I. Photovoltaic Pumping Systems Technology

II. Policy Recommendations to Improve the Sustainability of Rural Water Supply Systems

Dr. Thomas Meier, International Off-Grid Renewable Energy Conference, Accra, Ghana, Nov. 2., 2012

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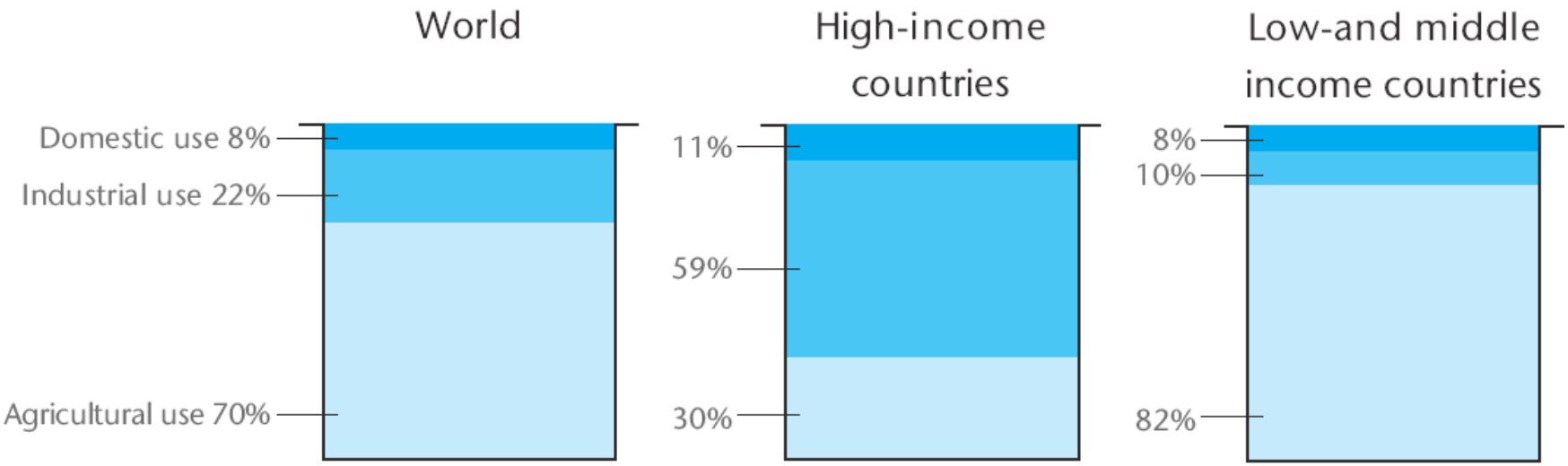
The Link between Water, Energy and Sustainable Development

- 7% of total world energy consumption is consumed for the provision water services.
- MDG target: to halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.
- About 2.8 billion people suffer from water scarcity, est. 50% of them in off-grid areas.

→ Renewable energy powered water services contribute to sustainable development in off-grid areas of developing countries through increased energy independence and thus reducing the vulnerability of their economies and people.

