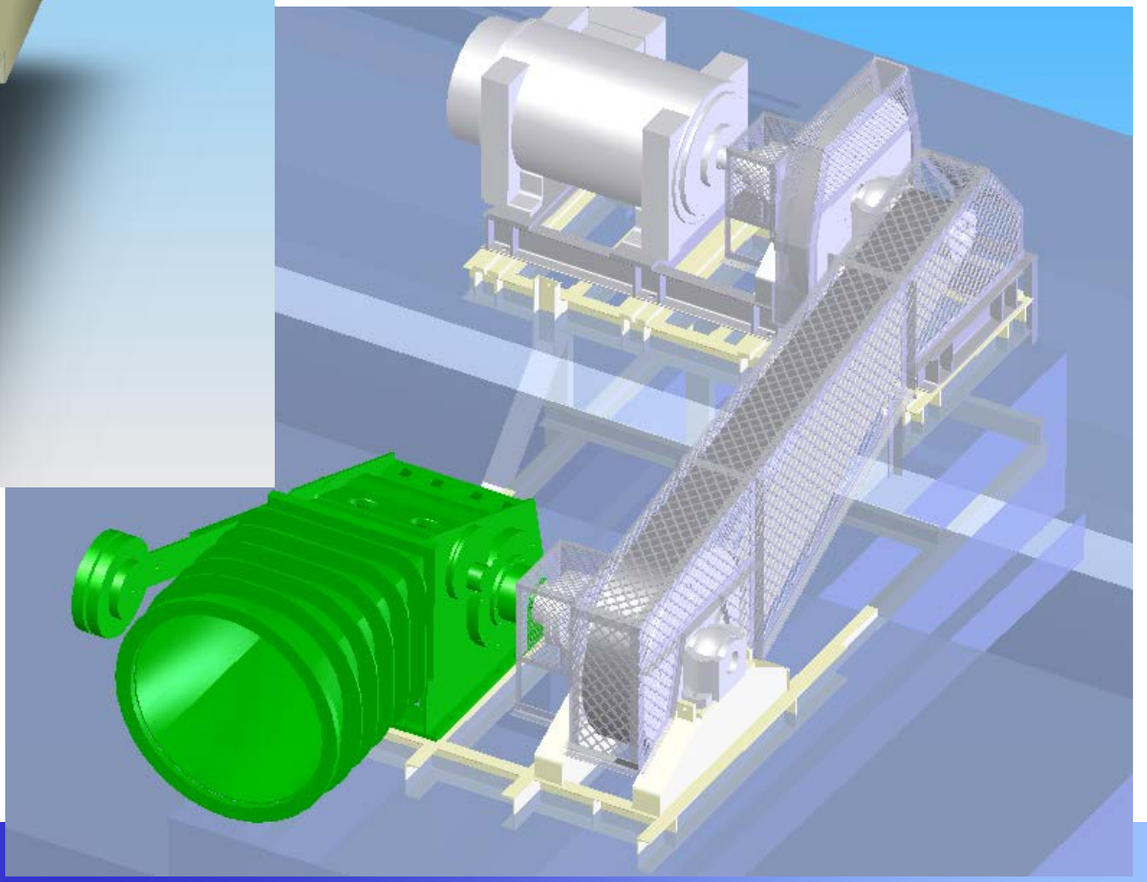
In 2005 the first locally manufactured T-15 Cross Flow turbine with a runner diameter of 500mm was commissioned selling power to the grid

