



Energy Efficiency in Water Pumping – An Important Tool for Cost Recovery for the Water Authority of Jordan



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Structure of Presentation

- Introduction: The Project IEE
- Energy Audit
- Energy Performance Contracting (EPC)
- PPP „Piloting EPC“
- Summary and Outlook



The Project “Improvement of Energy Efficiency of WAJ” (IEE)

- **Budget:** total volume of 1.283 Mio. JOD
- **Funding:** German Ministry of Environment, based on initiative within the Joint Steering Committee of German/Jordanian Min of Environment
- **Objective:** Improve Energy Efficiency of WAJ in the MG
→ reduce (specific) electricity consumption
- **Activities:**
 - Conduct Energy Audit for major electricity users in MG (Baseline: 80 GWh, 5% of total WAJ consumption)
 - Develop measures to reduce electricity consumption
 - Develop institutional concepts for implementation (direct procurement with extended maintenance, Energy Contracting models)
 - Implement measures





Energy consumption of WAJ as key issue

- For energy sector: WAJ consumes 15% of all electricity used in Jordan: 1,590 GWh out of approx. 10,500 GWh (excluding grid losses)
- For WAJ: Energy costs are major factor in cost structure: Total electricity costs for WAJ approx. 60 Mio. JOD/a
- For the environment: production of electricity induces greenhouse gases and contributes to global warming; Energy mix in Jordan for electricity production: 60% gas, 40% oil → approx. 1'700'000 t CO₂/a for WAJ
- For public finances: WAJ receives electricity at subsidised prices



Energy Audit: Methodology

- A) Pump Performance Test**
- B) Electro-Mechanical Investigations**

Detailed Investigations

1. *Flow, pressure & electricity measurements*
2. *Establish specific Energy Consumption*
3. *Measure System Performance*
4. *Calculate System Efficiency*
5. *Establish Energy Saving Potential*
6. *Calculate required investments*



Energy Audit: Major Problems Identified

- LCC* not applied for procurement of pumping equipment
- Cost efficient operations not always applied in WAJ
- Operation pattern to maximise production, not to optimise cost
- No regular inspections & overhauling of pumps
- Fragmented organisation structure in WAJ (many divisions involved)

* **Life Cycle Cost**



Energy Audit: Summary of the Results

- 4% to 65% energy saving potential
- 21 million kWh per year (25%), JOD 935,000 per year
- 4 years to 13 years Pay-back periods
(recommendation: less than 15 years for equipment)
- Reduction in CO₂ emission 15,700 t CO₂ per year
(1 kWh = 0.728 kg CO₂ emission)



Change in Institutional Setting needed

- The assessment within IEE has shown that proper O&M of pumping stations is indispensable to achieve energy savings.
- Automation of pumping schemes corresponds to the state of art and is proposed.
- Attractive option: outsource O&M and, where possible, investment to private sector/ pump suppliers → Institutional changes needed, not only investment → Energy Performance Contracting (EPC)



EPC: What is Energy Performance Contracting?

- Contractual relation between an Energy Service Company (ESCO) and a facility owner (WAF) ; Target: reduce the facility owners' energy costs
- ESCO bears all project costs defined in the contract.
- The savings in energy costs is used to pay back the capital investment of the project over a certain defined period
- Not a predetermined technical solution or a single method for energy savings, but rather of a service innovation.
- It is common to see large capital improvements financed through energy savings projects



