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Swiss Resource Centre and Consultancies for Development

Hydropower in water supply and irrigation systems – Synergies and hidden hydropower potentials

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hydropower in existing infrastructure

- Irrigation systems
- Multi-purpose dams
- Water supply systems
- Waste water systems
- Thermal power plants

Any gravity flow of water stands for usable energy!

From Large to Micro hydropower

- Power supply for large cities or small hamlets
- Connected to the national grid or isolated grids only

From High to Low Head

- High pressure or high amount of water?

KW Campocologno, Switzerland
50 MW, 13m³/s
Foto: Rätia Energie / Isopermaproof

KW Niedergösgen, Switzerland
49 MW, 380 m³/s
Foto: halfin.ch

Impact of a 10 kW Micro Hydropower Plant

60 MWh Electricity per year …

- Electricity consumption of 15 Households HH in Switzerland
- Electricity consumption of 100 HH (rural village in Africa)

- Replaces > **20,000 lt Diesel** (Diesel generator) per year

- Similar to production of 375 m^2 photovoltaic Panels

Simplified estimation of available electric power

$$P = Q \times h \times 7$$

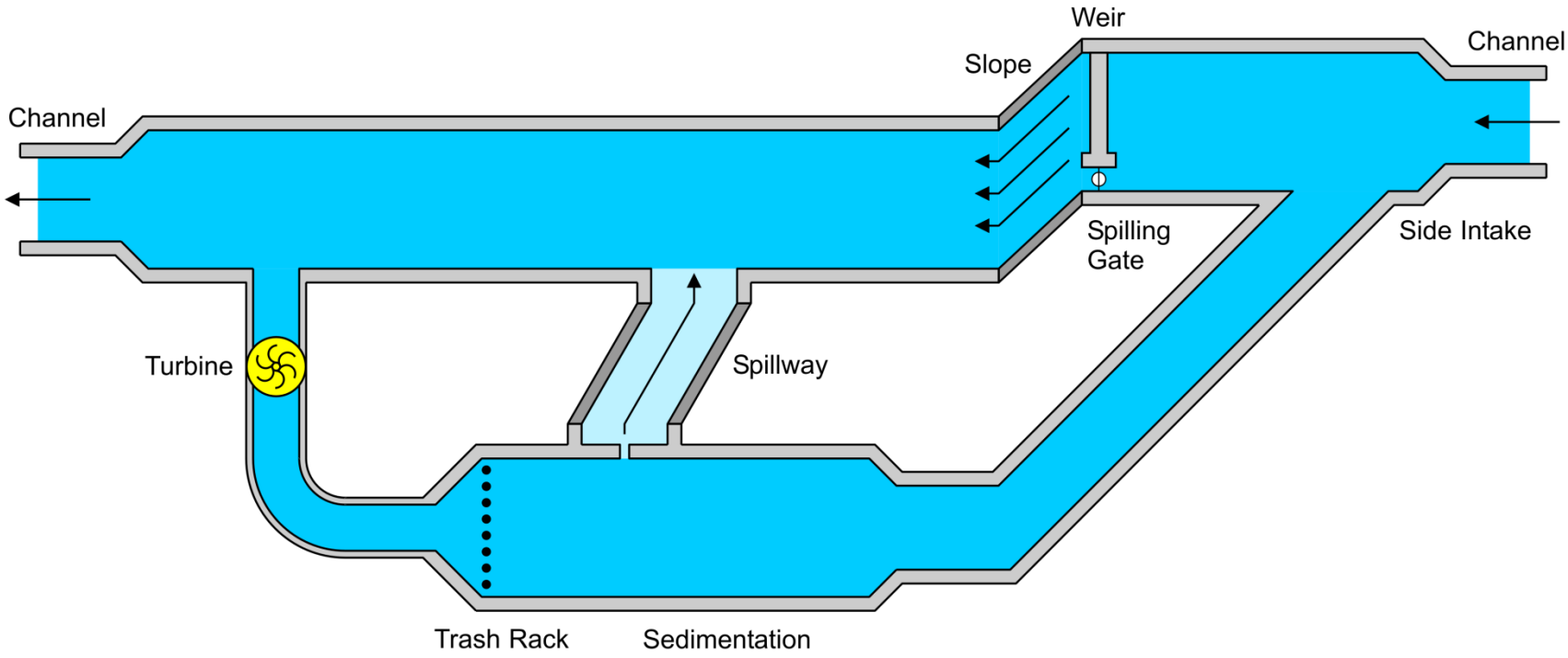
P	Electric power [kW]
Q	Available flow [m^3/s]
h	Cross head or potential pressure [m]
7	constant [m/s^2], based on efficiencies and gravity acceleration 9.81 m/s^2

Where to search potentials?