The Link between Water, Energy and Sustainable Development

Competing Water Uses

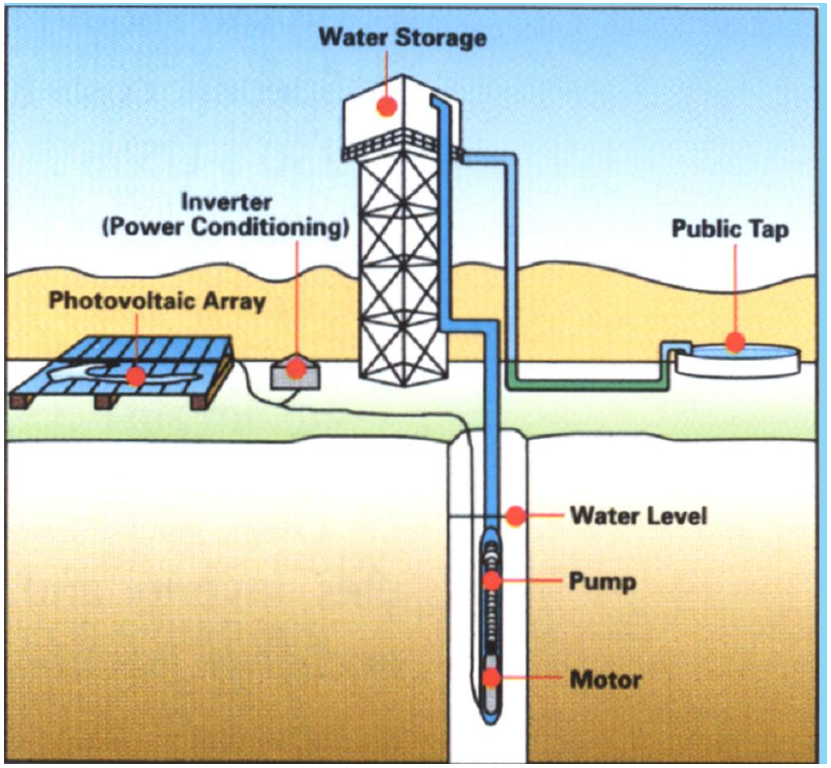


Source: Unesco, 2003

Examples of Solar Powered Water Supplies in Off-grid Areas

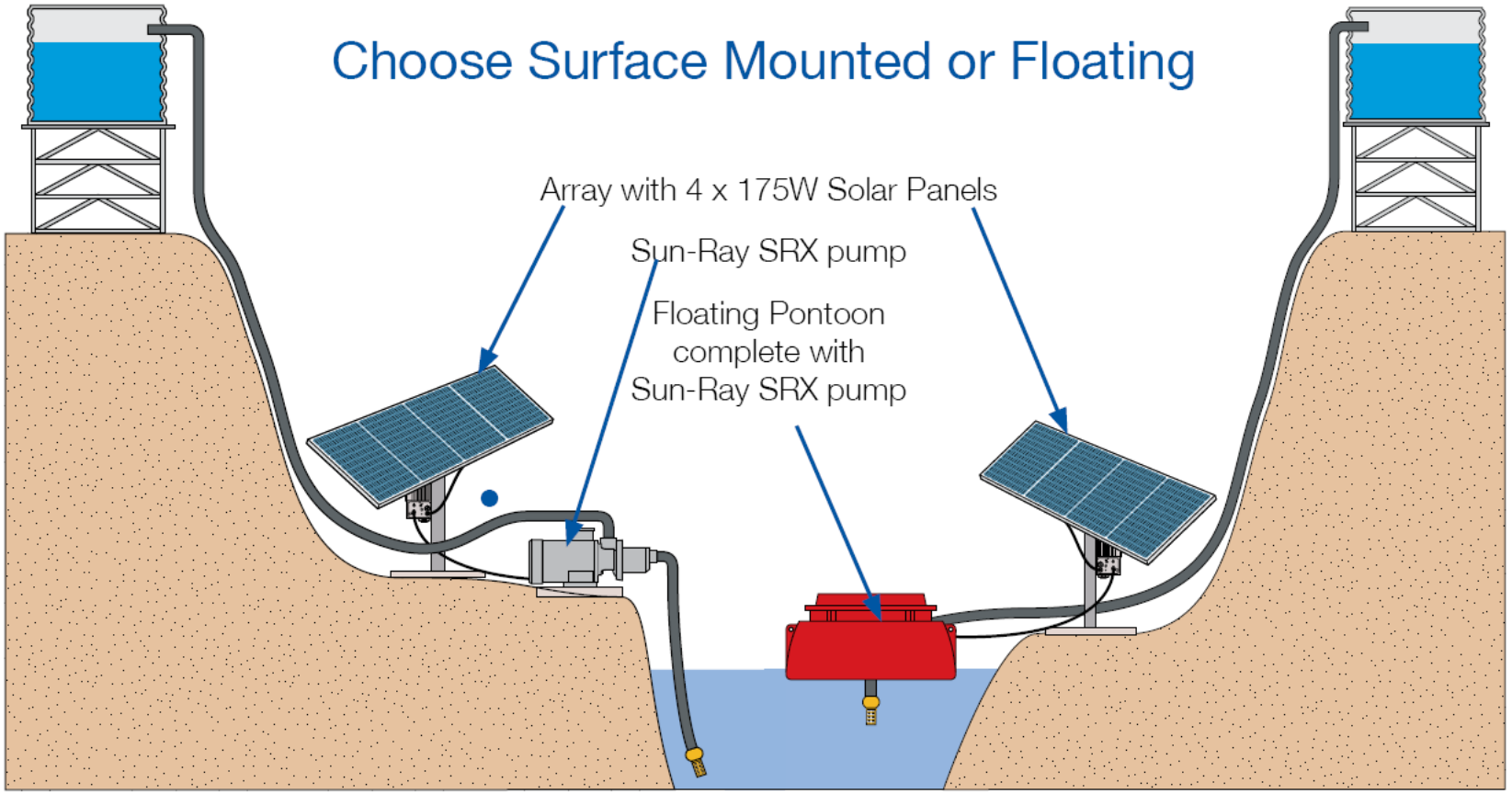
Application Range:

- Handpumps are least cost option up to 25m4 per hour,
- Motorized pumps are needed for higher pumping energies
- PVP is mainly competing with Diesel pumping systems



→ Economic Viability of PV Pumping depends on local costs for diesel fuel and price developments of PV components

Examples of Solar Powered Water Supplies in Off-grid Areas



Source: Mono Pumps, 2012

Examples of Solar Powered Water Supplies in Off-grid Areas

Photos: Wirzsolar, 2011

Examples of Solar Powered Water Supplies in Off-grid Areas

Photos: Erla Hlín Hjálmarsdóttir, 2011

Examples of Solar Powered Water Supplies in Off-grid Areas

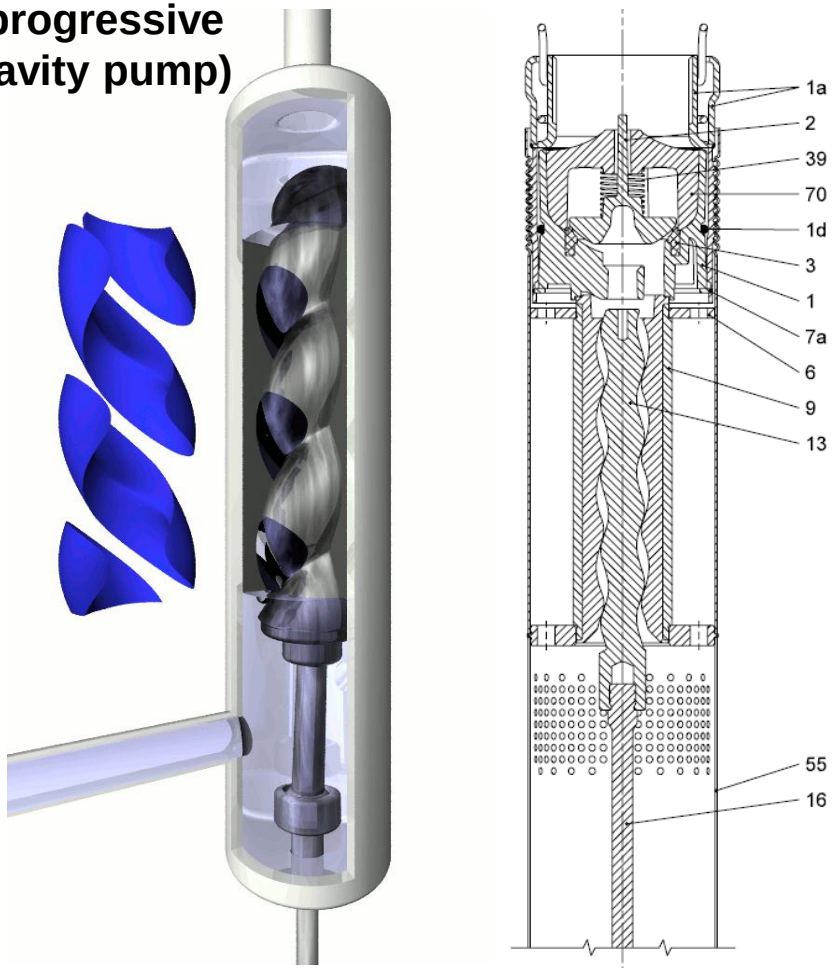
Water Purification System

-Ultrafiltration (removes 99.9% of bacteria and viruses)
-1200l/h
-Power supply 720Wp
-Power consumption 100-350W

