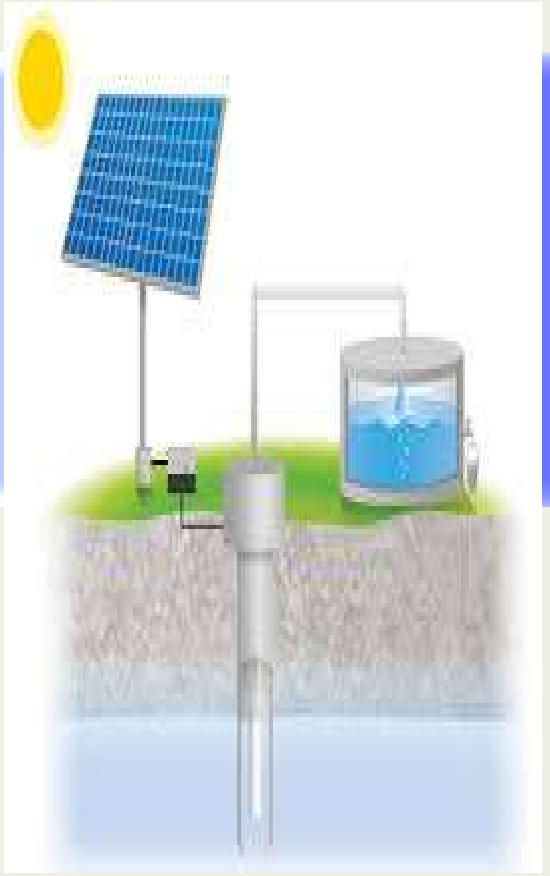


وزارة الموارد المائية والرى

قطاع شئون الرصد والاتصالات والمعلومات والاملاك

د. ايمن السيد ابراهيم

يونيو ٢٠١٩

مشروع إدراك إمكانات وإدارة مخاطر الرى بالطاقة الشمسية فى الشرق الأدنى وشمال افريقيا

الممارسات الجيدة فى مجال الطاقة الشمسية وإمكانيات تحقيق نظم الرى بالطاقة الشمسية

نبذة عن المشروع

- تم تخطيط المشروع ليشمل دول (مصر، الأردن، تونس، والمغرب)، ولكن فعلياً يتم تنفيذ المشروع في كل من (مصر، تونس).
- يهدف المشروع إلى تعزيز القدرات المؤسسية من خلال التعرف على الخبرات المتواجدة بالبلاد المختلفة من أجل الفهم الجيد لاستغلال الطاقة الشمسية في الري. كما يشمل المشروع على تدعيم الحوار حول السياسات للتأكيد على اتباع نهج مبني على التنسيق التام لاستخدام الطاقة الشمسية بهدف نهائي هو تحسين إدارة الموارد المائية وتقليل الانبعاثات، والوصول إلى بنية ذكية للزراعة.
- كما يهدف المشروع إلى توفير تدريب لخبراء الفنيين ليكونوا نواة للمعرفة ببلادهم.

محاور المشروع

يشتمل المشروع على ثلاثة محاور رئيسية وهي:-

- التعلم من الخبرات الأخرى في الدول الأخرى في مجال استخدام الطاقة الشمسية في أنظمة الري.
- حوار السياسات، وتقييم السياسات.
- تنمية القدرات.