Indicators for (hidden) energy potentials:

- High flow / water demand, or
- High pressure / head available (replacement of pipes?)
- High energy costs → energy efficiency potential

Hydropower in irrigation systems



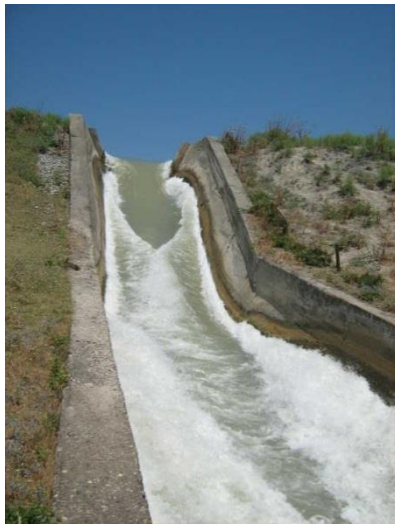
Integration of hydropower in existing irrigation structures / Lower Mekong

- Analysis of existing (and new) irrigation reservoirs and weirs in rivers
- Options for hydropower use and parallel
- Improvement of fish passage

Services for the Initiative on Sustainable Hydropower ISH / Laos

- Hydrological / topographic analysis; using the weir data base → flow continuity
- Visit promising selected sites, estimate potential for electricity production
- Develop specific designs (for parallel improvement of fish passage)
- Options for grid connection / isolated grids → where is energy needed?
- operational models

Hydropower in irrigation systems in Azerbaijan

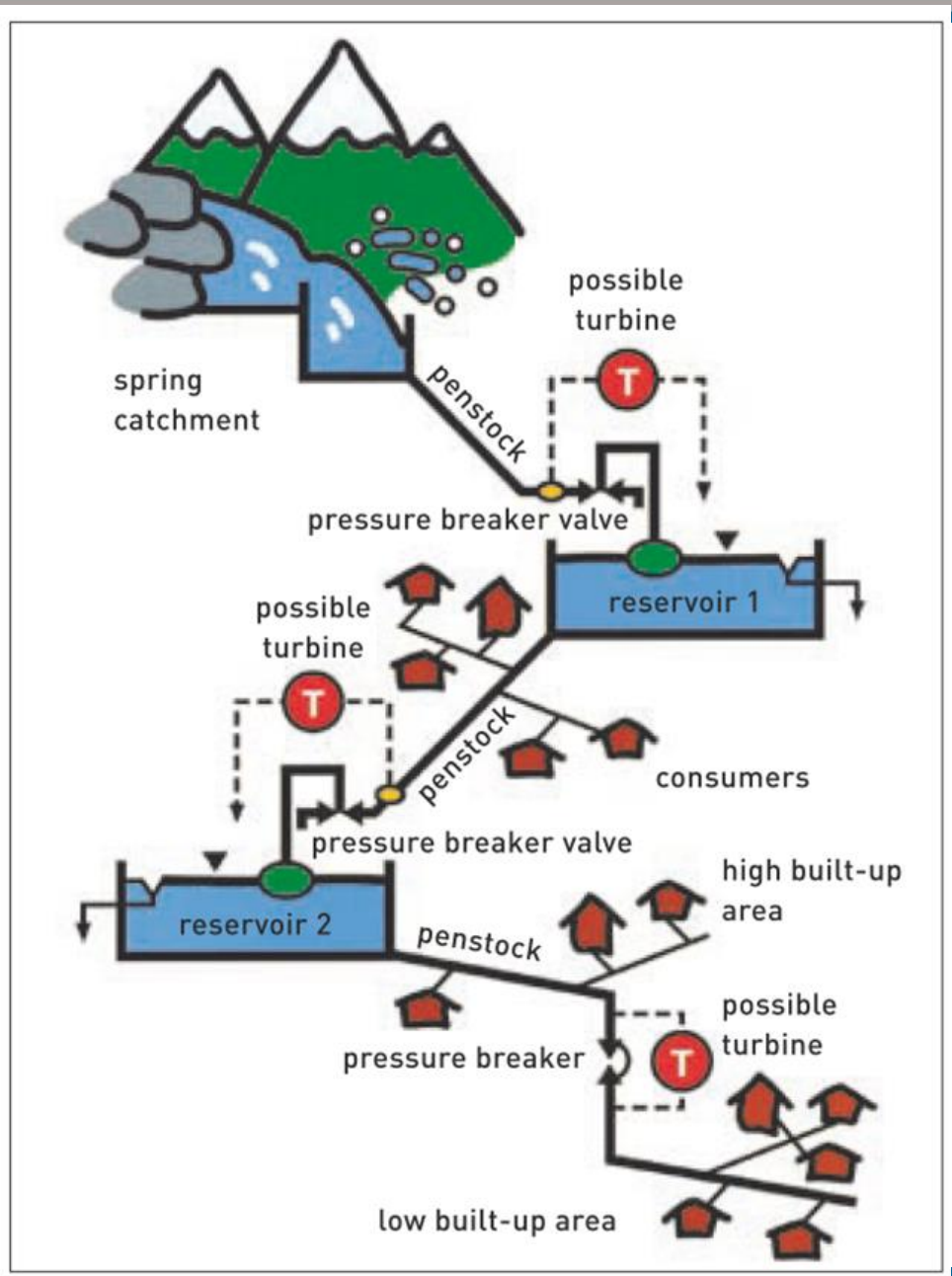


20,000 l/s, 14m
→ ~ 2 MW)

