Advancements in Solar Water Pumping
Building next generation water solutions

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Scene setting – solar pumping goes mainstream

The Solar Water Pumping Company

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VIDEO

Solar Pumping: A Cheaper and Cleaner Way to Access Groundwater

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Water supply: a global challenge

- more water needed for **people, crops & animals**
- Changing weather patterns, resources stretched
- Pumping water requires **energy**
- Fossil fuels are **expensive and are not sustainable**
- Grid power often **not available** of **bad quality** or **not reliable**

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So what do we see driving
solar water pumping deployment today?

Price of PV

- PV prices have dropped by 10x

- Almost any size of solar pump system is feasible

- Grid parity price is reached in many countries

- For pumping ROI is fast, always <2 years against a diesel generator

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Energy (water) security

- Degree of reliance on the grid

- Political influence on fuel and power

- Increasing awareness of natural disasters (fire / flood / earthquake / tsunami)

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Energy (water) security

- Water is dependent on external factors
  - How stable is your grid connection ?

- Availability of fossil fuels is not secure
  - Global politics
  - Refineries

- Delivery of fuels are a risk

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Operating costs

- Consideration of lifetime costs
- Cheapest today might hurt later
- Much more considered investments with a long term view

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Operating Costs

- Are always increasing

- Need to be minimized

- Funding for legacy projects is less available (not news worthy)

- Engaging private partnerships

Solar water pumping solutions

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Smaller Communities – PS2 range

- Maximum efficiency
- DC brushless motor
- Full monitoring and managment capability
- Very reliable
- Long life expectancy
- Hand pump replacement
- Livestock
- Small scale irrigation

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Ground Water Extraction – PSk2

- Solar direct systems
- Optimized controllers to mazimize yields
- Up to 30kW per pump - head up to 300M
- Hybrid solutions available
- Perfect for large communities and urban water supply

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Irrigation – PSk2

- Transformational technology
  - Fields from deserts
- Multiple pumps for very high flow
- All irrigation methods
  - Drip
 - Sprinkler
  - Pivot
- „Growing prospertity"

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Advancements in Solar Water Pumping
Solar and pump basics, system design

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Thinking about solar pumps

- Our power source is variable
  - Power varies through the day
  - We have seasonal differences
  - Weather changes power

- We design for solar direct
  - Let the intelligent controller make the best of the available power
  - Dedicated PV for the pumps (no sharing)

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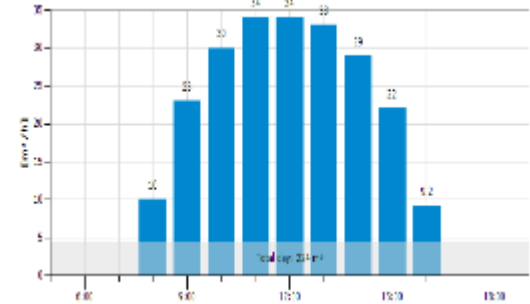
Thinking about solar pumps

Water per day

Historically pumps have been specified based on the flow they deliver per minute or hour.

With solar pumping you are looking to maximise the water pumped while the sun shines. For this reason gallons per day is the critical measurement.

Always talk about customer **requirements per day** rather than per hour to avoid confusion

Store water not electricity

Relying on batteries to pump water overnight introduces cost and complexity to a solution.

Batteries are heavy, expensive, difficult to transport and dispose of and have a limited (3 year typically) life.

Storing water in an elevated tank is efficient and means water is always available

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A simple solar pumping system

Digital pump controller optimizes pump running to available power

Water for people , crops and animals

Systems can be managed and monitored remotely

High efficiency pump either in a well or in a surface water source

Water storage for 24 hour operation – no batteries

PV modules generate electricity

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Real world components

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Advancements in Solar Water Pumping
Solar and pump planning

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Product range available today