Hydro Power Technology Transfer



We can do it- taking entrepreneurial risk

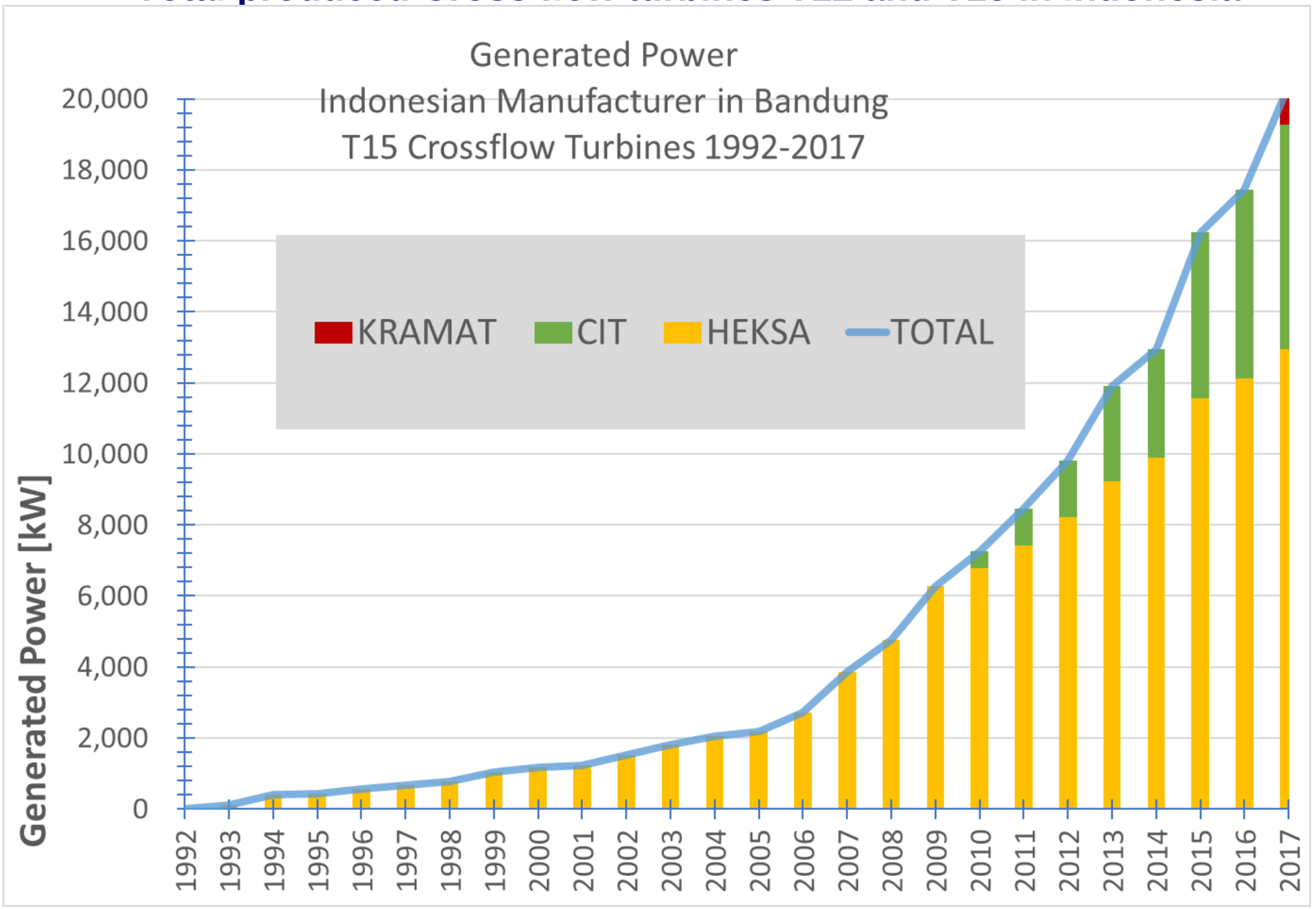
3xT-15_500 with 240kW each in Kyrgyzstan



Hydro Power Technology Transfer

Hydro Power Technology Transfer

Total produced Cross flow turbines T12 and T15 in Indonesia



Summary produced turbines as direct result of technology transfer program 1991-2018

Turbine type	Quantity	installed Capacity	
Produced Cross flow turbines T12	70	1,750	MW
Produced Cross flow turbines T14/T15	377	19,500	MW
Produced T15 (license out of Indonesia)	250	15,000	MW
local designes Sumatra+Sulawesi	300	7,500	MW
Produced Pelton turbines	20	1,670	MW
Propeller	101	4,400	MW
Total Turbines produced 1991-2018	1,118	49,820	MW

E&m equipment is exported to other countries like:

England, Swiss, Germany, Philippines, Nepal, Madagascar, Ethiopia, Uganda, Tanzania, Papua New Guinea, Cameroon, Zaire, Kyrgystan , Mozambique, Congo, Nigeria, Turkey, Thailand, South Africa etc.

Controllers

Beside turbines as well controllers are produced in Bandung. The 2 leading manufacturers produced until 2018

Renerconsys

- 1040 controllers controlling around 40MW

PME

- 700 controllers controlling around 10MW

Others

- (no data available)

T15 Cross Flow Turbines licences are issued in:

- Indonesia
- Nepal
- India
- Afghanistan
- Kyrgyzstan
- Pakistan
- Turkey
- Switzerland
- Ethiopia
- Nigeria
- Tanzania

Exchange of MHP know how and turbine manufacturer training 2008 (Ethiopia)

Hydro Power Technology Transfer

Achievements:

3 T15 sites installed

„new ideas“ for low cost turbines up to 25kW

upcomming 30 MHP projects 2018

2010 Pakistan MHP training

Achievements:

local manufacturing established for MHP smaller 200kW2

2 manufacturers produced about 250 T15 turbines with aprox.17MW installed power

T15 Production at HYDROLINK

T15 Production at Muchtiar Engineering

2010 Nigeria MHP training

2010 Nigeria MHP training

Tanzania Cross flow turbine training 2015 UNIDO

UNIDO Tanzania 2017: Implementation 60kW

Pico Crossflow Turbine T14-150

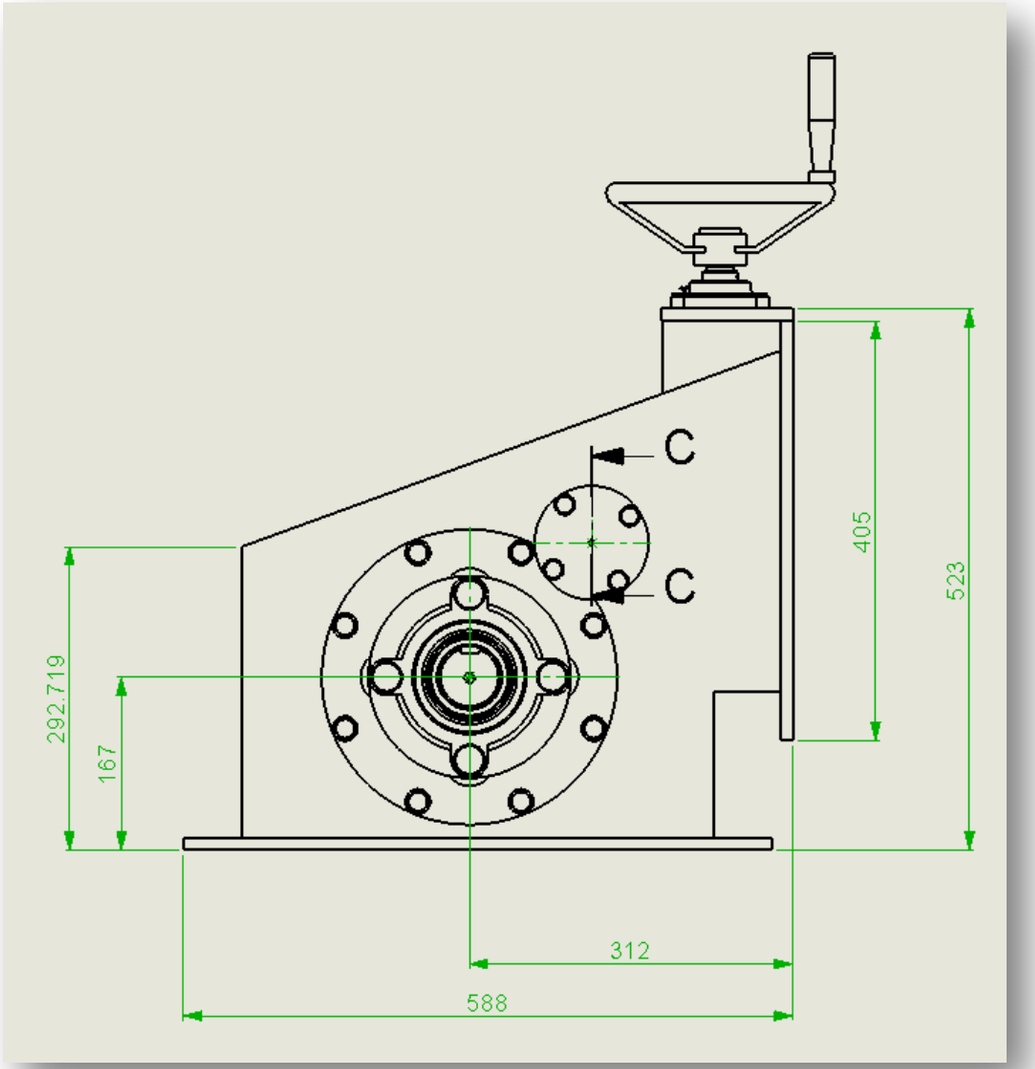
Compact Unit

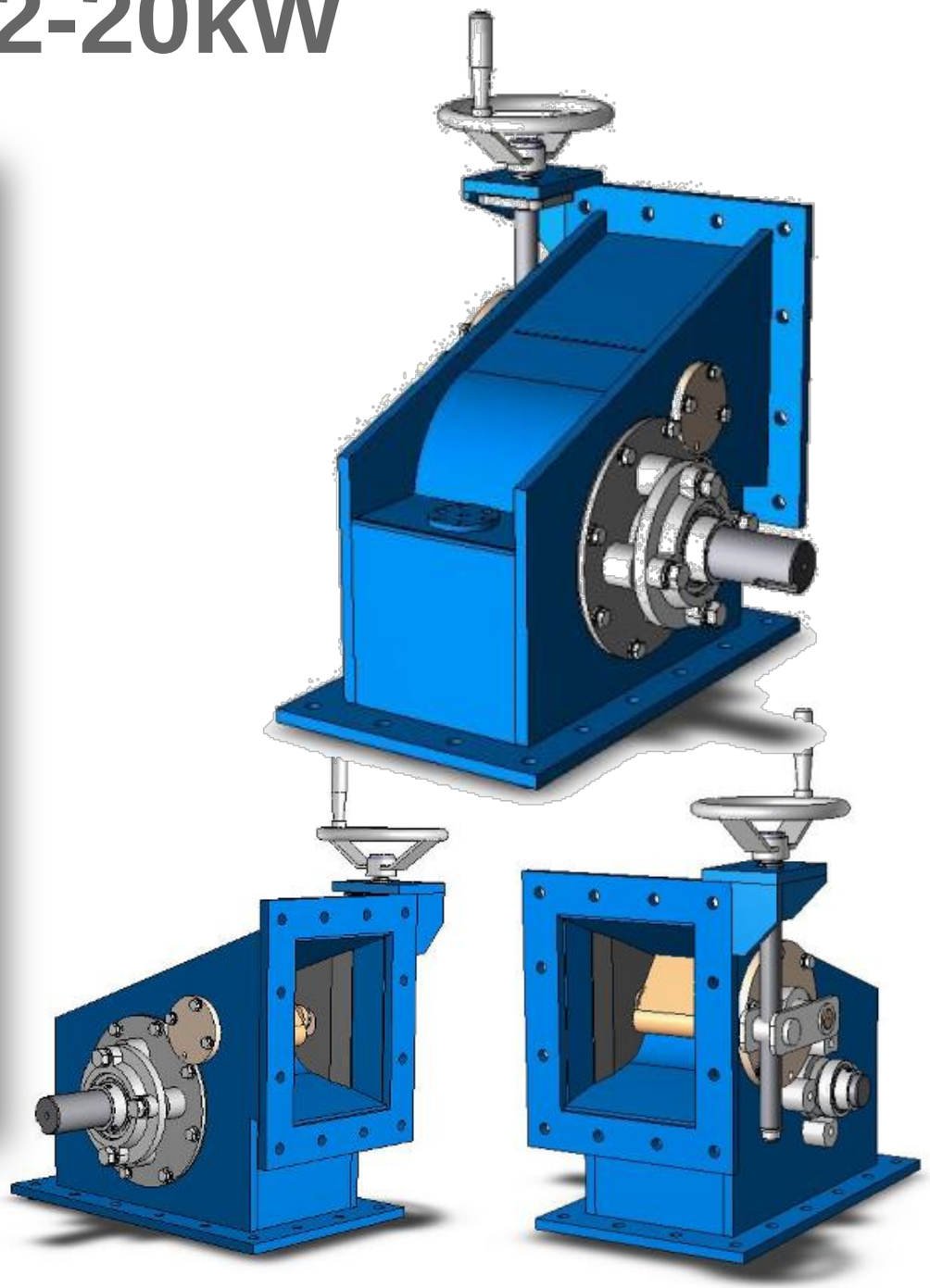
- Runner diameter 150mm
- Output Range 2 - 25kW

Applications:

- Small Village electrification,
- Small scale industries
- Hospitals etc.

