# Water-Energy-Food Nexus research in Aral Sea Basin



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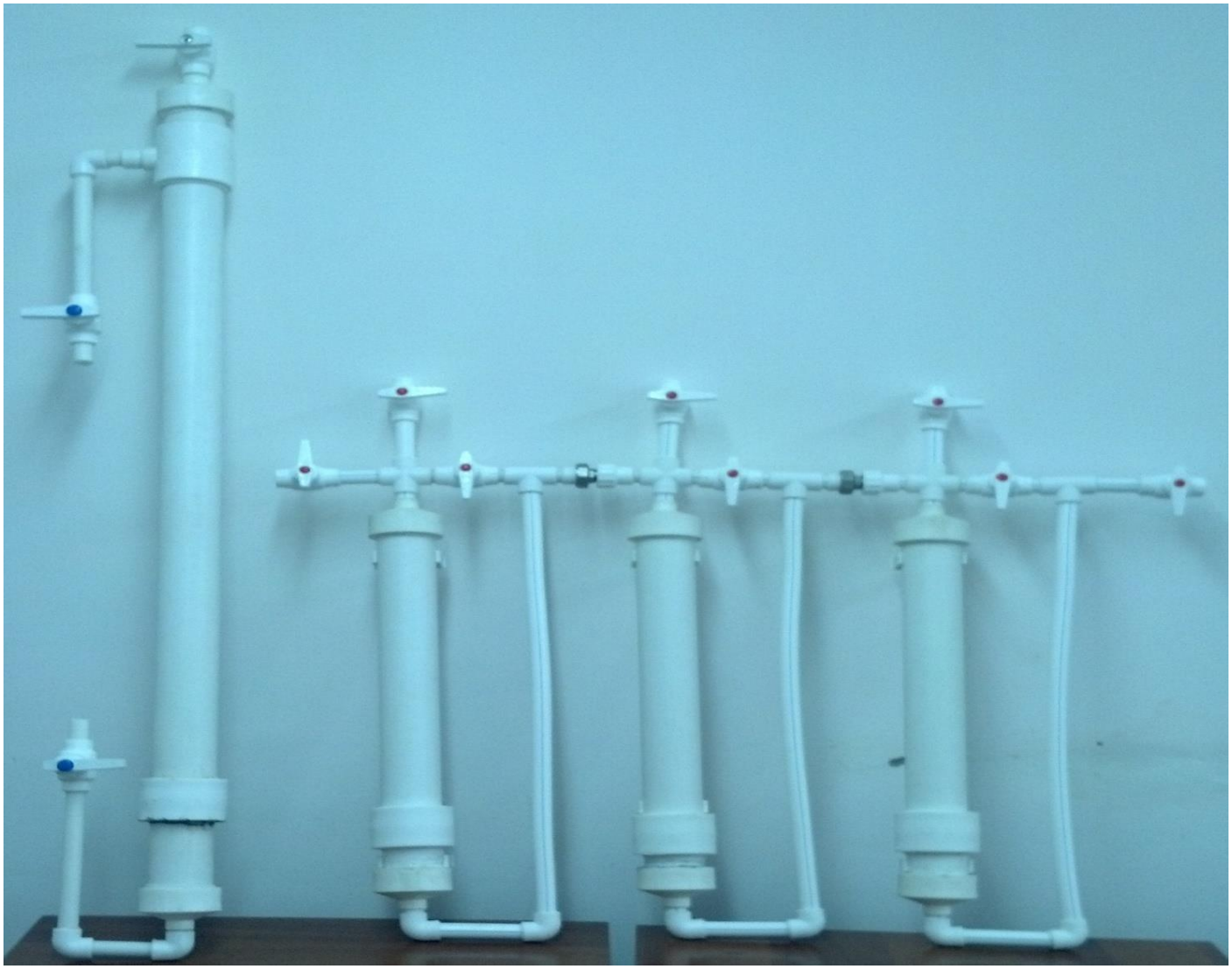
# *1) Hybrid Wind-Solar Water Desalination in Aral Sea basin (project development stage)*

