Solar powered irrigation systems in the Arab region: Reflections on case studies

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OUTLINE

• The Frame conditions
• Selected examples from current experience
• Issues to be addressed
• Concluding remarks and the way forward
Ideally SPIS works:
• as a comprehensive package: Technical – Economic – Social
• Well regulated
• With a clear policy
• Well monitored
THE BENEFITS AND RISKS OF SPIS

A climate-friendly, reliable and affordable alternative

- Rural electrification
- Access to renewable energy
- Independence from unreliable energy supply and volatile prices
- Reduced costs of production
- Improved access to water
- Potential for income diversification and increases in productivity

Yet it may be a curse for water resources

- May exacerbate groundwater depletion and water scarcity because of unregulated abstractions
- May not be competitive in light of energy and agricultural subsidies
- Requires access to finance, especially for small-holders
- Requires technical know-how and service infrastructure
- Skepticism whether technology is reliable
Technical options that appear beneficial at the conceptual level can have unintended consequences in practice, and policies focused on issues of scarcity and efficiency may exacerbate other dimensions of poverty and inequality.”
Growing fast, with a booming market
Faster than policies and regulations
A few comprehensive assessments: which purpose does it serve in theory and what happens on the ground

SPIS in the Arab Region
Morocco case study

Investigate SPIS impact on water consumption and farmers socio-economics in 3 pilot areas

- Clear National policy on REEE: 52% horizon 2030
- SPIS driven by removal of energy subsidies on fossil.
- Conversion policy 100,000 ha in 3 years with 2.5 Billion MAD
- Conditional SPIS subsidies with drip irrigation targeting small and medium scale
- Capped subsidies

- Case control study: 150 Farmers surveyed, half using SPIS
Findings 1

• High satisfaction 93% with two drawbacks:
  – Pump sizing and capacity (Under-sized generally)
  – Risks of theft

Compared to:
Gas: 22%
Diesel: 8%
Electricity: 24%
Findings 2

- 93% of Non-SPIS farmers would like to convert to SPIS if: access to subsidy and initial capital and access to suitable/flexible payback scheme.

- 86% have no objection to use meters conditional to pump sufficient water needed.

- Only 57% ready to shift to collective wells due to issues of common assets management and risk of conflicts.

  - Trend in water consumption:
    - 30%: increase in Marrakech (no increase in irrigated area)
    - 60% in Tata (Increase in irrigated area + intercropping)
    - No significant change in Midelt (Apple trees mainly).

  - Socio-economics:
    - Payback period: 2.5 - 3 years
    - Return 1000 - 1500 USD/ha
      - mainly gained through reducing production costs
      - Significantly higher than Gas, Grid and Diesel.
Key messages

- Incentivize collective wells
- High risk to subsidize conversion for large farms
- Remote sensing to assess vegetation cover and water use
- Extend uses of solar energy: value addition/off-farm to optimize income and minimize GW pressure
- Safeguard: Selection/restriction of one subsidized PV equipment: upstream control of sizing + Digitalization (crop water requirements)

Need for an adequate governance tool:
- A contract based governance model (inclusive, participatory, accountability)
- Cap the irrigated area
- Cap water volumes extracted

Certified PV equipment
Tunisia Case study

Investigate SPIS impact on water consumption and farmers socio-economics in 3 pilot areas

- SPIS driven by the Energy policy:
- Led by Tunisian Fund for energy transition
- Farmers decision to shift to SE: cheaper energy source or to bypass regulations as illegal wells are not connected to grid

### Diesel and electricity price for agricultural use 2008 et 2018 (Hors taxes)

<table>
<thead>
<tr>
<th></th>
<th>Tarifs en 2008</th>
<th>Tarifs en 2018</th>
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<tbody>
<tr>
<td><strong>Gasoil (mill/litre)</strong></td>
<td></td>
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</tr>
<tr>
<td>Jour</td>
<td>890</td>
<td>1480</td>
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<tr>
<td>Nuit</td>
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<tr>
<td><strong>Electricité pour usage agricole - Basse Tension (mill/ kWh)</strong></td>
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<tr>
<td>Jour</td>
<td>88</td>
<td>121</td>
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<td>Nuit</td>
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<tr>
<td>Jour</td>
<td>96</td>
<td>164</td>
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<tr>
<td>Nuit</td>
<td>76</td>
<td>120</td>
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mill = millime tunisien

SPIS installed between 2010-2017
(Source : Base de données de l'ANME)
An adapted incentive frame

Subsidy scheme

<table>
<thead>
<tr>
<th>SPIS</th>
<th>Subsidies</th>
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<tr>
<td>&lt; 2 kWc</td>
<td>3 500 DT/kWc</td>
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<tr>
<td>2 – 5 kWc</td>
<td>3 000 DT/kWc</td>
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<td>5 – 10 kWc</td>
<td>1 500 DT/kWc</td>
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<tr>
<td>&gt; 10 kWc</td>
<td>1 000 DT/kWc</td>
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</table>