450m (1800ft) of Head

550m³ (2200usg) / hour

<$1,200 Selling Price

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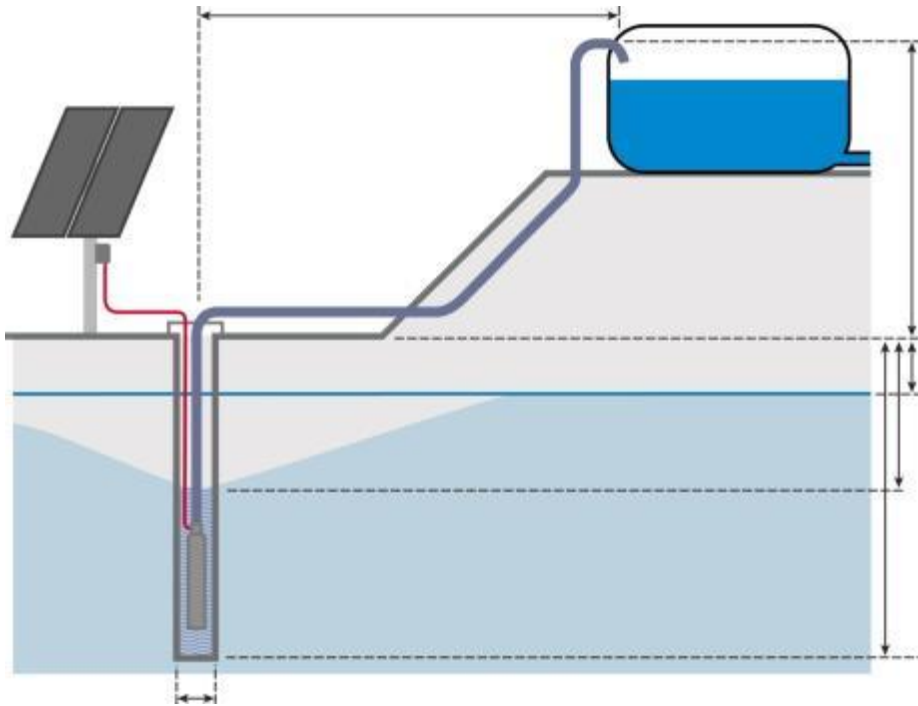
Pump terms

Static head (=static lift)

The Vertical distance between:

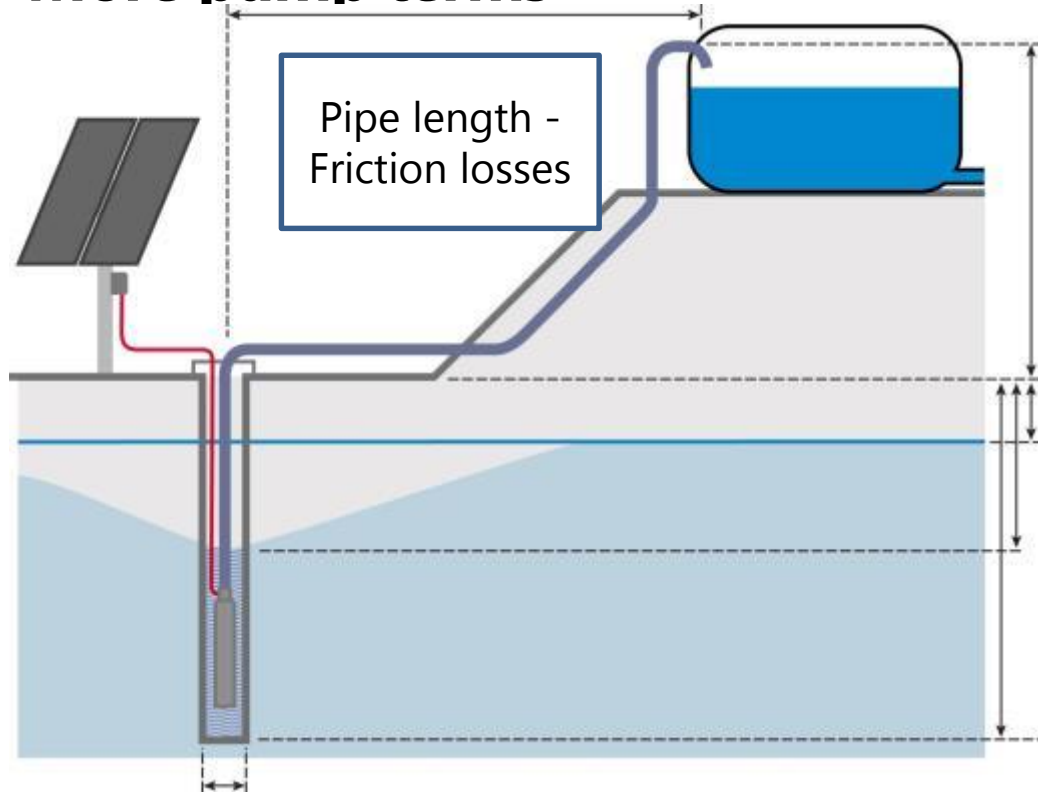- Lowest point of the water source (dynamic (pumping) water level)