إمكانات الطاقة الشمسية

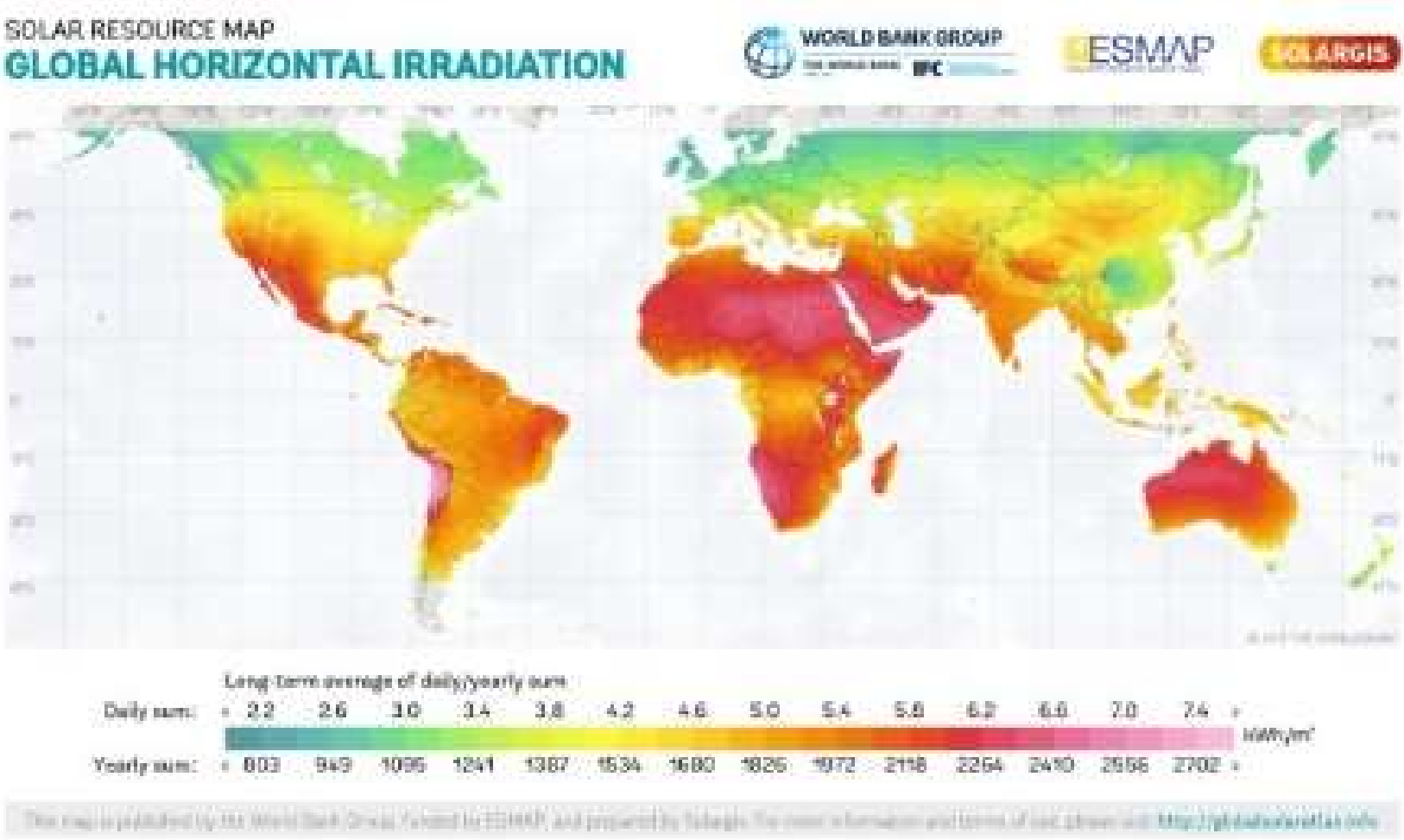
Three States:
Punjab, Rajasthan and Maharashtra

PHOTOVOLTAICS (PV)

is the conversion of light into electricity using semiconducting materials that exhibit the photovoltaic effect

الخلايا الكهروضوئية هي تحويل الضوء إلى كهرباء باستخدام مواد أشباه الموصلات التي تظهر التأثير الكهروضوئي

A photovoltaic system employs solar panels, . each comprising a number of solar cells, which generate electrical power. PV installations may be ground-mounted, rooftop mounted or wall mounted. The mount may be fixed, or use a solar tracker to follow the sun across the sky



Global Solar Map

A PhotoVoltaic system/ Solar PV system, is a power system designed to supply usable power by means of photovoltaic