Other incentives:

* Minimum customs fees for equipment not manufactured in Tunisia
* Minimum VAT
Why shifting to SPIS

- Réduction des coûts d'énergie: 22
- Pannes fréquentes pompage_ gasoil: 2
- Eloignement du réseau électrique: 7
- Subventions PV: 12
- Difficulté d'approvisionnement en gasoil: 13
Moins de 0,5 kWc/ha

De 0,5 à 1 kWc par ha

de 1 à 1,5 kWc par ha

2 kWc et plus par ha
24 Farms (10-50 ha) benefiting from subsidies and 4 illegal wells: main crops

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<thead>
<tr>
<th>Gouvernorate / main crops</th>
<th>Number</th>
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<tr>
<td>Gabes</td>
<td></td>
</tr>
<tr>
<td>Oliviers</td>
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<tr>
<td>Gafsa</td>
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</tr>
<tr>
<td>Amandiers/oliviers</td>
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<tr>
<td>Oliviers/pistachiers/fourrages</td>
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</tr>
<tr>
<td>Kairouan</td>
<td></td>
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<tr>
<td>Oliviers</td>
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<tr>
<td>Kébili</td>
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<tr>
<td>Palmiers dattiers</td>
<td>4</td>
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<td>Sfax</td>
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<tr>
<td>Sidi Bouzid</td>
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<td>3</td>
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<tr>
<td>Oliviers/pêchers</td>
<td>1</td>
</tr>
<tr>
<td>Sousse</td>
<td></td>
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<td>Oliviers/amandiers/fourrages</td>
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<td>Tataouine</td>
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</tr>
<tr>
<td>Oliviers</td>
<td>2</td>
</tr>
<tr>
<td>Oliviers/pêchers/figuiers</td>
<td>1</td>
</tr>
<tr>
<td>Oliviers/grenadiers/pêchers</td>
<td>1</td>
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<tr>
<td>Oliviers/maraichage</td>
<td>1</td>
</tr>
<tr>
<td>Oliviers/pêchers/amandiers/figuiers</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
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</tbody>
</table>
Findings 1

No difficulties to maintain
- Faible: 96%
- Moyen: 4%

Limited Recurrence of breakdowns
- Absence de pannes: 92%
- Pannes occasionnelles: 8%

Highly satisfied
- Très satisfait: 67%
- Satisfait: 25%
- Insatisfait: 8%

Ready to further invest in SPIS
- Oui: 96%
- Non: 4%
* All farms use drip irrigation
* 67% use a meter
Source of information and advise

<table>
<thead>
<tr>
<th>Source of information</th>
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<td>Extension services</td>
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<td>Other farmers</td>
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<td>Own experience</td>
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RESERVOIR OR NO RESERVOIR

2/3 of farmers use a reservoir for multiple reasons:
* Cheaper and sustainable than batteries
* Allows for night irrigation
* Autonomy in water supply

Energy used for water uptake and distribution from reservoir
Grounding the technologies

SP origin

- Tunisie: 54%
- Chine: 25%
- Allemagne: 17%
- Autre: 4%
Way forward
More research is needed

• What are the real costs and benefits of SPIS compared with other technologies?
• What rules, regulations and policies are needed to manage the risks and optimize the potential of SPIS?
• What are the viable business models for SPIS?
• How can smallholders benefit from SPIS technology?
More research is needed

• How can the risk of groundwater depletion be addressed effectively?
• How can SPIS empower the poor man and woman and promote social equity?
• What types of capacity development programmes are needed to support farmers, extension workers, the private sector and others?
• What are the opportunities for knowledge exchange and technology transfer?
Concluding remarks

• Remarkable opportunities for Water food and energy security in Arab region and for regional integration to ground a world leading hub in SE technology
• Need to position SE for non conventional resources in a broad sense for sustainability and water security and skate away from the supply management
• Need effective/anticipatory water governance with inclusive and enforced regulations.
Needs a comprehensive Approach: FAO SPIS Tool Kit

- GET INFORMED

- PROMOTE & INITIATE
  - SPIS Rapid Assessment Tool
  - Impact Assessment Tool

- SAFEGUARD WATER
  - Water Requirement Tool
  - Water Resource Management Checklist

- MARKET
  - Market Assessment Tool

- INVEST
  - Farm Analysis Tool
  - Payback Tool

- FINANCE
  - Finance Deployment Tool

- DESIGN
  - Site Data Collection Tool
  - SPIS Suitability Checklist
  - Pump Sizing Tool

- SET UP
  - PVP Acceptance Test
  - Workmanship Quality Checklist

- IRRIGATE
  - Soil Tool

- MAINTAIN
  - Maintenance Checklist
  - Water Application Uniformity Guide