   and

- Highest point of water delivery (e.g. top of a tank)

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More pump terms

Static water level

Dynamic (pumping) water level

Drawdown

More pump terms
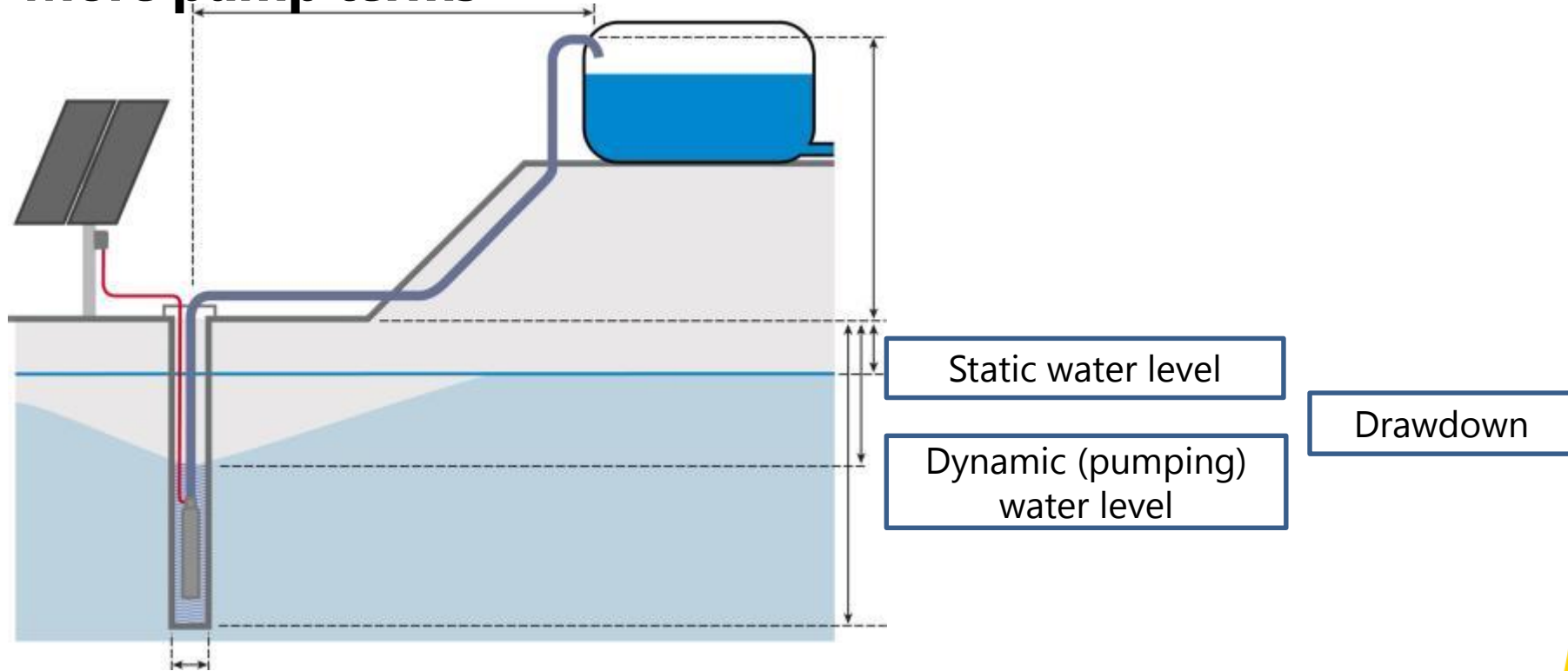
Pipe length - Friction losses