C-235 simple CFT 2-20kW

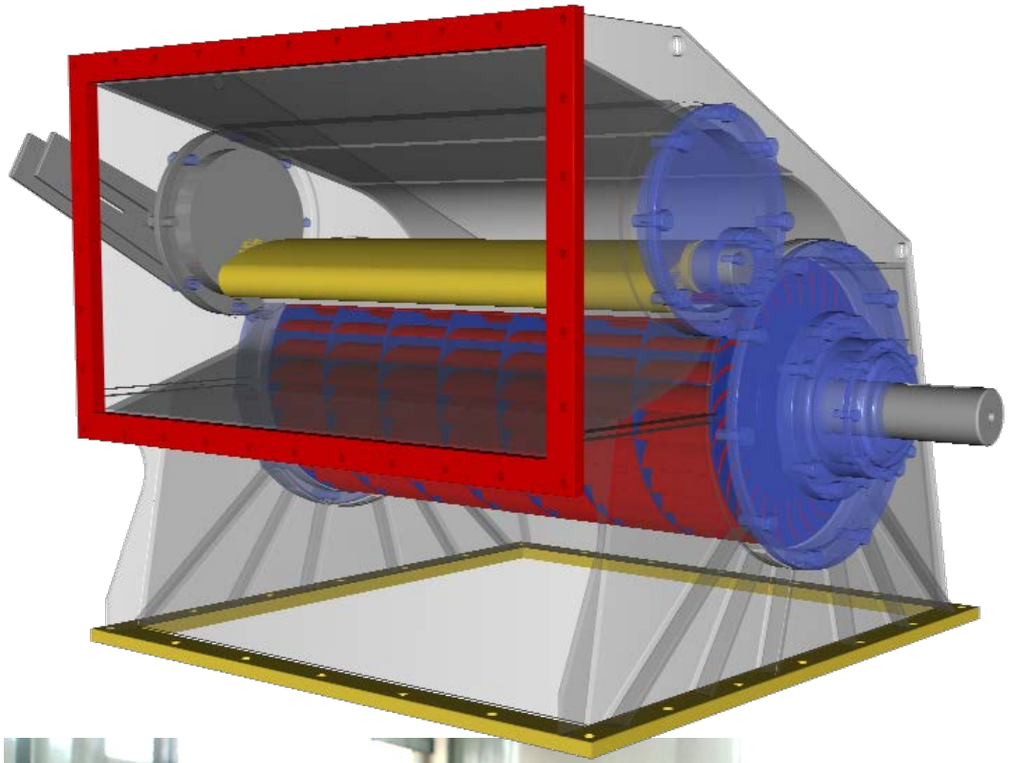


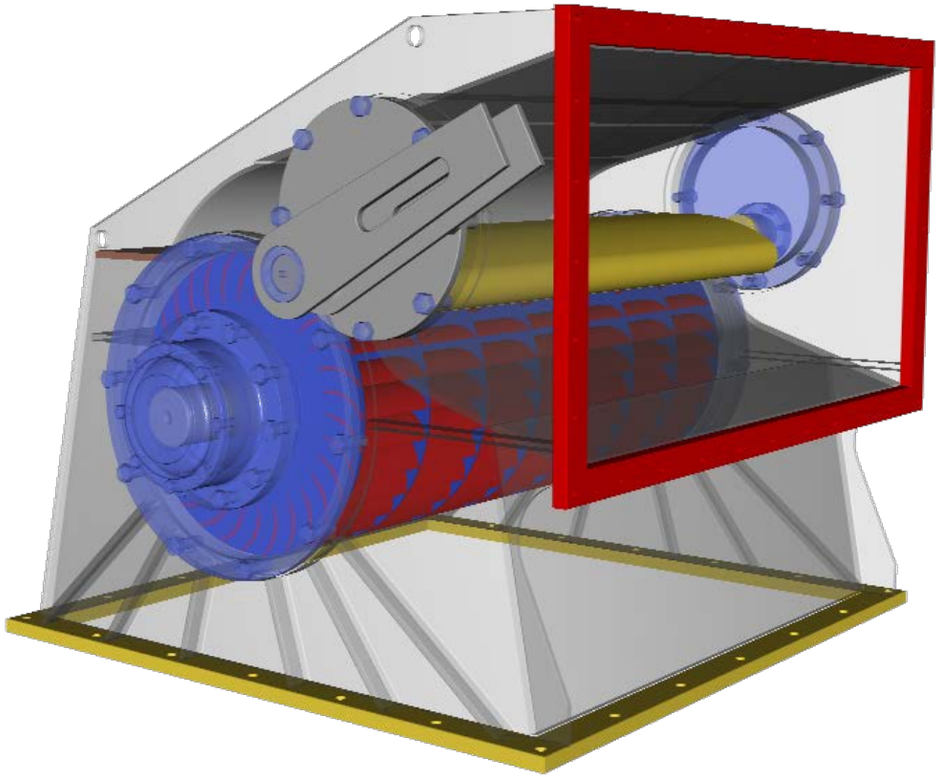


T15-800 (failed Project 2002)