Our services in Azerbaidjan

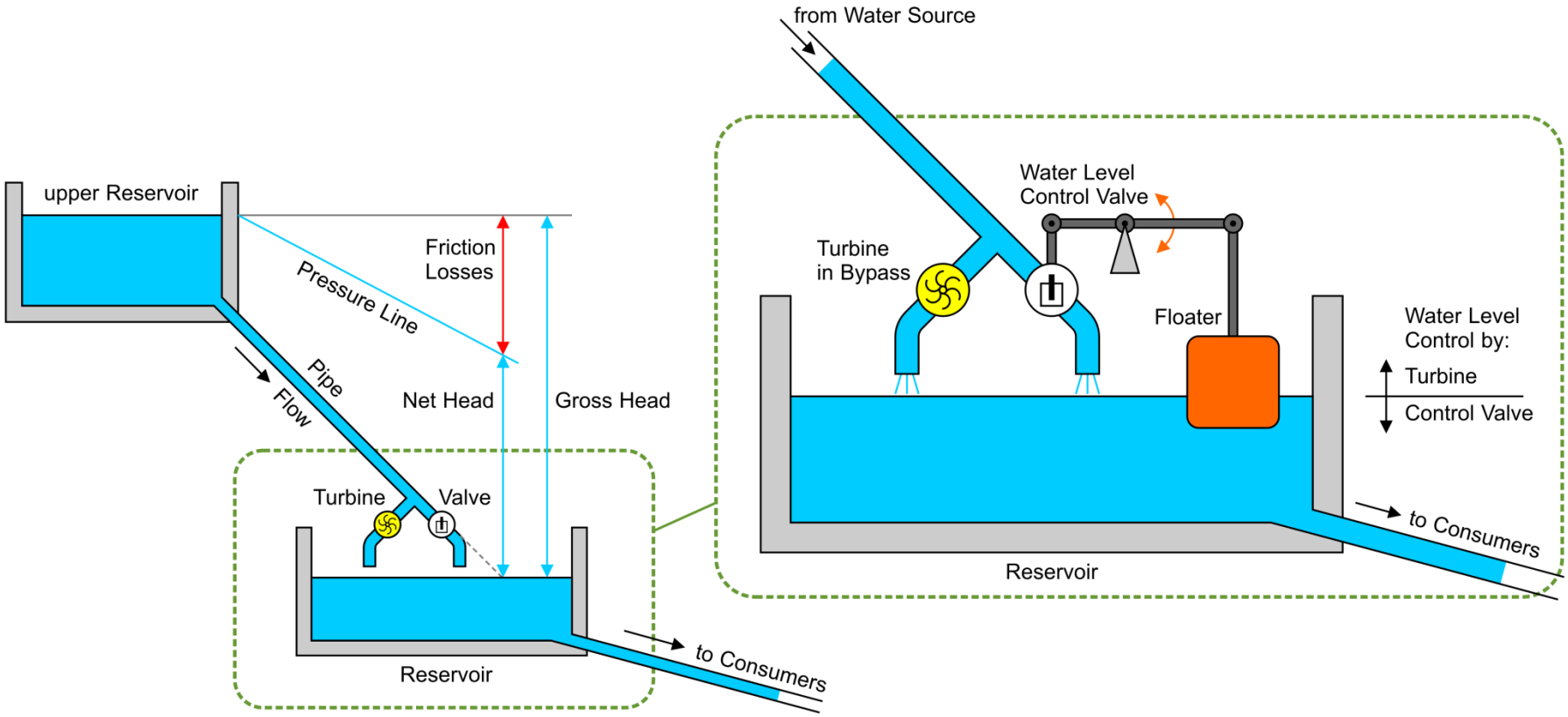
- Assessment of the potential of Renewable Energies in Azerbaijan
- Least-cost analysis, identification of bankable projects
- Capacity building requirements of the Ministry of Industry and Energy MIE
- Identification of technical, institutional, financial and regulatory barriers, policy recommendations
- Development of techno-economic feasibility studies on selected projects

Hydropower in drinking water systems



Example Drinking Water Supply (Tunisia)