Total Dynamic Head

=

Vertical lift

+

Pipe length - Friction losses

+

Pressure required (bar x 10 = m)

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Concept – LORENTZ system components

Solar generator or
Solar array

Controller + pump unit
= **Pump System**

Pump end

Controller

Pump
end +
motor =
**Pump
Unit**

ECDRIVE – DCMotor

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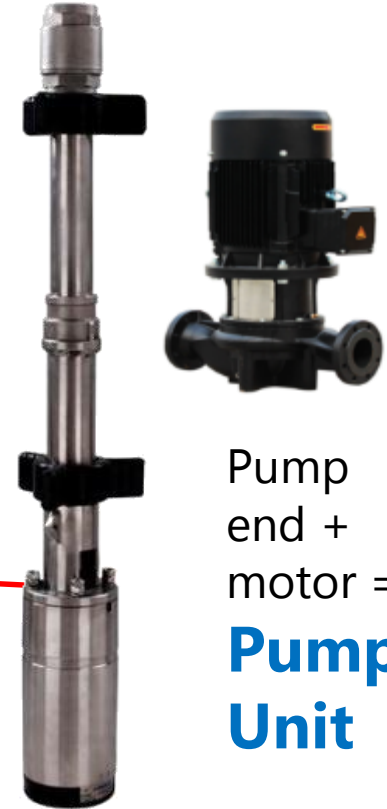
LORENTZ sizing SW COMPASS

- Location
- TDH <u>or</u> static head and pipe length
- Required daily flow

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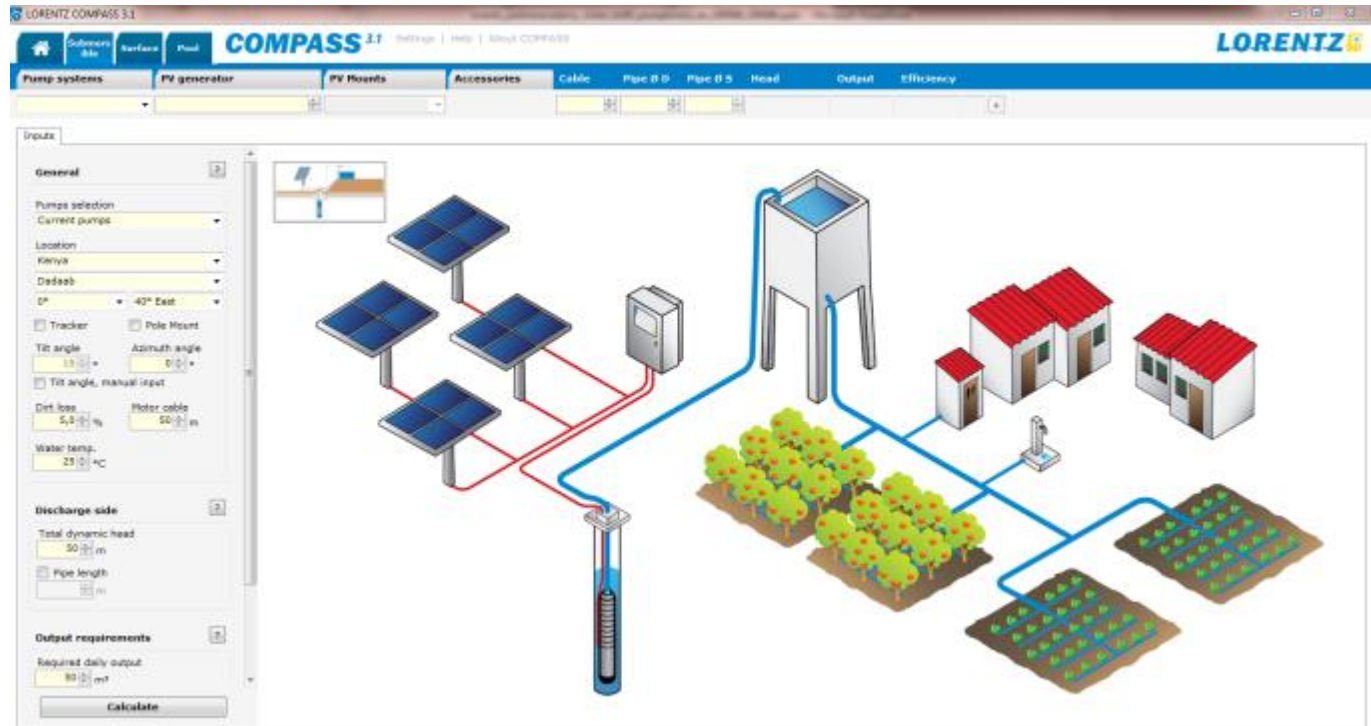
Advancements in Solar Water Pumping
The right match of system components is important!