It consists of

Solar panels

Solar inverter

Mounting,

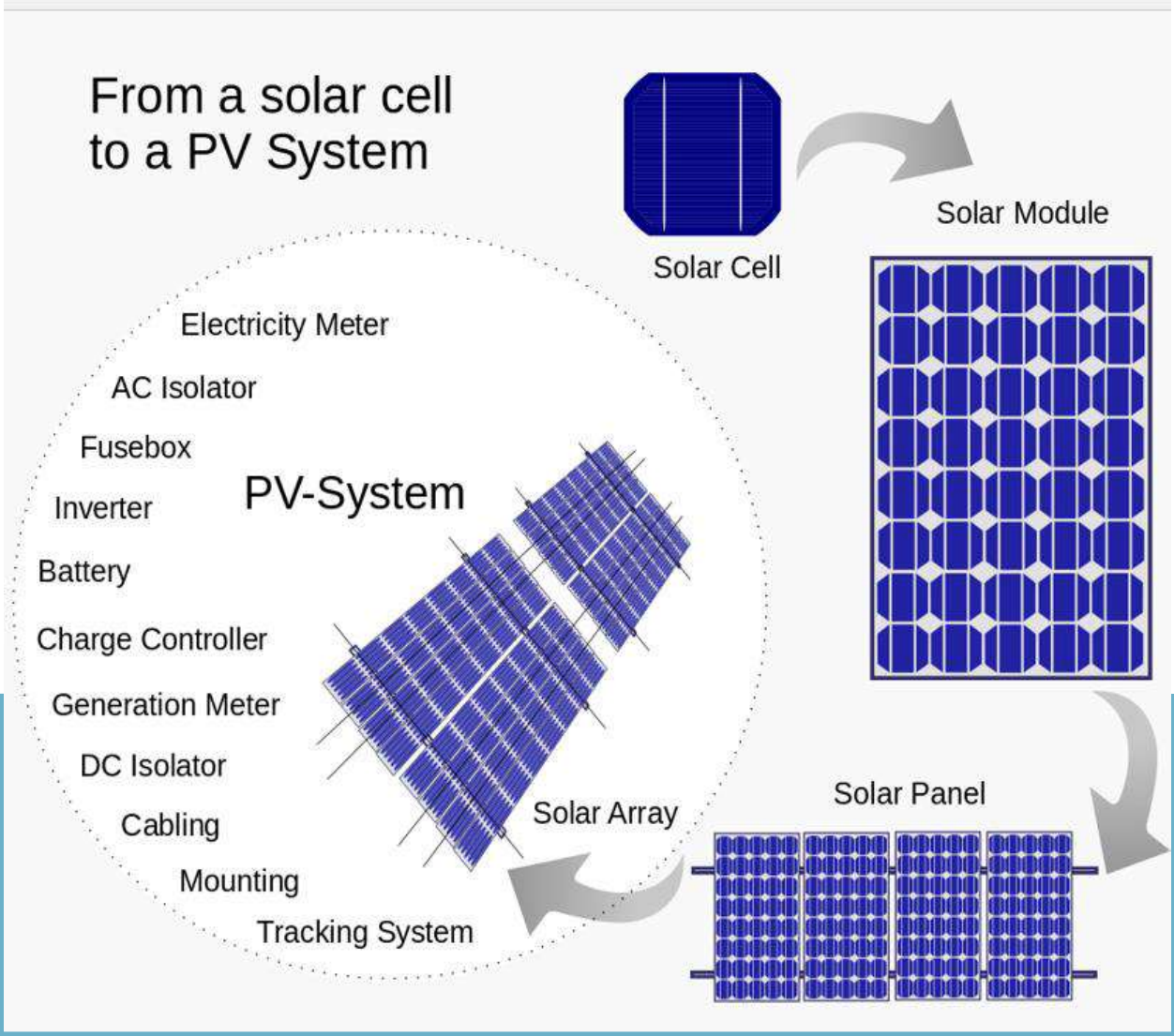
Cabling

Electrical accessories

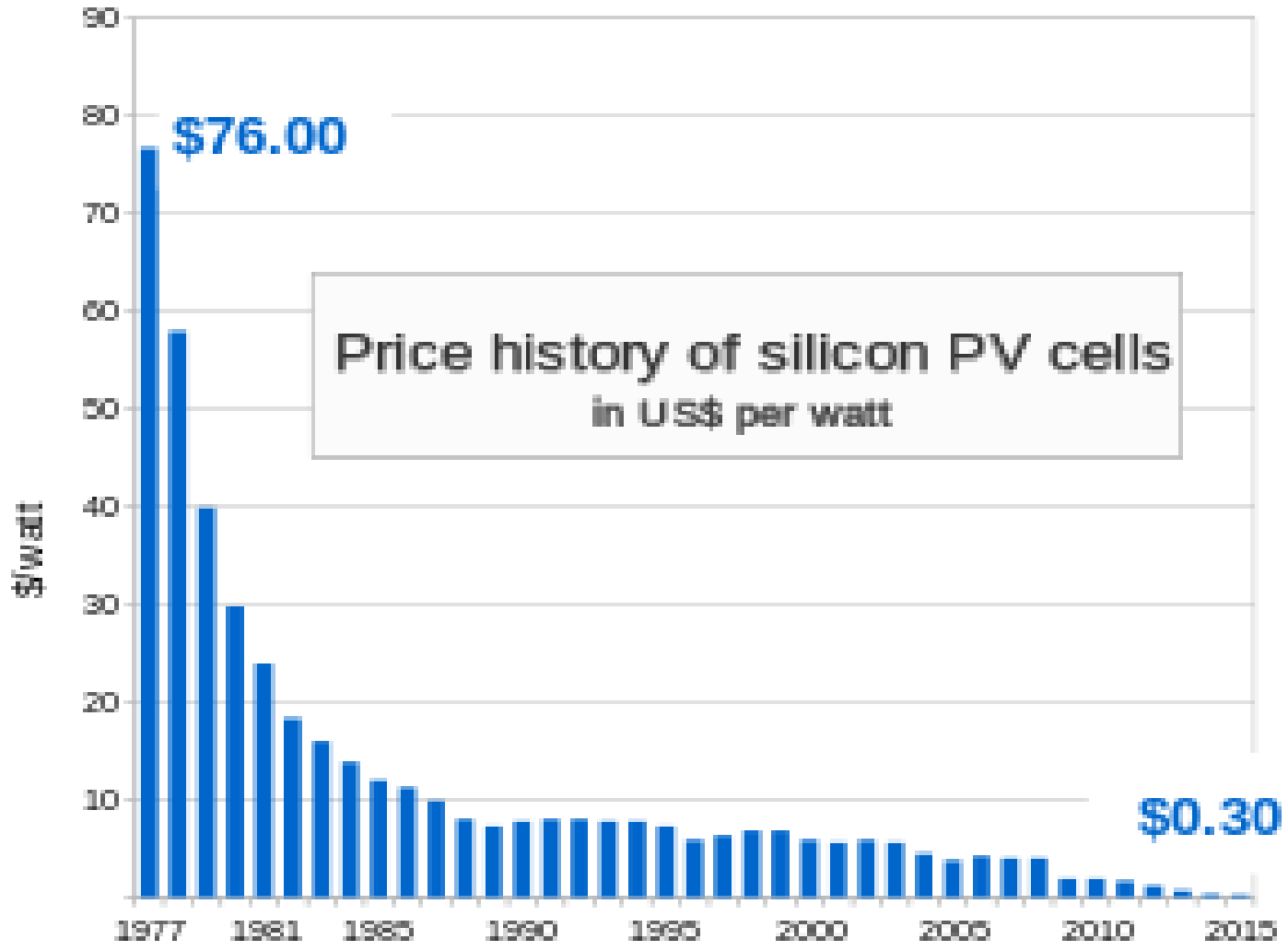
It may also use

solar tracking system

integrated battery solution



PRICE HISTORY



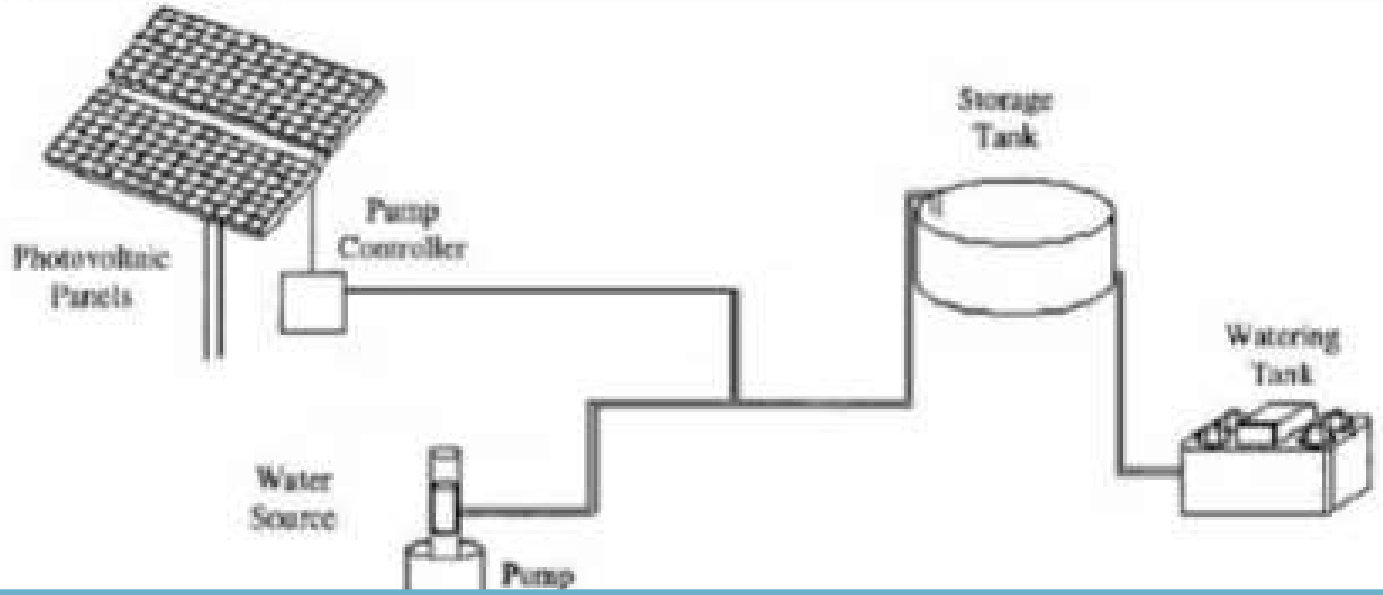