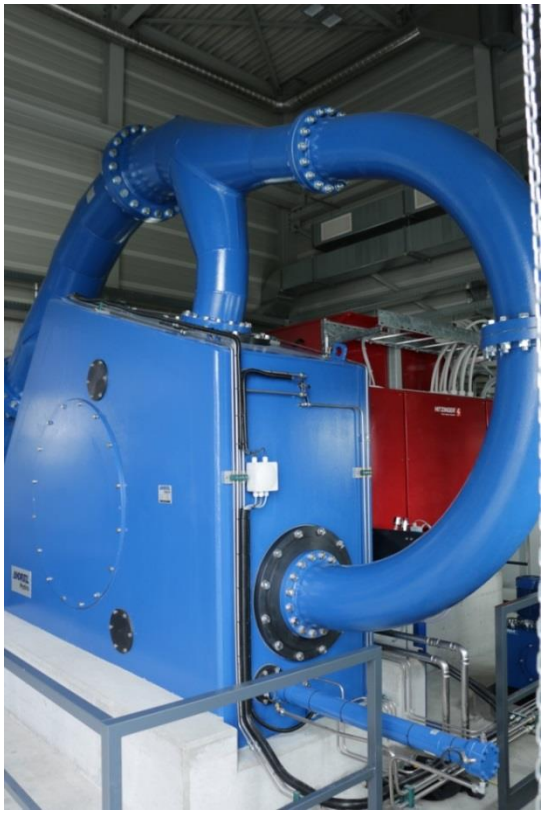
Hydropower in drinking water systems



Our services in Tunisia

- Countrywide assessment of potential in water supply system of SONEDE
- Estimation of investment and generation cost
- 1 week training of utility staff (water + energy) on technical, economical, legal and regulatory aspects
- Common selection of appropriate pilot site
- Development of exemplary FS & tender docs: 50 kW turbine, 300 MWh/an, investment 230,000 USD (4,600 USD/kW), tariff paid by SONEDE 0.08 USD/kWh, generation cost can be kept below this
- **Roughly**: 6 MW (5,800 Euro/kW; 35 Mio Euro; 35 GWh/an, production cost **0.05 Euro/kWh (= 0.06 USD/kWh)**

Examples Waste water turbination



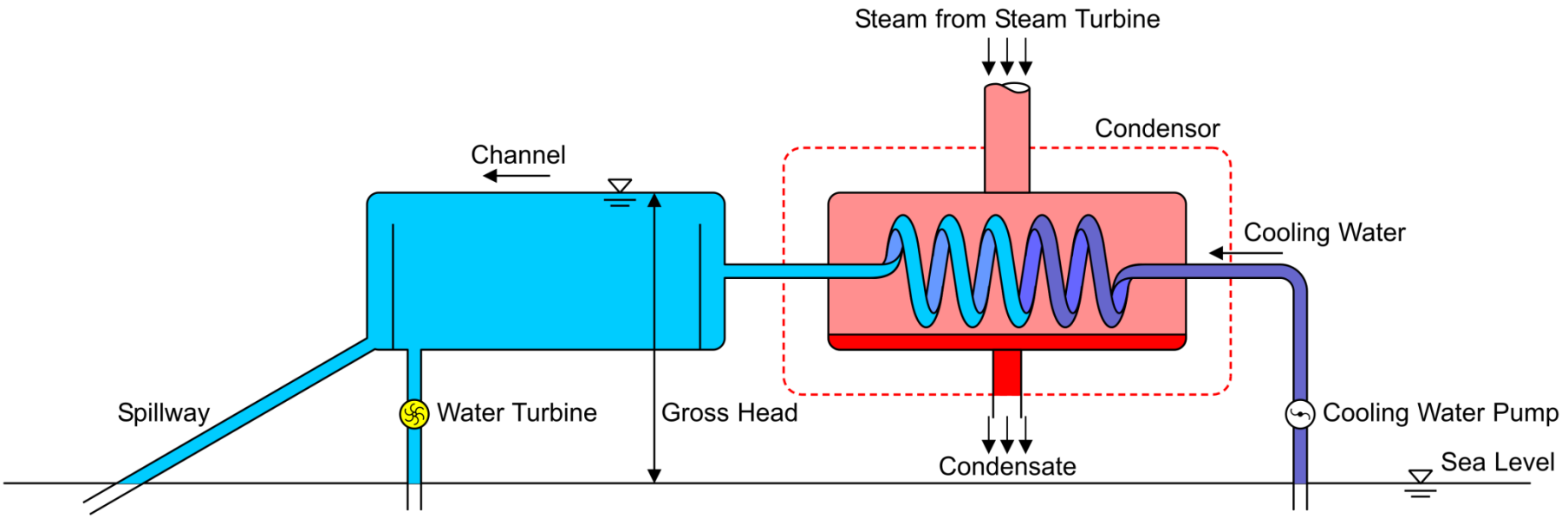
Morgental, St. Gallen, Switzerland
190m, 850 l/s, 1,300 kW

