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Solar energy and water supply services in West Africa

Lessons learned, challenges and ways forward from a workshop held in Senegal, January 2018

A workshop in Senegal

- Involving participants from 3 Sahelian countries, with representatives from: ministers and other governmental institutions, local authorities, operators of local water services, experts of solar energy for water supply, NGOs
- Sponsored by the SEDIF
- Objectives of the workshop
  - to take lessons from various experiences
  - to identify the main challenges
  - to formulate recommendations

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Reasons to choose solar energy for small water supply services

- Big solar potential in Sahelian countries (5,5 kWh/m²/day)
- Energy is the main part of the operational cost of water services (until 50 %)
- Limited development of electric power network and high cost of eletricity produced by thermal generator (cost of petrol)
- Solar energy contributes to reducing the emission of greenhouse gas

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Major technological evolutions the last years

- **The output power** of solar modules has considerably increased, rising from 50 Watt peak (Wp) /m^2 at the end of the 1970s to 300 Wp /m^2 in 2017.
- The cost of a solar module has fallen tenfold in 30 years, dropping from around €10/Wp to nearly €0.5/Wp.
- It is now possible to **extract** groundwater from depths of over 100 meters using the new generation of submersible pumps.
- **Hybrid pumping systems** (thermal and solar) and advanced inverters are now available.

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3 main options available for hybrid (or combined) systems:

- **Full solar power**: solar pumping only.
- **Hybrid with 75% solar**
- **Hybrid with 50% solar**

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Criteria for determining the suitability of the solar option for different sized settlements

Settlement Size	Average water demand (15l/c/d) M^3/day	Full Solar Power	Hybrid: 75% Solar	Hybrid: 50% Solar	Electric power
Less than 400 to 1,000 inhabitants	9				
From 1,000 to 2,500 inhabitants	26				
From 2,500 to 6,000 inhabitants	60				
From 6,000 to 10,000 inhabitants	120				
From 10,000 to 20,000 inhabitants	250				

Recommended To be assessed To be discounted

Investment costs of equipment for solar pumping systems

Settlement Size	Average Water Demand (15l/c/d)	Estimated Cost Range		
	M3/day	Low TDH 30-50	Average TDH 50-80	High TDH 80-120
From 200 to 1,000 inhabitants	9	from €1,500 to €2,000	from €2,200 to €3,500	from €3,500 to €5,200
From 1,000 to 2,500 inhabitants	26	from €3,000 to €4,000	from €6,200 to €10,000	from €10,000 to €15,000
From 2,500 to 6,000 inhabitants	60	from €5,500 to €6,000	from €12,000 to €18,000	from €18,000 to €22,000
From 6,000 to 10,000 inhabitants	120	from €10,000 to €12,000	from €22,000 to €25,000	from €25,000 to €30,000
From 10,000 to 20,000 inhabitants	250	from €25,000 to €30,000	from €30,000 to €33,000	from €33,000 to €37,000

Comparison of operation costs

	Energetic costs	Maintenance	Provision pour renewing
Solar energy	0%	≈8%	≈31%
Electric power	≈26%	≈17%	≈2%
Thermic energy	≈54%	≈18%	≈12%

Source: Datas from 11 services from the region of Saint-Louis in Senegal (ONG Gret – Sénégal)

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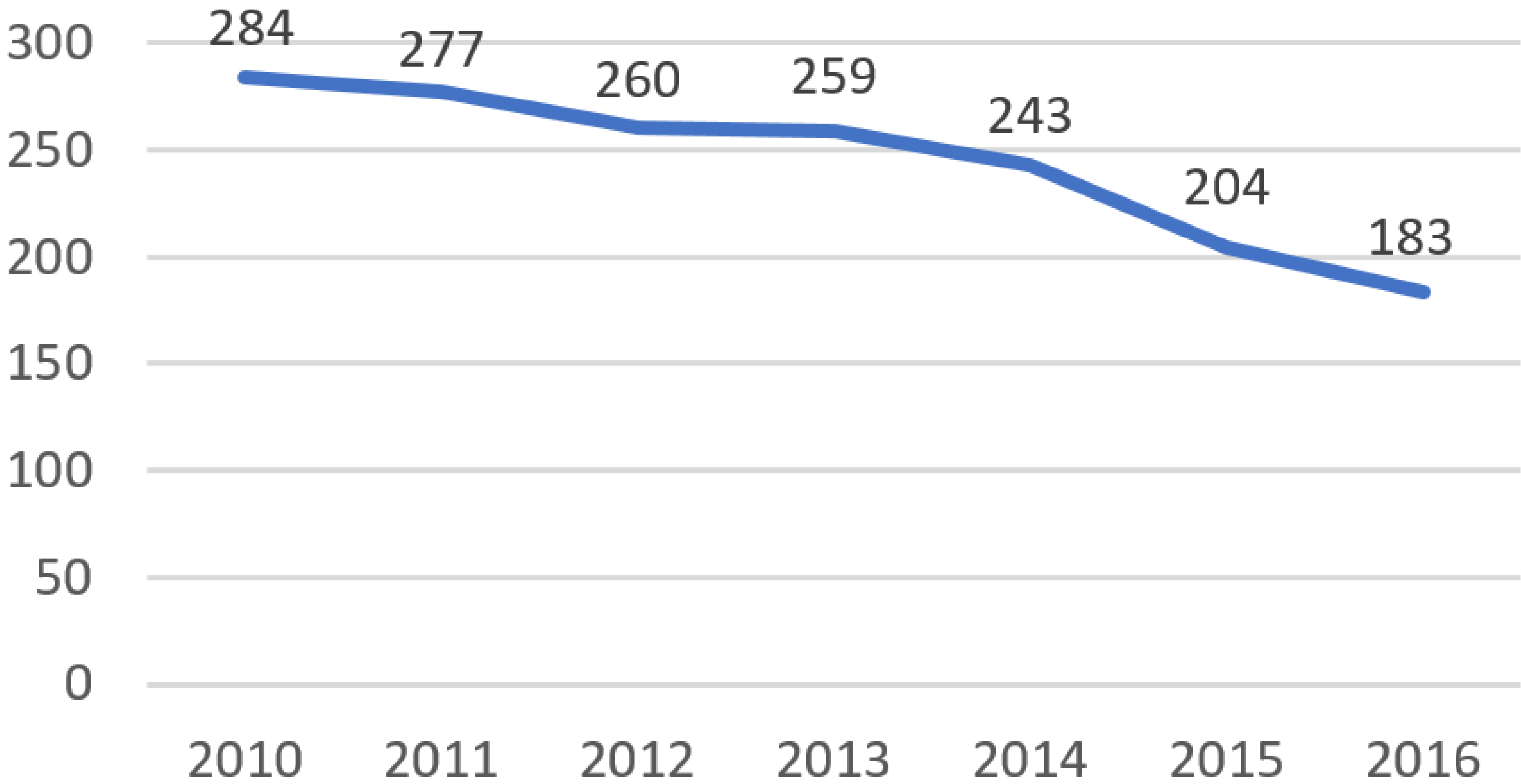
Average cost per m³ in, Mauritania after introduction of solar energy (in MRU/m³)



Challenges and recommandations

- **Systematically conduct a comparative analysis of the various energy solutions** as part of projects' technical studies.
- **Prioritize the technical capacities and traceability of equipment** over price.
- **Develop training courses/modules** on pumping and photovoltaics (installation, maintenance, monitoring)
- **Consider using hydraulic storage against the use of batteries**

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Thank you for your attention

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For more information on solar energy for small water supply systems:

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