Source: Bloomberg New Energy Finance & pv.energytrend.com

أنظمة الضخ باستخدام الطاقة الشمسية

أنواع أنظمة الضخ التي تعمل بالطاقة الشمسية

Solar-Direct Pumping System

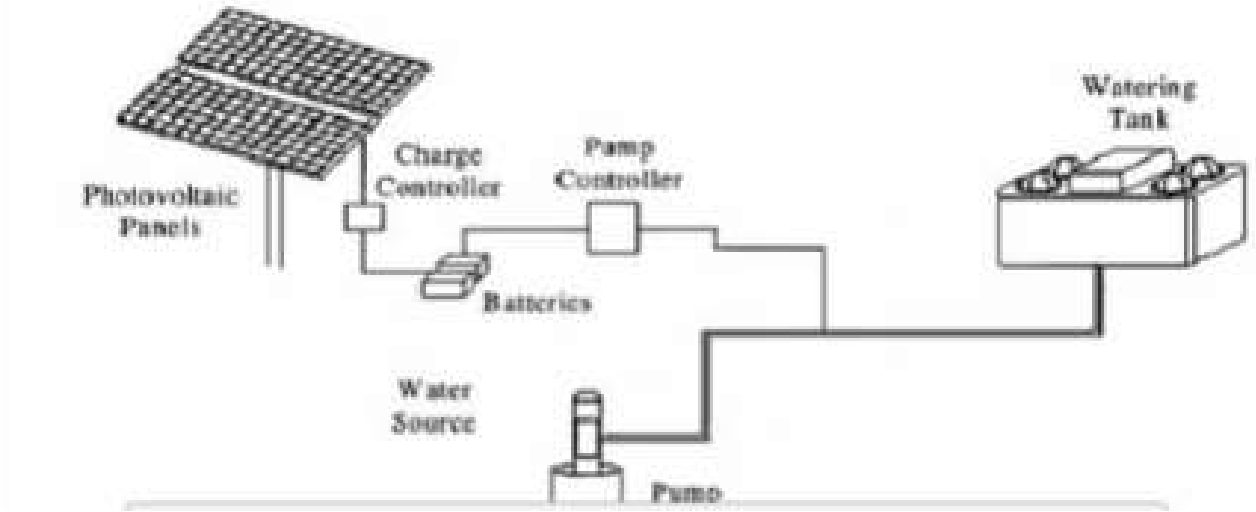
- In solar direct pumping systems, electricity from the PV modules is sent directly to the pump, which in turn pumps water through a pipe to where it is needed.
- Solar-Direct pumping systems are sized to store extra water on sunny days so it is available on cloudy days and at night. Water can be stored in a larger-than-needed watering tank or in a separate storage tank and then gravity-fed to smaller watering tanks