Profray Verbier, Switzerland
449m, 100 l/s, 380 kW

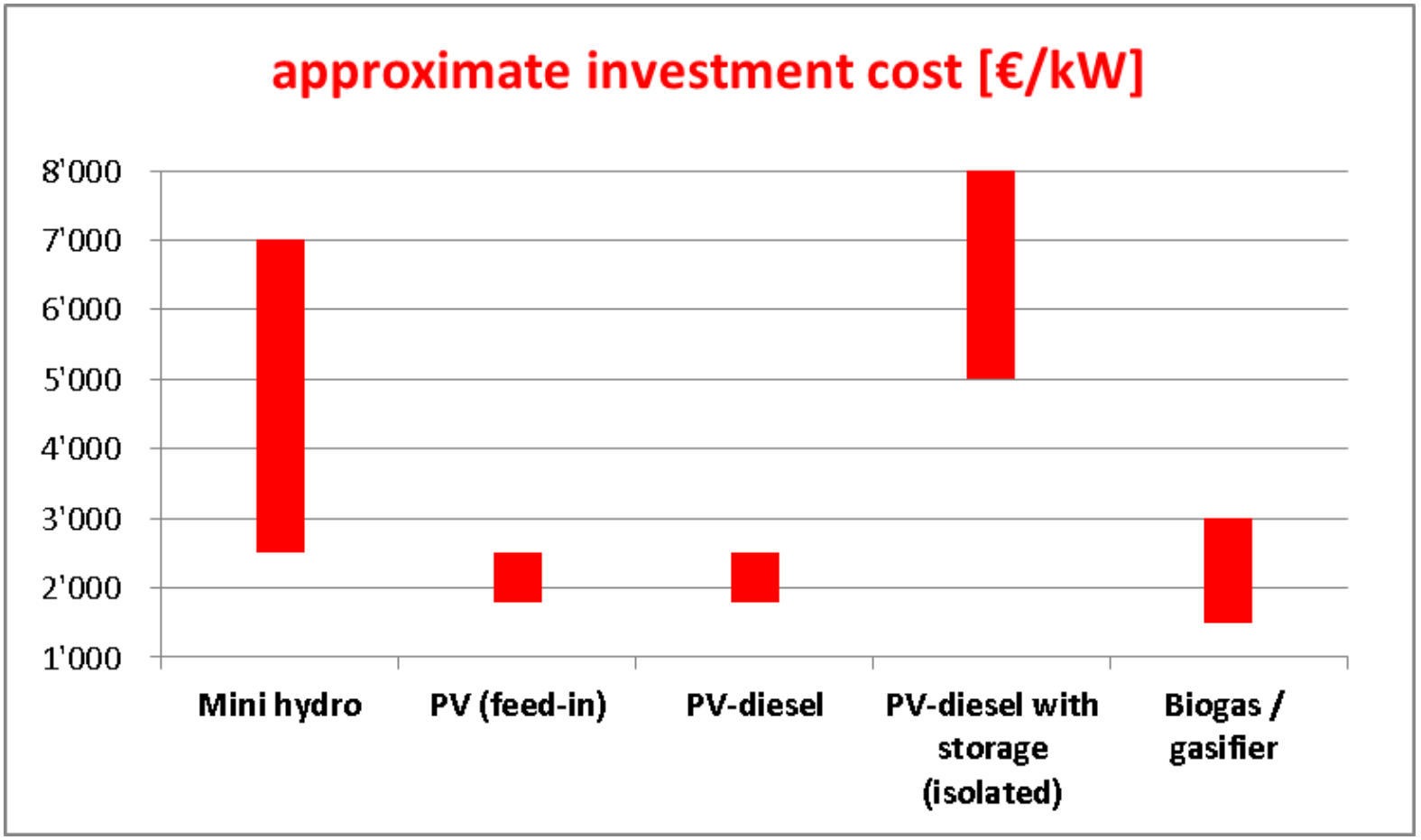
As Samra, Jordan
104m, 2,500 l/s, 1,660 kW