7m head

3x120kW grid connected using irrigation water





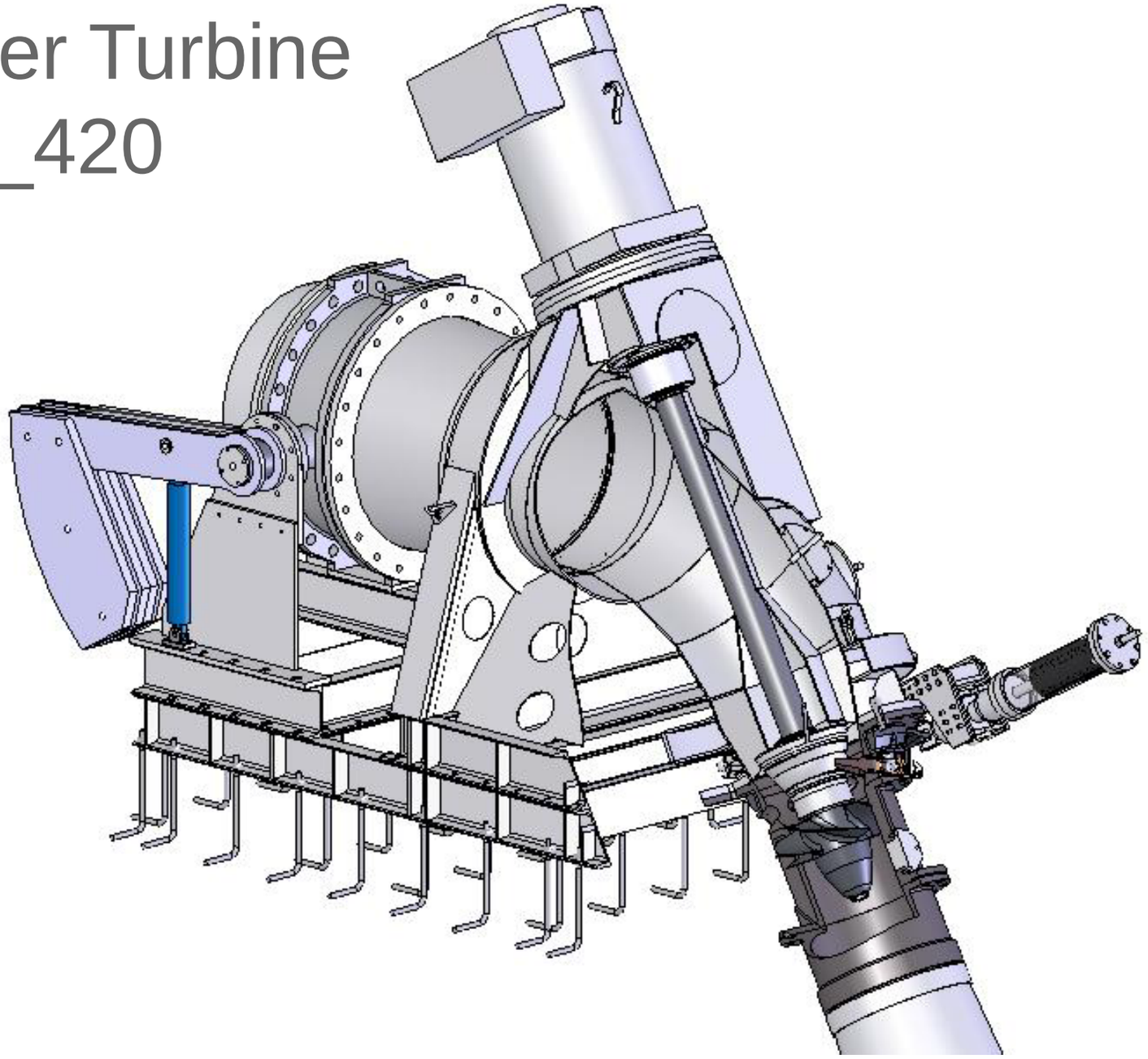
T15-800 became reality (2015-1MW)

Propeller Turbines

Propeller

- Open flume turbine design (2-5m)
- Tubular turbine design (8-15m)