Source: Trunz Water Systems, 2011

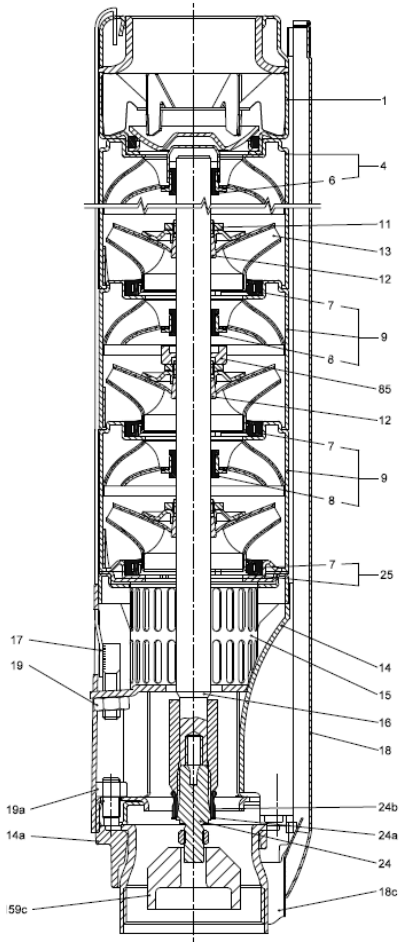
4. Solar Pumping Technologies

Helical Rotor Pump (progressive cavity pump)



-medium to high heads (up to 350m)
-low flows (2.5 to 4 m3/hour)

Centrifugal Pump



-low to medium heads (up to 170m)
-high flows (10 to 70 m3/h)

Sources: Wikipedia and Grundfos

4. a) Experiences with Conventional Rural Water Supply Systems

Main concept pursued: VLOM (Micro-level approach)

- -Supply of handpumps for small communities,
- -Improvement of wells operated by individual households (self supply),

Project characteristics:

- -Heavily subsidized donor driven projects,
- -Little consideration of national policies,
- -Low water usage fees,
- -Too little consideration of maintenance for long term operation.

4. a) Experiences with Conventional Rural Water Supply Systems

Results achieved:

-Hundreds of thousands handpumps installed,

-Numerical targets achieved,

Problems encountered:

-up to 50% of handpumps out of operation due to

-non-affordability or non-availability of spare parts,

-communal management problems,

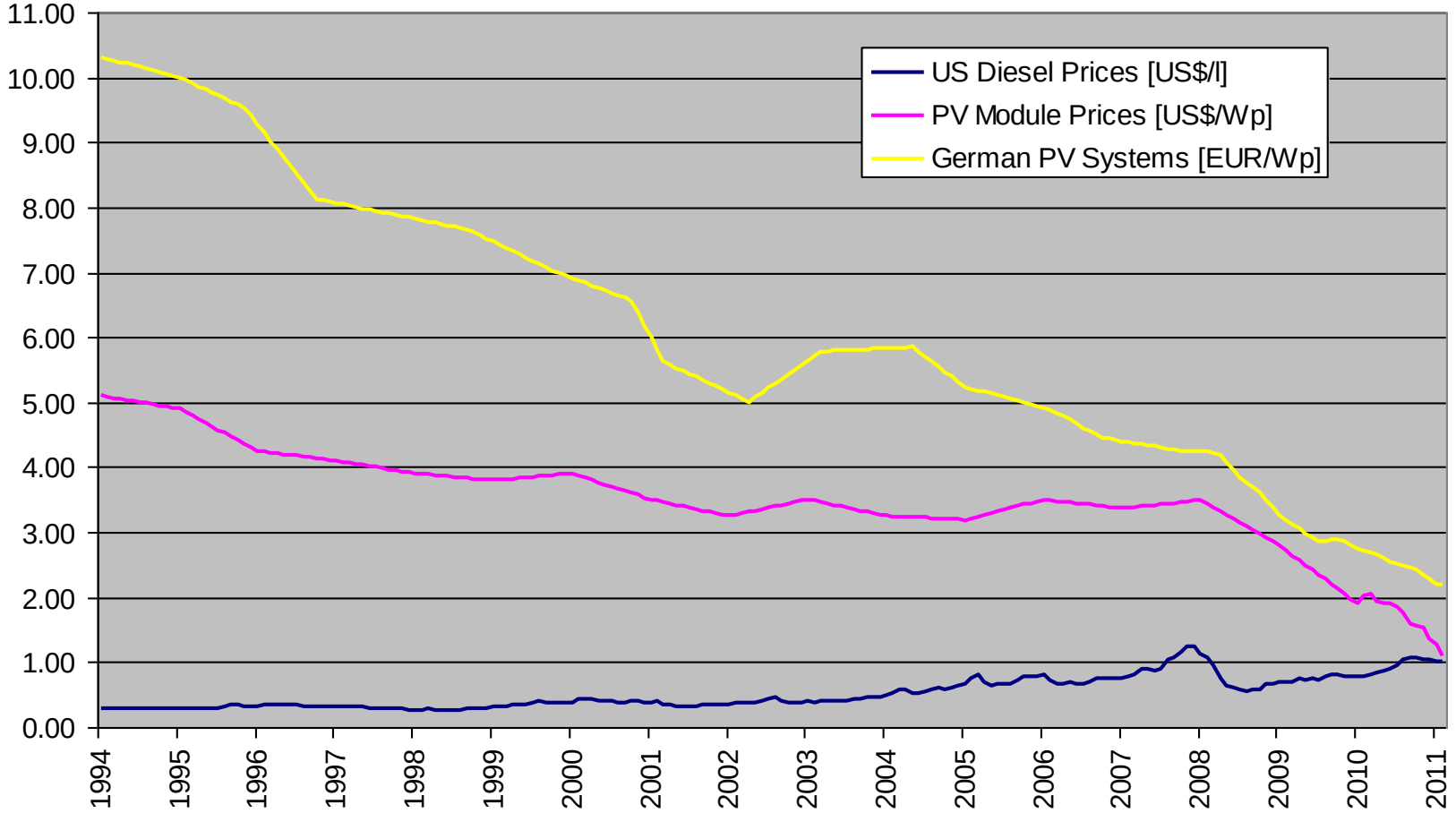
-overpricing of system components due to market distortion effects.