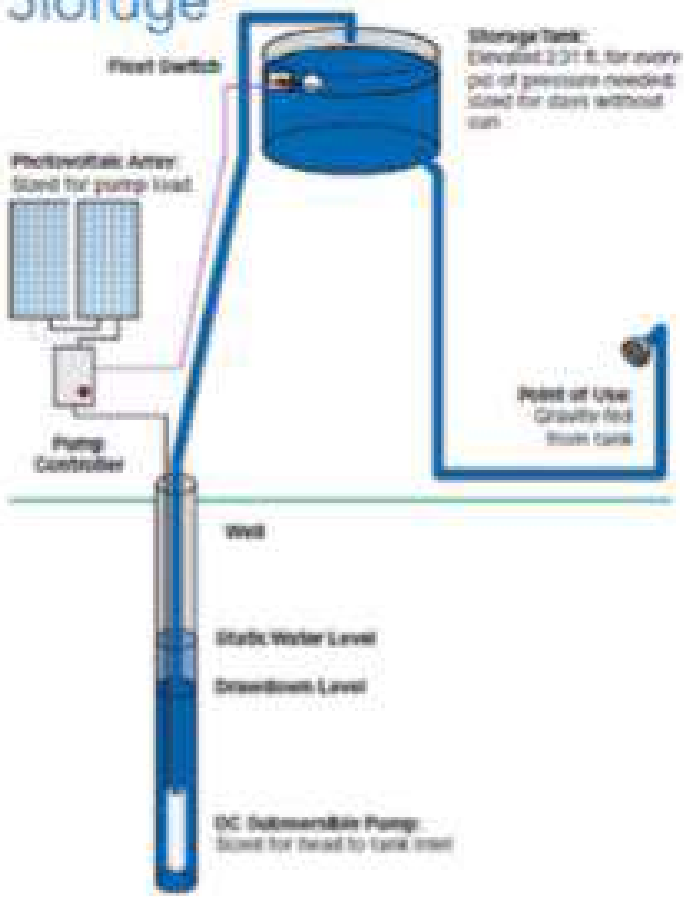
Battery-Based Solar Pumping Systems

- Battery-based water pumping systems consist of photovoltaic (PV) panels, charge controller, batteries, pump controller, and DC water pump.

-Water supply for home or cabin
-Pumping water at night
-Fragile water table/geological conditions.



Array-Direct to Elevated Storage



ADVANTAGES OF SOLAR PUMPING SYSTEMS

- Rugged construction
- Simple installation and maintenance
- Highly reliable
- No conventional grid electricity required
- Long operating life
- Durable
- Easy to operate and maintain
- Eco-friendly
- No fuel cost

POSSIBLE DISADVANTAGES AND MITIGATION

- High initial capital cost
- Additional cost
- Batteries
- Water tank
- Diesel in hybrid systems.
- Lack of specialized technicians/ providers
- Panel theft in some communities
- Can lead to excessive groundwater extraction.

Important Applications of Solar Pumping System

- Ground water lowering
- Irrigation systems
- Industrial Application
- Tank / Cistern filling
- Wildlife refuge
- Fountains
- Drip irrigation & sprinkler
- Rural water supply for ranches, cabins, and cottages

Micro irrigation in watersheds/ un-irrigated areas

Use of harvested water through drip/ sprinkler irrigation system

Use of solar pumps and drip irrigation in desert areas

تشغيل مضخات المياة عن طريق الطاقة الشمسية

المشروعات التى تم زيارتها

OBJECTIVE

Egypt seeks to explore how the promise of SPIS can be realized, whilst openly addressing the risks and challenges that come with the technology with focus on how this technology can be used to regulate groundwater use, to provide energy access to rural areas, and to promote innovative investment models and organizational structures.

Many countries around the world have been experimenting with solar irrigation and it is necessary to first take a closer look at their experiences to understand how governments, banks, businesses, NGOs and farmers around the world have managed to realize the promises of, and to cope with the risks of solar irrigation technologies.