- Continental cold arid desert climate
- Mean annual temperature **13.4°C**
- 320 sunny days per year
- Total mineralization = 1800 mg/liter
- Ground water toughness =
- 10-25 mg / liter
- Water salinity 10-fold increase (from 10 to >100 g)
- Hydrogen parameter  pH = 8.5

# Local needs:

1) **Clean water** with low level of salinity
2) **Green energy** generated from solar – wind power in a decentralized way
3) **Socio-economic model** – choosing the best matching technology to ecological conditions of Aral Sea basin

# Current experiments:



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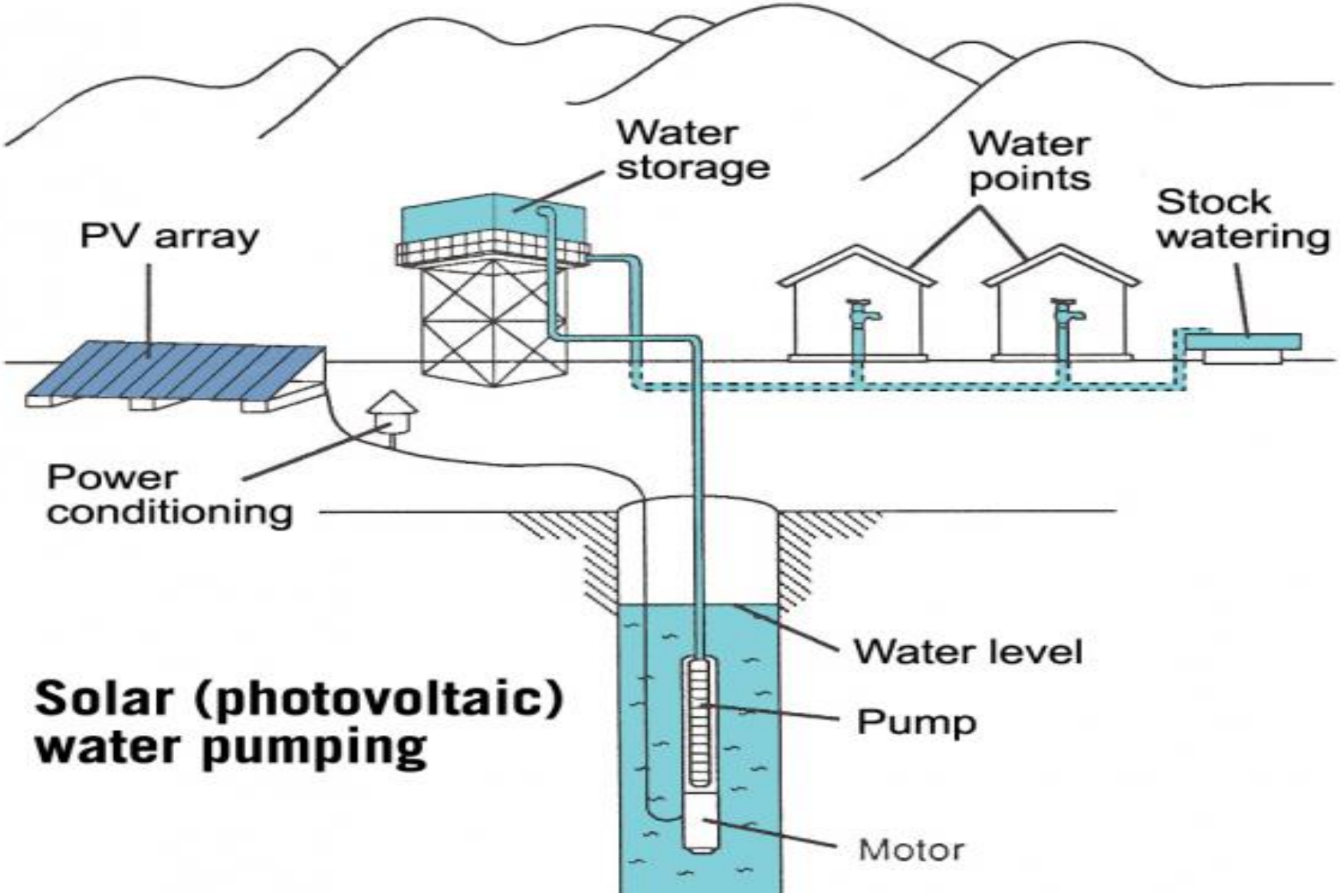
# Research specifics