→ more than 1 billion people remain without sustainable water supply

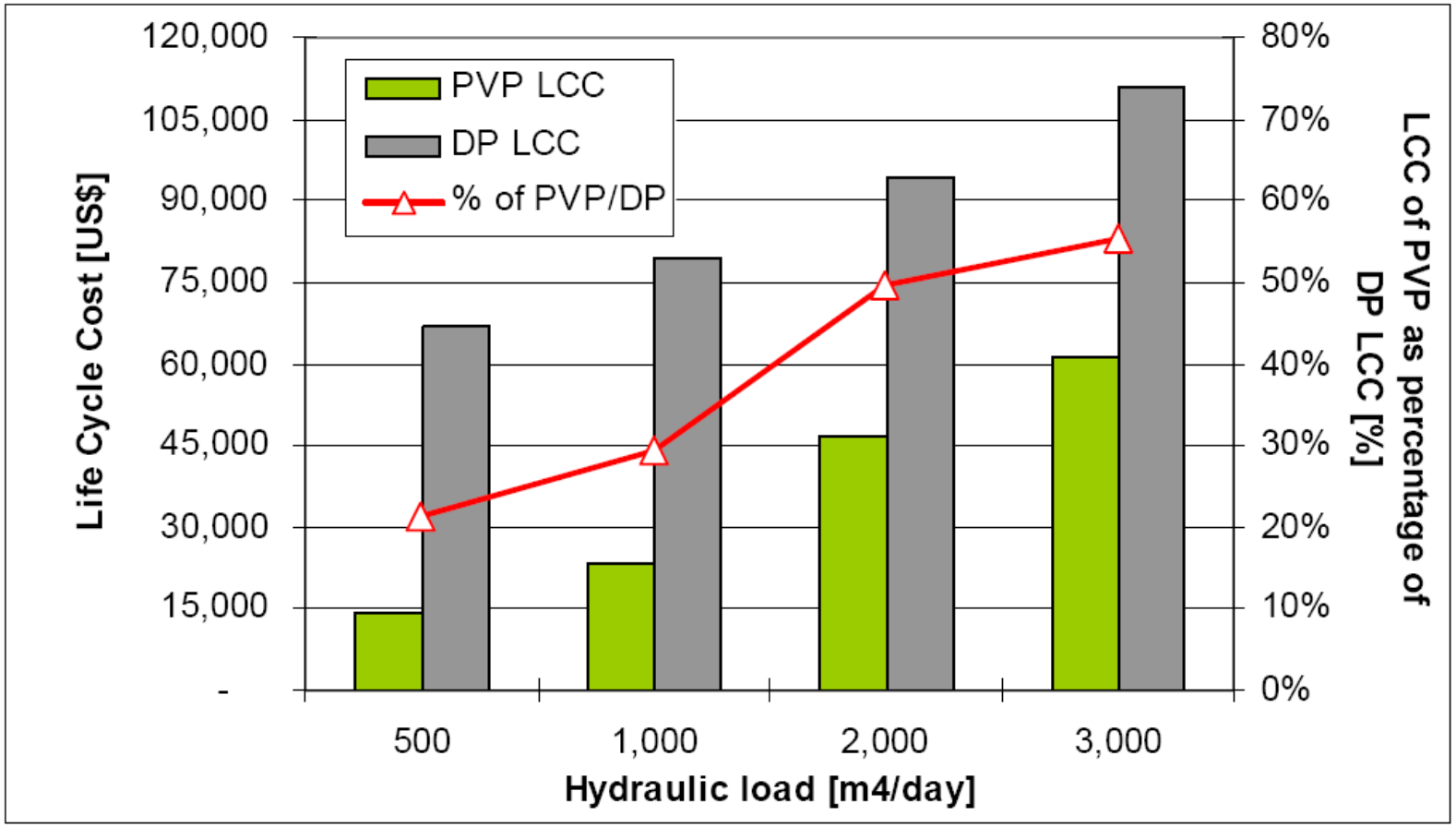
Photo: RWSN

5. Economics of Solar Pumping vs. Fossil Fuel Powered Systems

Development of Prices for PV Modules, Roof-top Systems and Diesel Fuel