OBJECTIVE

The study tour to India aims to highlight good practices, provide insights into how the potential of SPIS is realized (through targeted policies, innovative financing and user arrangements, etc. to promote and regulate such systems) and how risks are addressed. The main output of study tour will be to produce, achieve or deliver the following: (1) learning from existing experiences in India to understand how to promote and regulate the use of SPIS; and (2) providing field knowledge from India experiences for technical experts to act as multipliers of knowledge.

- Policy,
- Technology, Business models and
- Capacities of various stakeholders

ISSUES ADDRESSED

Specific issues addressed:

1. What are the real costs and benefits of SPIS compared with other technologies?
2. What rules, regulations and policies are needed to manage the risks and realize the potential of such systems?
3. What are viable business models?
4. How can small-holders benefit?
5. How can the risk of groundwater depletion be addressed e1ffectively?
6. What types of capacity development programmes are needed to support farmers, extension workers, local private sectors and others?
7. What are the opportunities for knowledge exchange and technology transfer?

NEED FOR SPIS

- The SPIS has proven to be a benefit for a number of pilot and near-commercial scale projects in India.
- The SPIS' provide a reliable source of clean energy to the farmers to irrigate their lands. They reduce the operating cost and provide relief to the farmers from the financial burden of fluctuating fuel prices.
- The SPIS provide the opportunity to the farmers for an additional income in case of surplus power generation, where the excess electricity may be sold to the national electric grid and the farmers may draw the power back from the grid when required.

BENEFITS

- In rural areas in India, agriculture is the main source of livelihood for the farmers. Since the opportunity cost of the land in such remote locations is minimal, and the connectivity to the electrical grid is very poor, the farmers are unable to have an on-demand power supply to irrigate their crops timely and hence the resultant agricultural activity in these areas is very low.
- Moreover, the costs of acquisition and maintenance of diesel engine-based pump sets are also not affordable at all levels. With SPIS in place, the farmers have a dependable source of electricity for irrigation and if coupled with a sustainable source of water supply, subsequently a sustained source of livelihood.
- Women play a fundamental role in agriculture and thus the impact of SPIS on women is of great importance. SPIS replaces the strenuous physical exercise required during the conventional irrigation with the convenient on/off switches which may be operated remotely as well. SPIS, additionally, opens the door for additional income for the family by the means of backyard vegetable farming for women and other local businesses.

زيارة مشروع Talware بمدينة Punjab

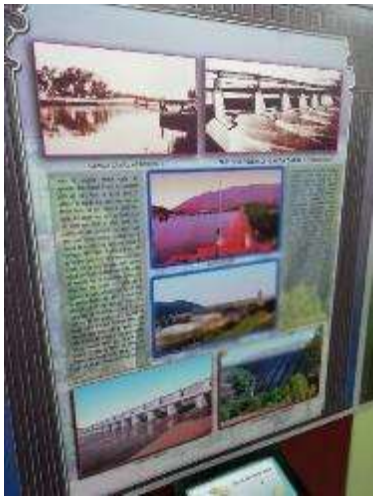
بدأ هذا المشروع في عام ٢٠١٥ ويشتمل على تطوير مساحة ٦٦٤ هيكتار، وتم الانتهاء من تنفيذه في أغسطس ٢٠١٧، يشتمل المشروع على إنتاج ١١٠٠ كيلو وات من الطاقة الشمسية لعدد ٤٦ طلمبة بقدرة (٢٠ ـ ٢٥ حصان)، كما يشمل على خلايا شمسية عائمة بقدرة ١٢٠ كيلو وات، ويعمل نظام الري الحديث بالرش أو التنقيط ويخدم تعداد سكاني قدره ٨٠٠٠ نسمة، ويتضمن نحو ١٢٠٠ مزارع (١٨ رابطة مستخدمي مياه)، كما تم لقاء بعض المزارعين والاستماع إليهم وتلاحظ الاتى:-