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Efficiency example – motor technology
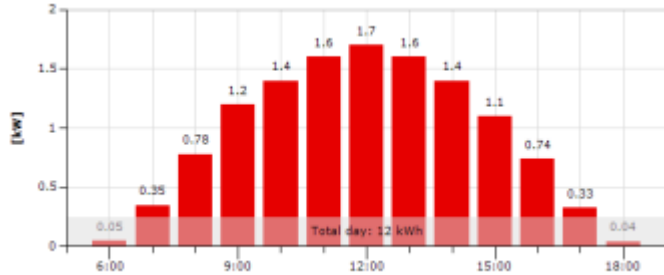
Average day in Jaipur
12kWh of energy from 2.6kWp of modules

Then we map on the motor efficiency
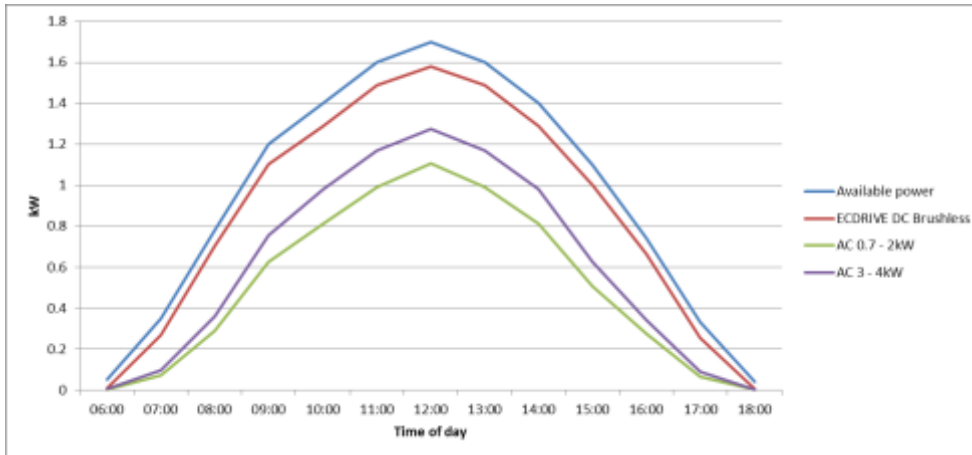
Average day efficiency
ECDRIVE = 91%
AC <3kW = 53%
AC >3kW = 64%

For the equivalent of 2.6kWp on the ECDRIVE
AC <3kW needs 4.4kWp
AC >3kW needs 3.7kWp

LORENTZ ECDRIVE motor

- DC brushless motor
- Very high efficiency across a wide power range
- DC brushless motors are a perfect match for solar generators (variable power available)
- 20-30% better peak efficiency
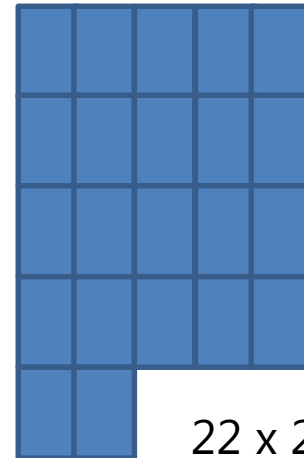- Variable nature of solar means >40% better avg. efficiency