Comparison of Life Cycle Cost of a PV vs Diesel System



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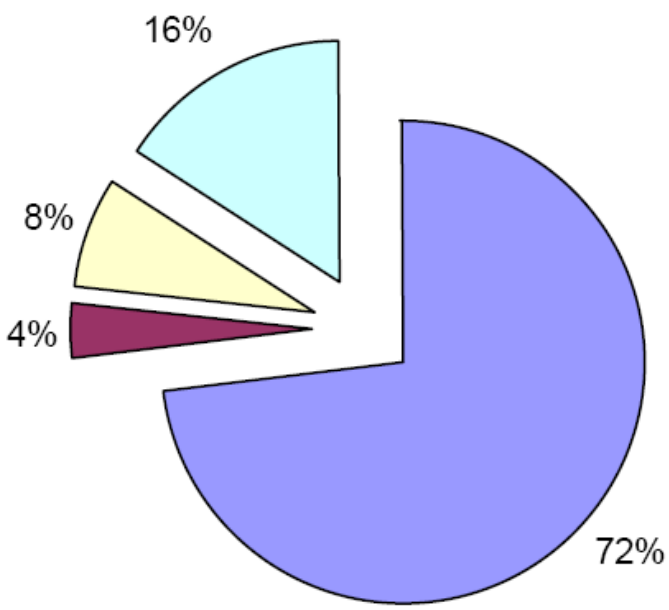
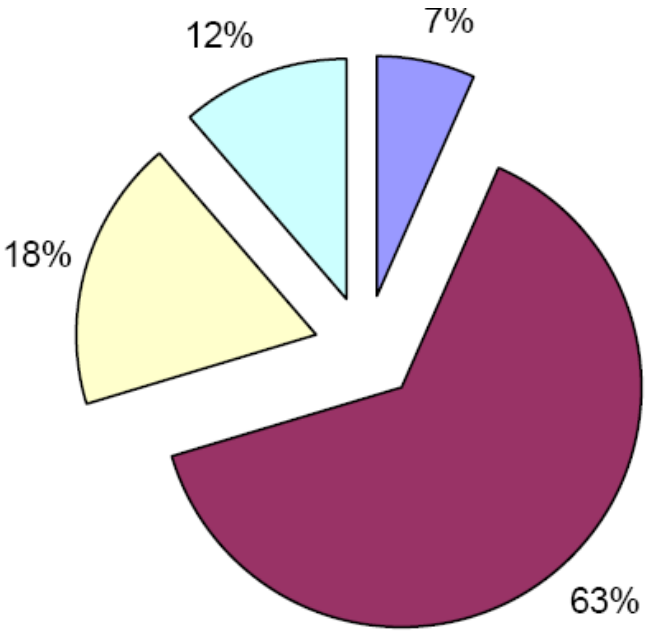
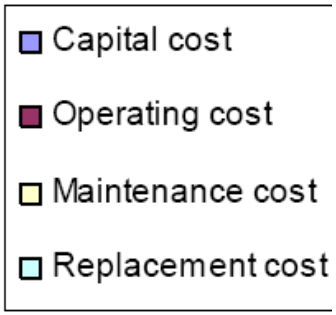