Propeller Turbine TPT01_420

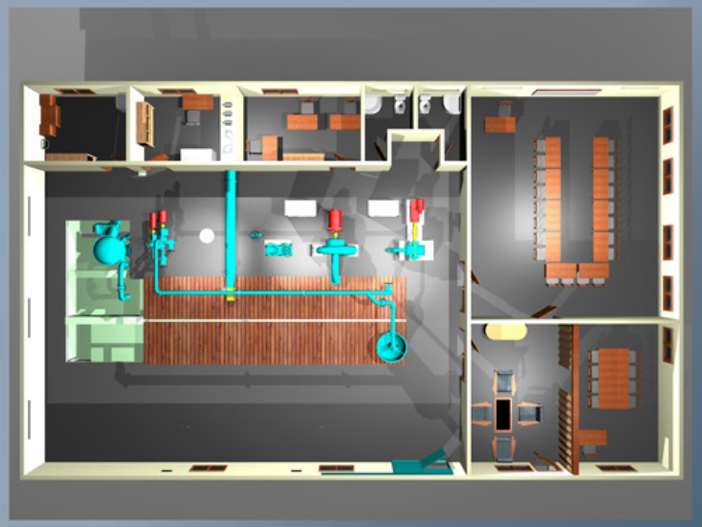


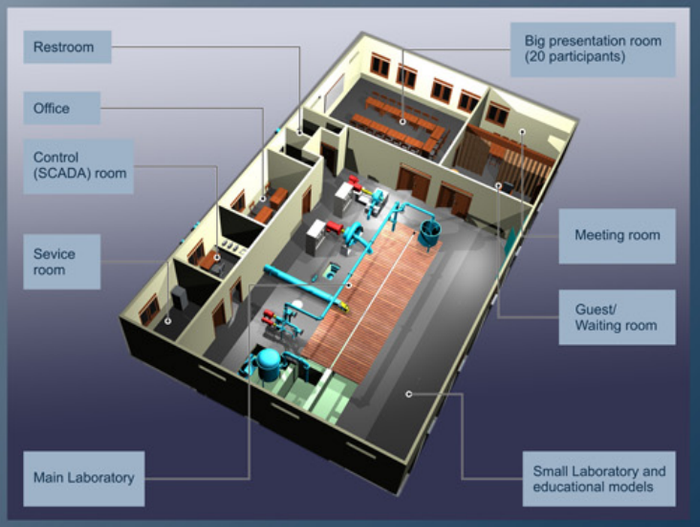
Hydro Power Technology Transfer

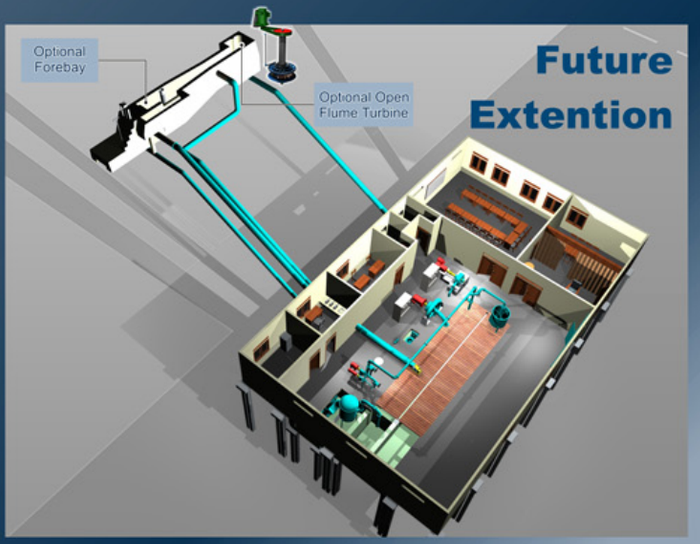
Hydro Power Technology Transfer

2017: 400kW Pelton (160m head)

Hydro Power Technology Transfer







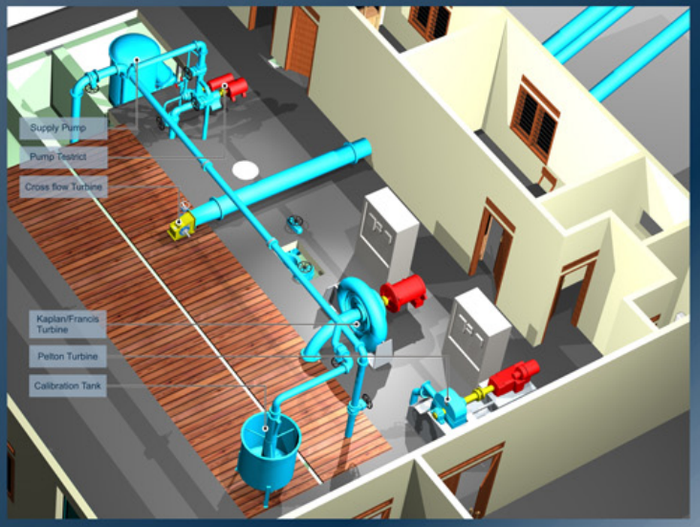
HYCOM

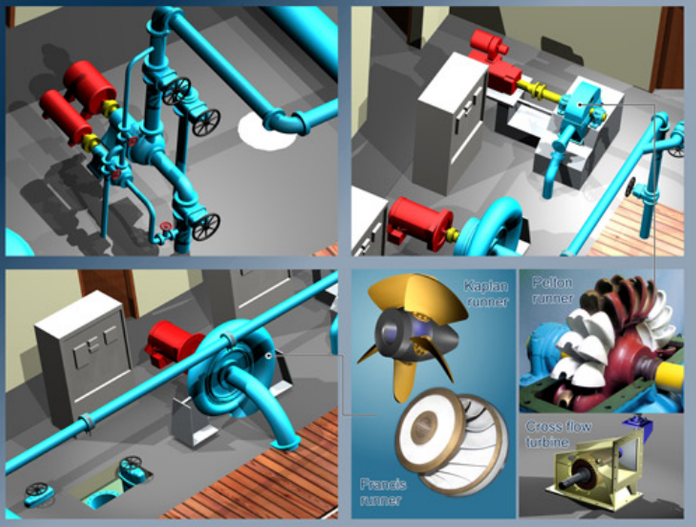
ASEAN HYDROPOWER COMPETENCE CENTRE

gtz

Pusat Pengembangan dan Pemberdayaan Pendidik dan Tenaga Kependidikan – Bidang Mesin dan Teknik Industri (PPPPTK BMTI)