Efficiency 1-6HP (0,7-4kW) submersible Motors
AC vs. brushless DC Motor
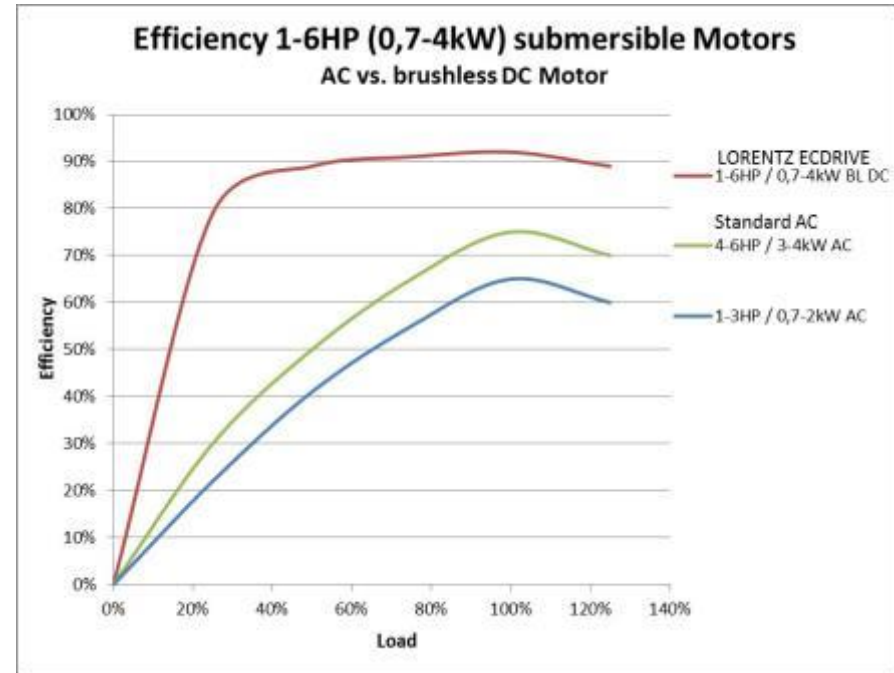
What does efficiency look like?

- To achieve the same water output (28,000 gallons/day)
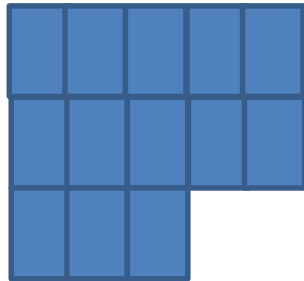
AC motor competitors

13 x 200Wp modules

22 x 200Wp modules

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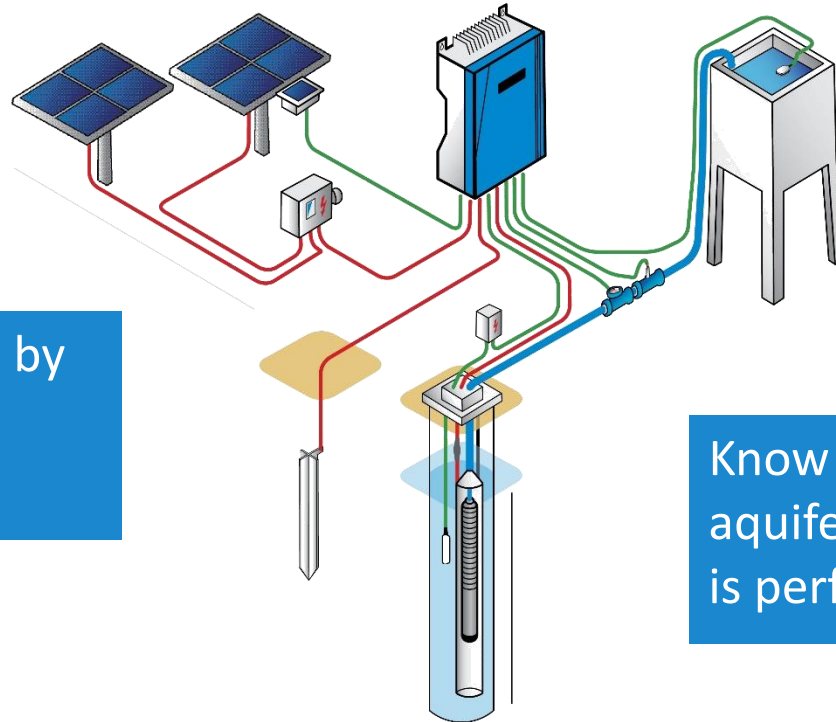
But modules are cheap, does it matter?