Cooling water of thermal power plant

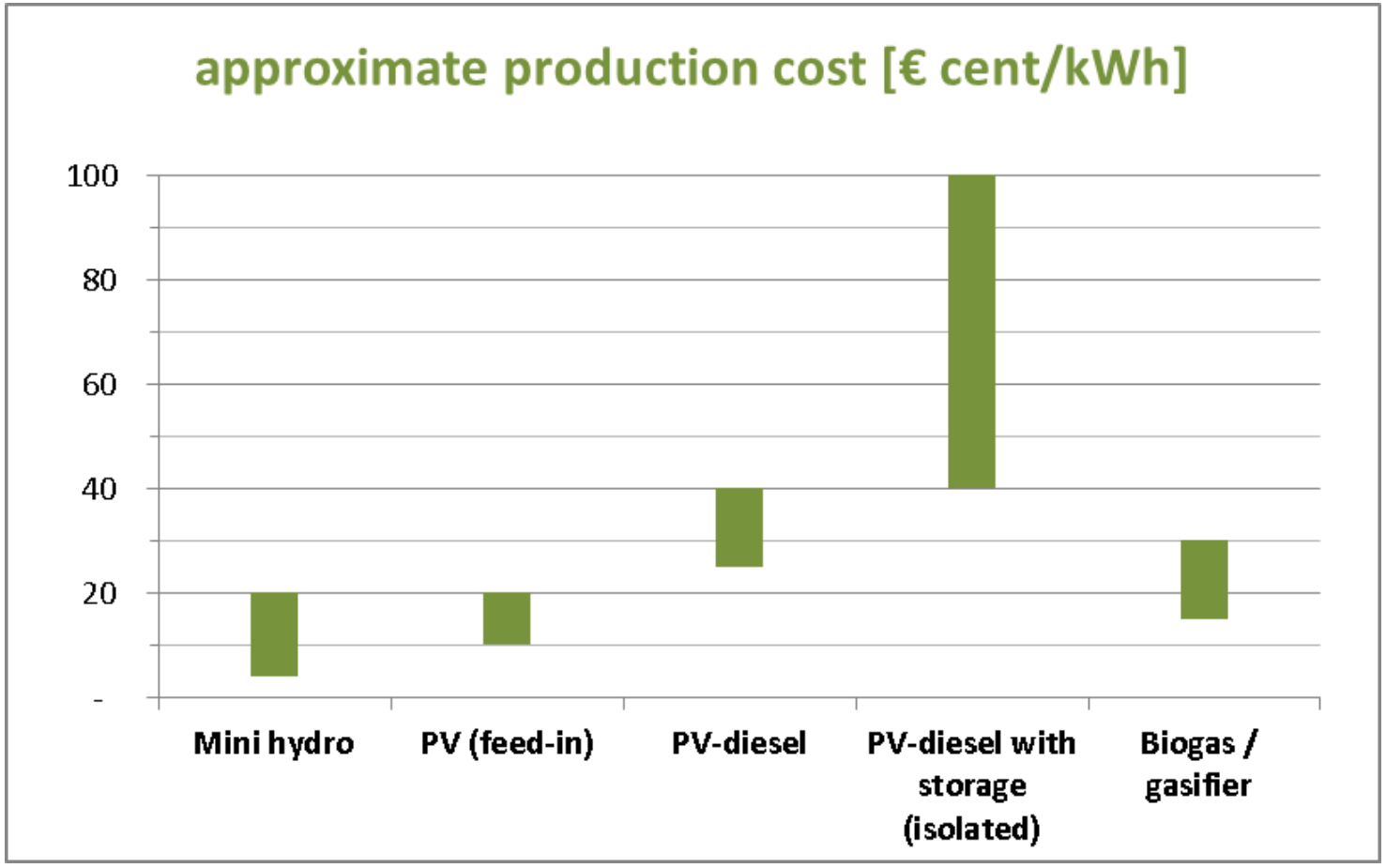
Hydropower in a thermal power plant



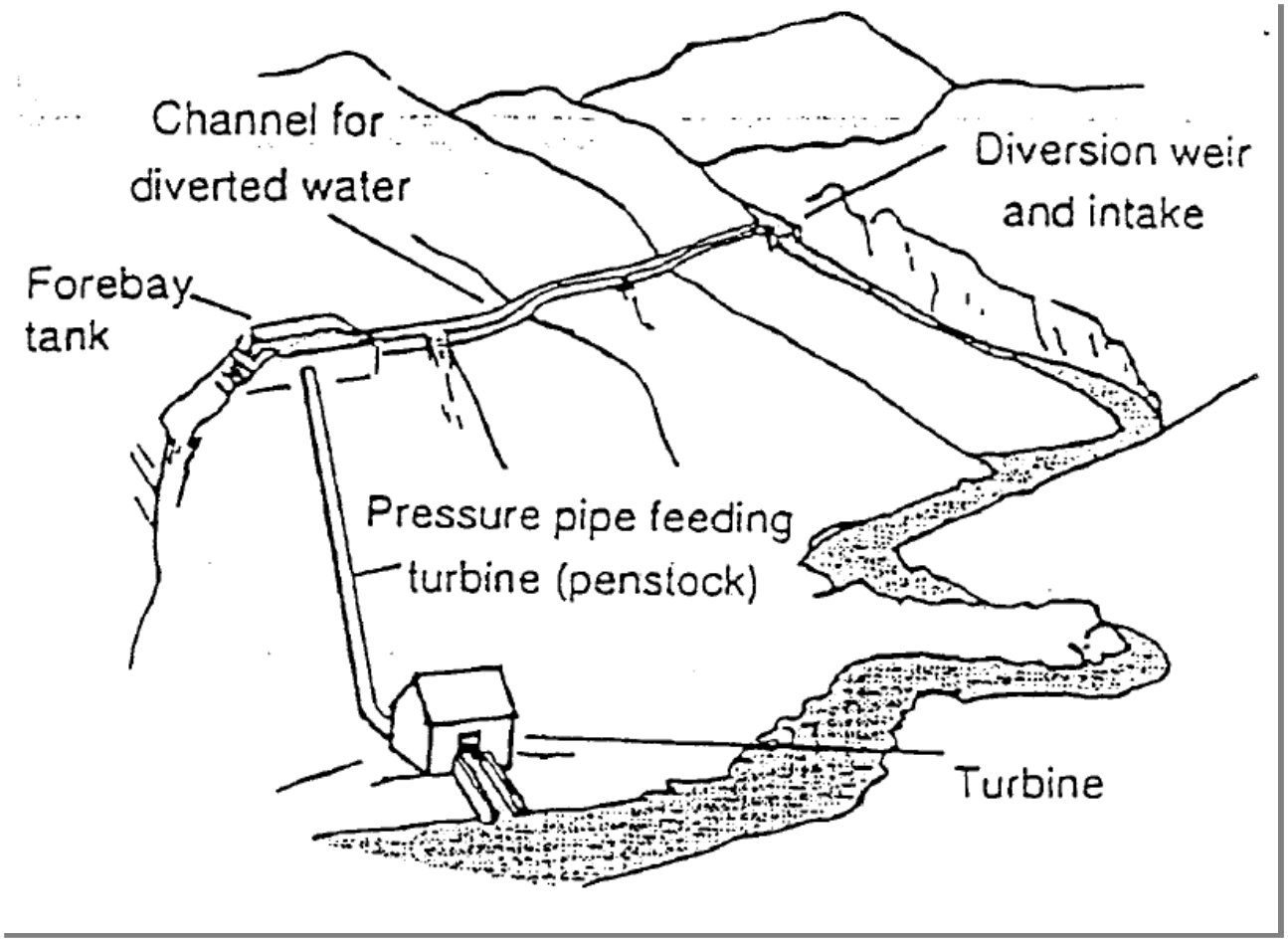
Comparison investment cost



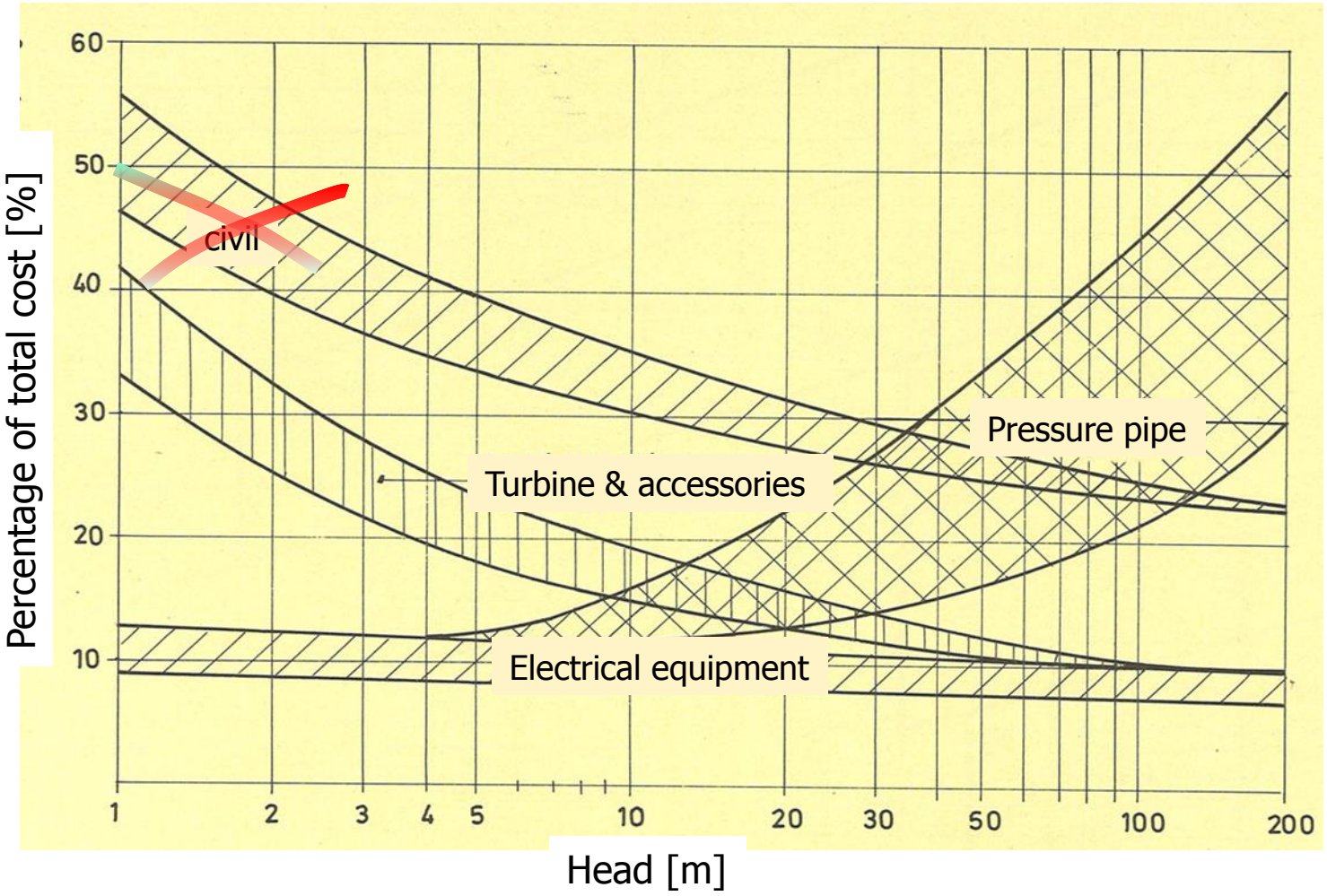
Comparison production cost



“normal” runoff river plant



Repartition of costs



Synergies & cost efficiency

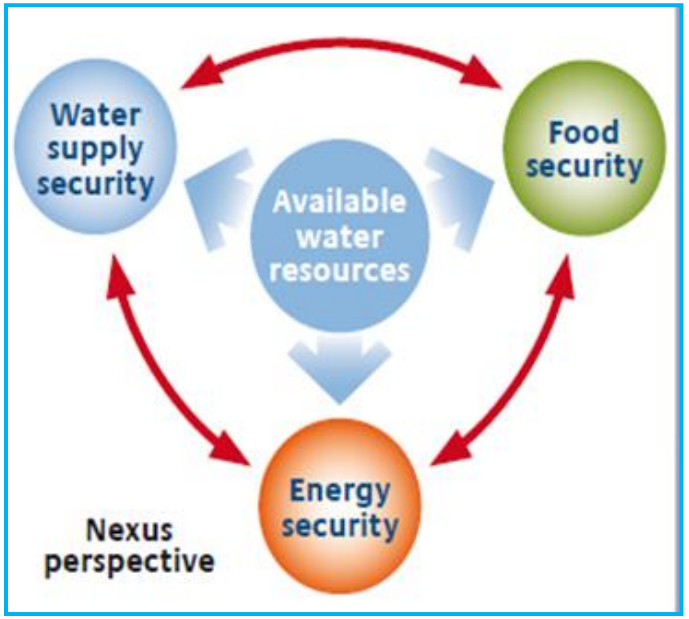
- Often no costly civil works required
- Pressure pipe already existing (or during rehabilitation anyway necessary)
- Often EM equipment can be installed in existing building
- Often pulley / winding tackle for installation of equipment already there
- Water supply staff on site can also operate hydropower system

→ **Reduced cost!**