EPC: Contract Objectives

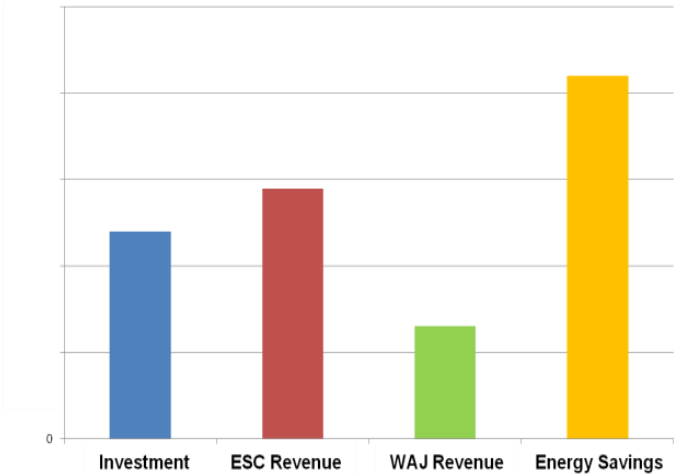
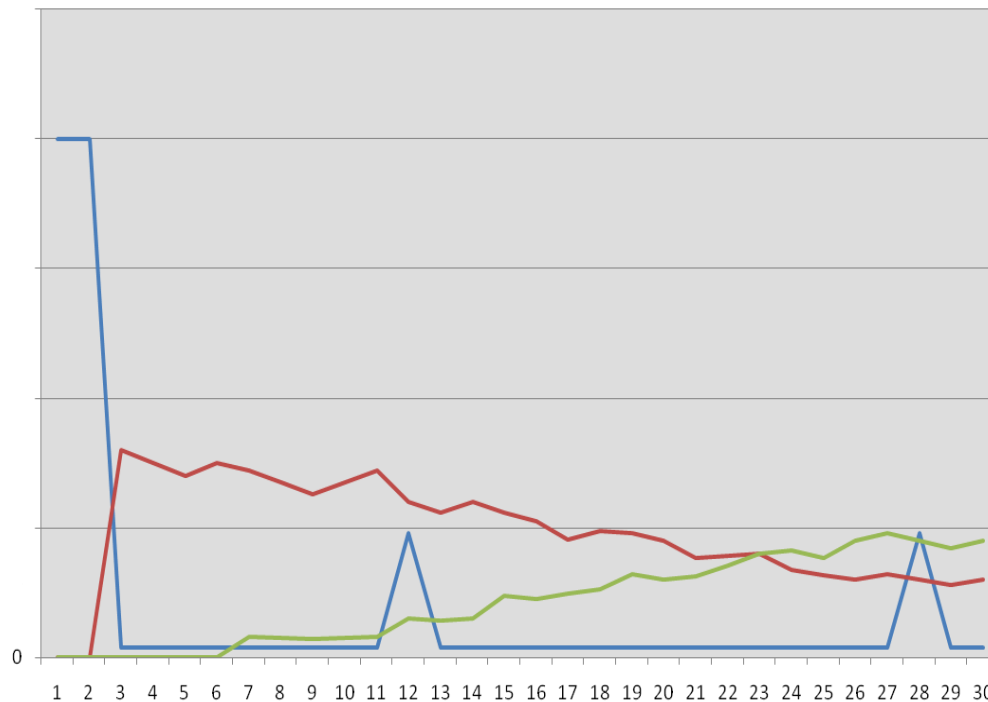
- Reduce energy consumption and costs as part of a comprehensive energy saving strategy
- Improve pumping, mechanical and electro-technical equipment of the pumping station
- Improve operations management and performance monitoring
- Deliver excellent results on repairs and maintenance
- Boost staff productivity and energy saving capabilities



EPC: Application Khaw Pumping Station

Example EPC project dynamic between investment and ESCo revenue for Khaw Pumping Station

Investment / Revenue



- Investment (JOD)
- ESC revenue
- WAJ revenue

Quarters



PPP “Piloting EPC” – The Reasoning

- Energy Audit showed: new equipment not sufficient, also institutional change needed, but no experience with Energy Performance Contracting
- Exposure to risk for private sector and WAJ with lack of knowledge about critical issues
- Hence required: Pilot project to learn how model can work, what improvements can be expected in reality, what potential bottlenecks might be of relevance



PPP “Piloting EPC” – The Approach

- Pilot project: pumping equipment and operations → pump producer (WILO) joined hands with local consulting/ engineering (Engicon)
- PPP Contract with GTZ (50% of costs paid by GTZ, 50% by private partner)
- MoA with WAJ/ GTZ about responsibilities (project boundaries, operation, repairs, seconded staff etc.)
- Since December 2009: staff training, in March 2010 equipment was installed, since then also O&M
- Regular meetings with WAJ, GTZ and WILO/engicon



PPP “Piloting EPC” – Results, Impacts, Visibility

- March – September 2010: average 40% energy saving in Bakoria
- 7% additional water pumped with 36% less electricity used
- Energy cost savings of 60,000 Euro p.a. expected; water purchasing cost reduced 40'000 p.a.
- CO₂ reduction by approx. 1'200 t/a
- Lessons learned about critical issues (which staff to be seconded, operation of pipeline, etc.) to be included in full EPC approach



Some pictures of the Pilot Pumping Station



before



Visit of Secretary General of WAJ

After





Summary IEE and outlook

- Huge energy saving potential identified
- Pilot project in Bakoria showed: potential can be reaped with EPC
- Concept for other EPCs developed
- 6 companies prequalified for Khaw EPC, tender to start soon
- New specifications for the procurement of high quality pumps developed
- High visibility in media (local newspapers, DW-TV)
- Energy saving gained in importance within WAJ
- New projects also with other organisations planned (JICA, KfW)
- → Triple Win: for WAJ (new equipment, cost savings), for private companies (profit) , for the environment (CO2-reduction)



Thank you for your attention.

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