entec pt entec indonesia

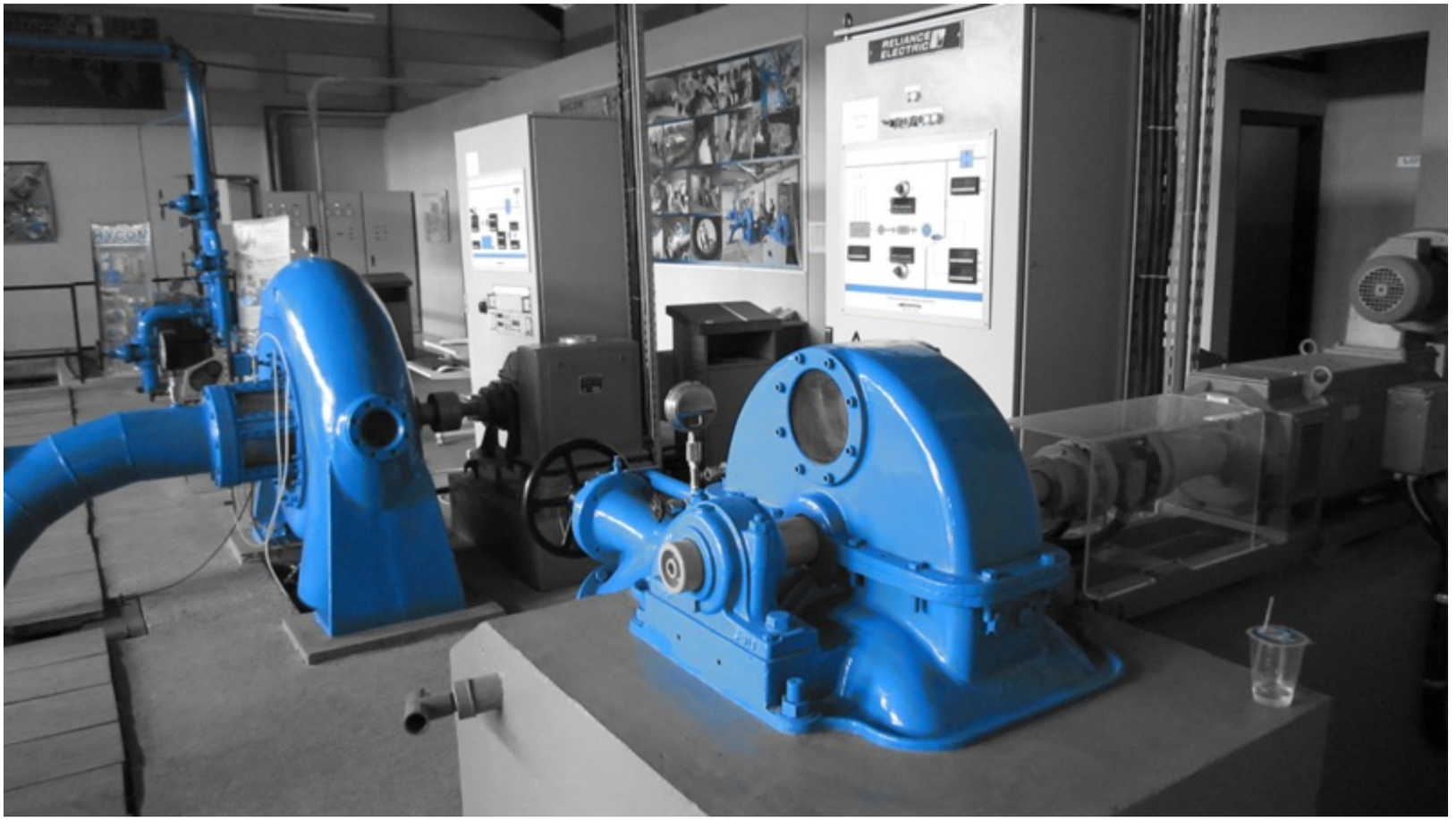




Website: www.hycom.info

Recent Development

- Mini Hydro (above 1 MW) current market demand
- Establishment of Laboratory HYCOM
- Technology advances in Computerized simulation
- Expanding HYCOM to a renewable energy center



Hydro Power Technology Transfer

2013: GLOBAL ENDEV HYDRO WORKSHOP

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Hydro Power Technology Transfer

ASEAN MHP TRAINING

Hpnet Workshop 2015 at HYCOM

Hydro Power Technology Transfer

2nd ASEAN Training

Expanding HYCOM with other renewable energy training facilities for vocational school teacher training

What is Next ?

Technology transfer
(all aspects of MHP)

- Myanmar
- Philippines
- India
- African countries

South - South co-operation

- linking actors
- avoiding repeating errors
- accelerating learning curve
- Use training options of HYCOM

Terima Kasih – Thank You

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