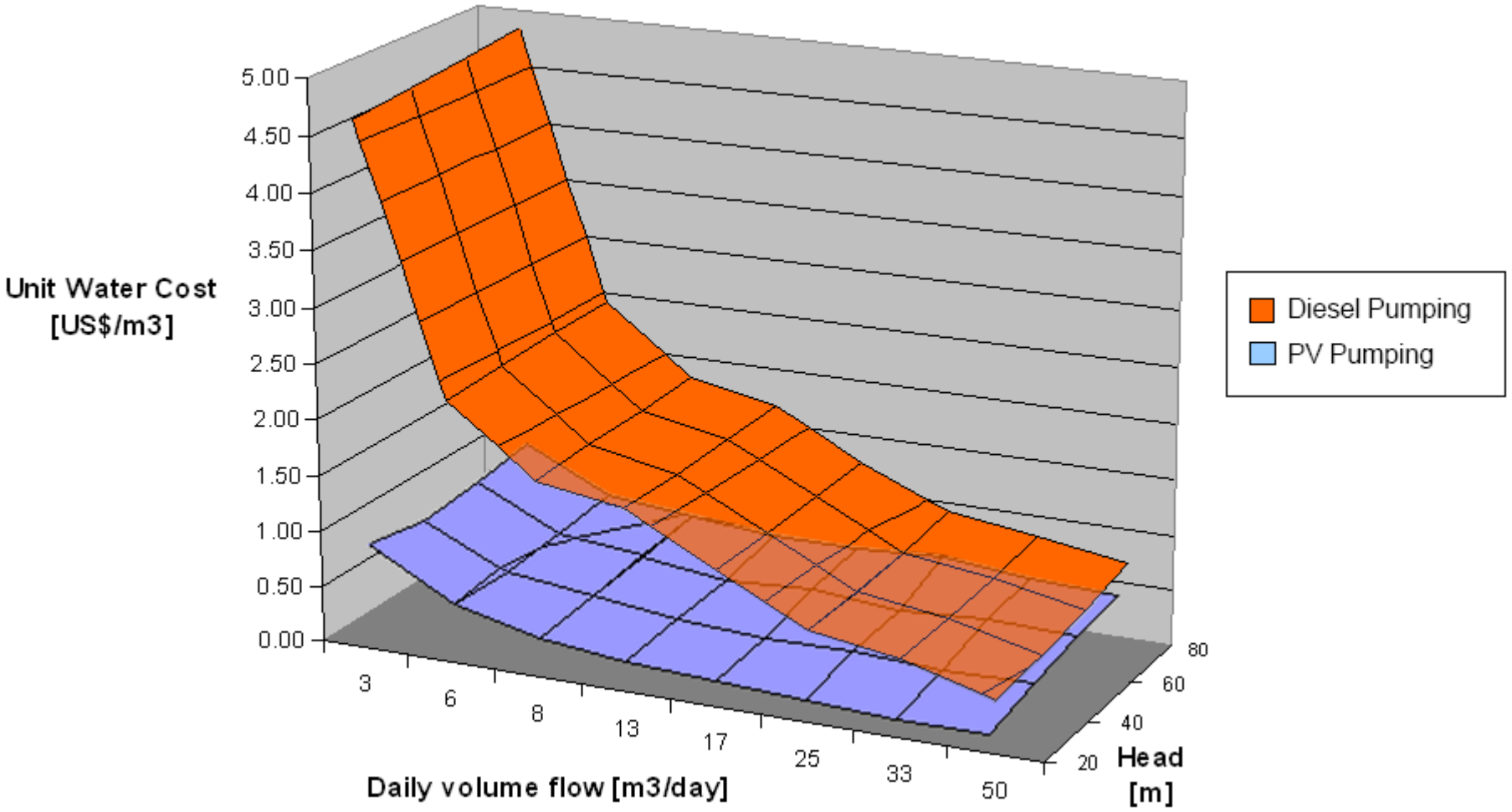
Solar Pumping



Diesel Pumping



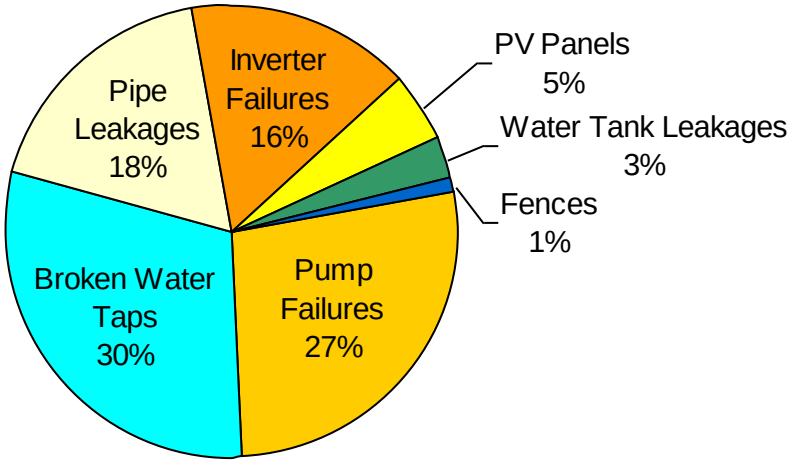
Unit Water Cost



Known Problems of PV Pumping

-PVP is a mature technology with very low failure rates. Mean time to failure rate of PV components is almost 9 years.

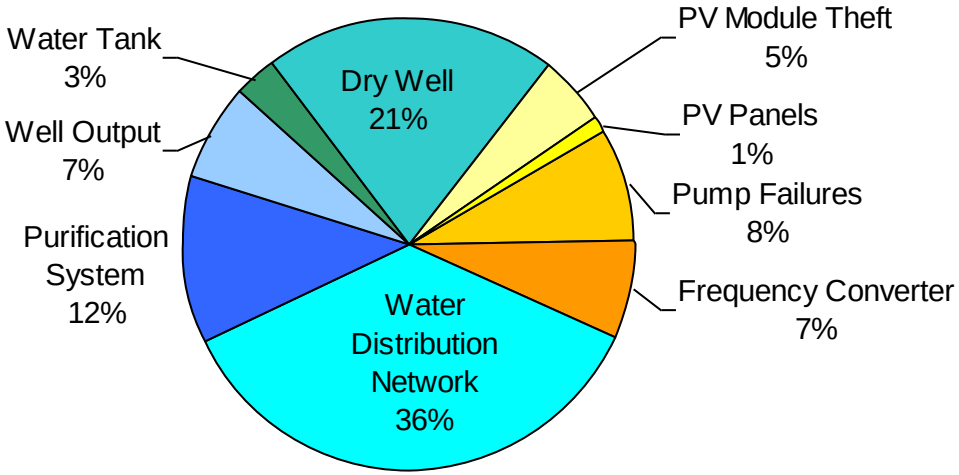
-Water distribution component are more prone to failure and can lead to the collapse of whole systems (MTTF 2.3 years).



Thailand

Evaluation of 500 PVP Units

40% out of operation after 6 yrs due to inadequate post project support



Morocco

49 PV units within 200km evaluated after 12 years, 100% still operational, maintenance system available

6. Recommendations

Increase Support to Governments in Creating Enabling Environments for Rural Water Supply Development

RWS projects need to be embedded in government policies

Role of donors: support the creation of enabling environments (includes licensing, concessions, permits, pricing mechanism, capacity building, incentives, financing schemes, quality assurance, technology advice etc.)

Attract Private Investors to Leverage Available Funds

Where an enabling environment allows private investors to achieve adequate returns up to 70% of required investment can be raised from the private sector.

6. Recommendations

Develop Rural Water Supply Projects at Scale

Sustainable operation requires maintenance service providers. This requires a critical number of pumping systems in a region making repair services economically feasible. To operate on a financially sustainable basis, a maintenance service provider should be able to achieve an annual turnover of the order of USD 50,000 to USD 60,000.

Base Investment Decisions on Life-Cycle Cost of Rural Water Supply Infrastructure

Investment Decisions taken on the grounds of initial investment costs result in too high operational costs for rural communities. Sustainable operation requires low life-cycle costs.

6. Recommendations

Consider the whole Water Chain to Guarantee System Reliability

PVP technology has very low failure rates. Where PV contractors are not in charge for the whole water chain, system break downs are often related to leaking tanks, pipes, or broken taps.

Contacts

Thomas Meier – tmeier@bluewin.ch