Retrofitting Existing Electromechanical Pump Installations to Solar Power

water mission

Why Retrofit?

Water Mission has installed well over 1,000 new solar powered pumping systems. Now that use of solar has become proven, we've had increased calls for retrofitting existing systems to solar.

Common Applications for Retrofitting:

- Refugee/IDP camps
- After a disaster
- Community water systems

Why Retrofit?

Tanzania

Puerto Rico

Why Retrofit?

Common reasons for a solar retrofit:

- Reduce costs
- Reduce dependence on fuel supply and logistics
- Reduce reliance on generator
- Reduce reliance on grid power
- Build resilience in the face of future disasters

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Information will be needed on the following:

- Pump
- Generator
- Borehole
- General system
- Information for installation

Pump Information

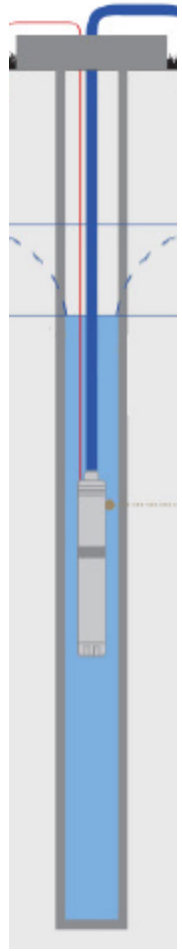
1. Pump information:
    a. Make:
    b. Model:
2. The existing power requirements of the existing pump:
    a. Single Phase or Three Phase?
    b. Pump voltage?
    c. Pump wattage (or Horsepower)?
3. Pump flow rate?
4. How many hours per day is the pump required to run to meet water demand?

Generator Information (if existing system is powered by generator)

5. Generator information:
    a.Make:
    b.Model:
    c.kVA:

Borehole Information

6. What is the intended (or expected) water production (volume) from the borehole per day? Does this fluctuate with the seasons?
7. What is the tested yield of the borehole (preferably maximum safe yield)?
8. When was the yield and drawdown test performed?
9. What is the dynamic water level of the borehole? Does this change with seasons?
10. Where will the water from the borehole be delivered to (where is the storage tank and how does the water get there)?



General System Information

11. What is the required standard for water supply per person for this project?
12. Is there an existing water storage tank? What is the ratio of daily water demand versus the tank volume size?
13. What is the current water treatment method at the borehole?
14. Has there been satisfaction with the current function of the water system? If no, what are the concerns?
15. Has there been satisfaction with the equipment (procurement, performance, support)? If no, what are the concerns?