→ **Better impact at limited additional investment**

Important Aspects

- Improvement of resource efficiency «create more with less» (system efficiency instead of isolated sector productivity)
- Responsibilities in ministries and utilities (water – energy – agriculture / irrigation)
- Consider overall profitability
- Feed-in conditions



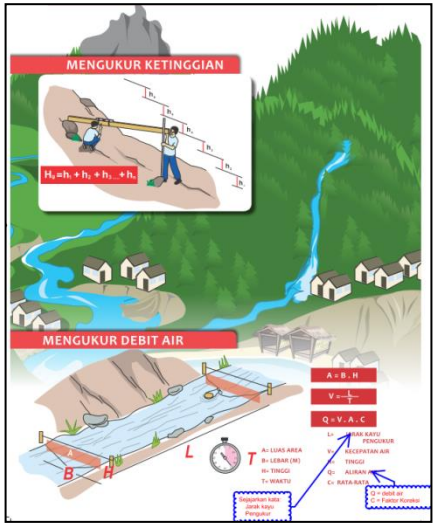
- Energy recovery (!) relevant in all «efficiency projects»: efficiency in water supply networks (e.g. EE in urban water supply Brasil/GIZ)
- Climate relevance (CO_2 avoidance) in water waste, drinking water and irrigation projects

Our constribution

- Independent expert opinion (no own products or construction projects), e.g. Backstopping; management of Swiss small hydropower association ISKB)
- Broad know-how: technical, economic, legal / policy framework, social and environmental aspects
- Cross-sectoral activities (water, energy), e.g. «Nexus-Analysis», Utility Management
- In-house staff and cooperation with proven partners
- Broad experience in knowledge management and networking
  → Skat acts since years as «resource center» in different infrastructure topics

Capacity Building, knowledge management, networking

- Making information and know-how available and disseminate it (E-learning courses, publications, newsletters…)
- Establish & support knowledge networks and centres e.g. «work the net»
- Development of media (posters, films, manuals / handbooks)



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