- Modules +
  - Space - lost agricultural area
  - Transport of extra modules and racking
  - Mounting system
  - Cable and wiring
  - Installation time

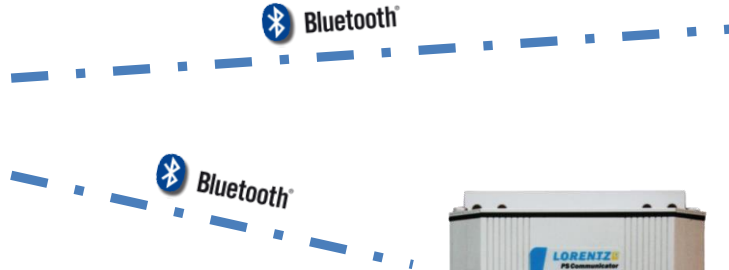**Sun. Water. Life.**

Making sense of sensors

Know how much water there is in a tank

Control pump by water level

Know how the aquifer / borehole is performing

All LORENTZ products are CONNECTED

Bluetooth

Bluetooth

PumpScanner

*pump*MANAGER

Cellular / mobile network
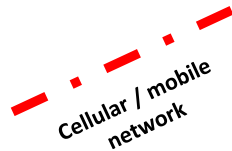
PS Communicator

- Fully integrated DataModule on mainboard

- New extended protocol for more data collection
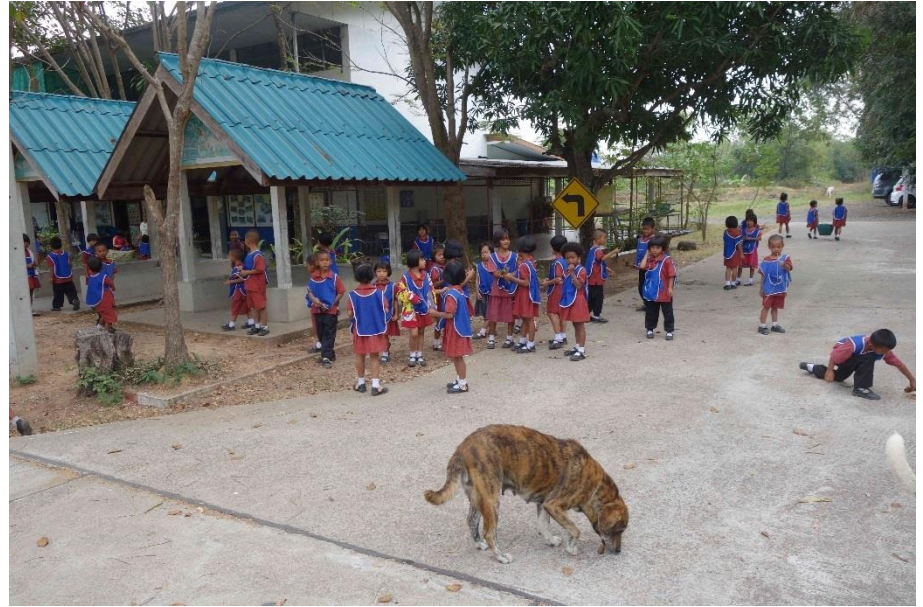
- Higher sensor resolution

- Improved diagnostics

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Small scale in Laos

- Low pressure drip
- Small tank for 24 hour irrigation

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Thailand temple & school water supply scheme

- 30 m3 water per day @ 20 m TDH
- Water for 15 monks and 100 students

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Thank you for your attention!