Information for Installation

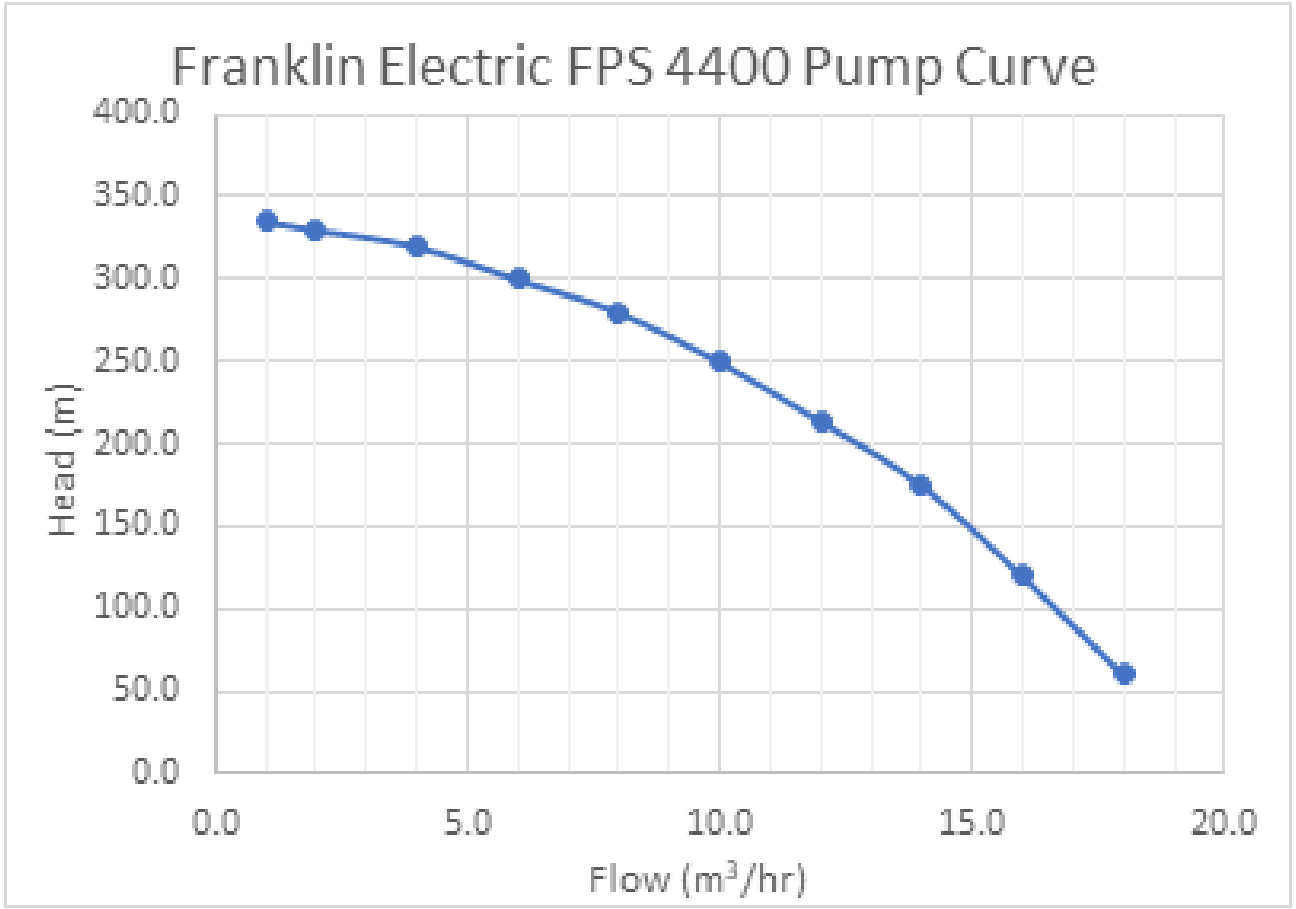
16. What space is available for the solar array?
17. What type of security for the solar array will be needed (perimeter fencing, elevation of panels 2m, securing panels within rack using welds or anti-theft bolts, etc.)?

Example from Puerto Rico Hurricane Maria (2017)

- Existing AC grid powered water distribution system that produced about 75 m^3 per day to the community prior to the hurricane
- Hurricane Maria did extensive damage to the power grid throughout Puerto Rico which left this water system with no power
- Even prior to the hurricane this community experienced disruptions in the power supply through their grid connection
- In the hurricane response, a donation was received to install solar power to provide a more reliable power source to this water system

Pump Information

Make: Franklin Electric
Model: FPS 4400
Three Phase
230 VAC
20 hp (15 kW)



Borehole and System Information

Based on discussions with the water system operators and our own analysis of the system:

- System was producing 12.5 m^3/hour
- 12.5 m^3/hour over 6 hours = 75 m^3 to achieve their daily water demand
- Adequate information was available to show borehole performance was appropriate
- The existing system met required standards and expectations of the community, **with exception of power supply**

Great candidate for solar

- 6 hours required run time achievable on solar alone
- Adequate space existed near the existing water system to install a solar array
- Agreement was made to fence the solar array upon completion
- Community leadership was in support
- Funding existed for the retrofit

Retrofit

- Reused the existing pump, as well as the piping, water treatment, and water storage
- Added Grundfos 15kW RSI (VFD inverter)
- Added solar array of 72 panels (panels were rated for 345W and arranged in 9 strings of 8 panels in series)
- Appropriate disconnect and changeover switches were added so that AC grid power could be used in future

Retrofit

Options to size array and check water production of system on solar:

- Manufacturer proprietary software (in our example, Grundfos)
- Water Mission has its own design methods based on fulfilling internationally recognized standards (IEC) and on leading manufacturers methods (Grundfos, Lorentz)
- These calculations are detailed in the *Solar Powered Water System Design and Installation Guide* that Water Mission has released with UNICEF (available at: https://globalwatercenter.org/solar-guide-access/)

Two common questions on this example:

- What if the daily water demand cannot be produced in a solar day?
- What are the some of the considerations to mixing different brands of equipment?


Questions

Thank you!

water mission

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