- 3 step desalination process
- 36 litres/hour ground water desalination
- sediments, salts, microbes are removed
- Salinity decreases from 20 to 1 mg-eq/l
- Easy to apply in households
- wind-solar energy should be integrated with ground water pump

# Options under revision



# Impact

- Clean drinking water for community
- Increased human well-being in rural communities
- Tackles medical diseases resulting from ecologically un-clean water
- better socio-economic life conditions

# 2) Biogas Production from Agricultural Wastes in the Aral Sea Basin

- Funded by REPIC (Renewable Energy Promotion in International Cooperation)
- Project duration: 2016-2018

*Location specifics:*

- Continental cold arid desert climate
- Mean annual temperature **13.4°C**
- 320 sunny days per year
- Agriculture oriented region

# Field-trip to farms

- Situational analysis and data-mining trips to livestock famers

# The solution must be:

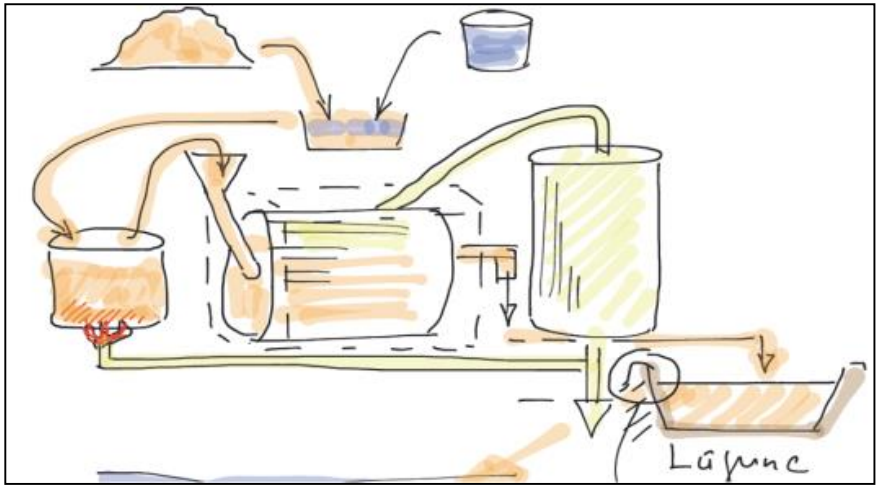
- **Practical:** manure is mixed with stones and sand in stables
- **Flexible:** organic wastes are heterogeneous (solid, dry, liquid, mixed with inorganic…)
- **Well isolated**: it is a sharp-continental climate zone
- **Simple and cheap:** farmers have limited technical knowledge and finances.

# Bottlenecks

- **Sedimentation and clogging**
- **Temperature fluctuations** due to poor insulation
- **Very short retention period**
- **Extensive water use** ($CO_2$ production rather than methane)
- **Air-compressed loading of the biomass**
- **Poor circulation and mixing in the digester**

# Options under revision

a)enhancement




b) Container solution


c) Plug flow

# Water-Energy-Food Nexus impact of biogas & bio-fertilizers:

1) Yield increases by +20%
2) Water consumption decreases by -15%
3) Land is protected from wild plants
4) Chemical fertilizers are not utilised
5) Land mineralization decreases
6) Fossil fuels are not used for cooking

# Project partners:

KRASS
Khorezm Rural Agricultural Support Service

Khorezm Mamun Academy

Urgench State university
good thoughts, good words and good deeds

# Thanks for your attention !