- تقوم الحكومة بدعم المزارعين، وذلك بإنشاء نظام طاقة شمسية بحد أقصى قدرة ٥ كيلو وات للطلمبة.
- يتم تطبيق نظام الري الحديث.
- اقتناع كامل من المزارعين لتطبيق النظام.
- يتم تطبيق المشروع بتمويل محلي دون الاعتماد على أي جهات خارجية.
- معظم المهمات من إنتاج وتصنيع محلي.
- الاهتمام بأعمال تدريب المزارعين على رفع الوعي وكذا على أعمال مستقبل وصيانة المنظومة.
- يتم مراقبة المشروع بصورة أوتوماتيكية بواسطة أجهزة مجمعات بيانات ومجسات قياس.
- مستقبل الطاقة الشمسية المنتجة من الخلايا الشمسية في ازدياد مستمر بدأت بـــــ ١٠٠ ميجا وات عام ٢٠١٣، وقد وصلت الآن ٢٠٠٠٠ ميجا وات.
- يتم استخدام قطع الطاقة الشمسية المتحركة مع اتجاه الشمس لزيادة عدد ساعات إنتاج الطاقة.
- يتم مساعدة المزارعين حتى حيازات صغيرة تصل إلى واحد هيكتار.


WIRELESS DATA LOGGER
JAIK

زيارة مركز تكنولوجيا المياه التابع مركز البحوث الزراعية

مركز البحوث الزراعية منظمة مستقلة تابعة لوزارة البحوث الزراعية والتعليم ، وزارة الزراعة ورعاية المزارعين ، منصة دراسية وبحثية في مجالات إدارة المياه للزراعة، وابتكار تكنولوجيات لتحسين إدارة المياه، وقد تم إنشاؤه سنة ١٩٦٩ بالتعاون مع جامعة كاليفورنيا. كما تم زيارة المتحف الزراعي، وكذا المشروعات البحثية الخاصة بالري المطور، وكذا المشروعات الخاصة بالري المطور، كما تم زيارة محطة معالجة صديقة للبيئة، وإعادة استخدامها في الزراعة.




ECO-FRIENDLY WASTE WATER TREATMENT
For augmenting IARI farm irrigation water supply and promoting safe aquaculture
Water Budgeting of IARI
Wastewater Treatment Potential
Quality of Treated Water Vs. IARI Groundwater
Benefits & Business Model
Mitigation of Consumer Health Hazard due to Food Grain Metal Contamination


Sintex

زيارة مشروع PEHAL بمقاطعة RAJASTHAN

تم الاطلاع على كيفية استخدام الطاقة الشمسية والري الحديث، وتم الاستماع إلى المزارعين حيث تم شرح تجربتهم مع استخدام الطاقة الشمسية بالتوازي مع الري الحديث، وأفادوا إلى زيادة الإنتاجية وبالتالي زيادة الدخل وتحسين الوضع المعيشي لهم.

كما تم شرح سياسات التشغيل ودور الجهات في المشروع حتى تم إيضاح الآتي :-

تقوم حكومة الهند بتوفير الامدادات المالية اللازمة، وكذا تقوم حكومة مقاطعة Rajasthan بتوفير دعم يقرب من ٨٦% من إجمالي التكاليف.

يتم التنسيق بين الإدارات المعنية بالولاية بوضع إطار تنظيمي، وكذا اختيار الشركات المصنعة والموردين.

يتم اختيار المنتفعين بناء على الأسس الموضوعة ومنها حيازة الأرض.


Jain
Solar Pump
JAIN

زيارة شركة JAIN IRRIGATION SYSTEM LIMITED بمدينة JALGAON

- تم الاطلاع على الأعمال المتكاملة التي تتم في الشركة والعدد الهائل من المصانع والمعامل المتكاملة لتحليل المياه والتربة والزراعات والمنتجات الغذائية.
- المرور على الصوبات المستخدمة في إنتاج الشتلات والتي يتم تصديرها إلى العديد من دول العام.
- المرور على مصانع المواسير والأجهزة والمهمات الخاصة بالري الحقلي.
- المرور على مصانع الحبوب وإنتاج وتعبئة التوابل وكذا المرور على مصانع الأغذية والعصائر.
- معاينة محطة طاقة شمسية هائلة، وكذا محطة إنتاج طاقة من المخلفات الناتجة من المصانع والزراعات (Bio Gas).
- كما تم مقابلة الزراعيين والذين أبدوا قناعتهم الكاملة بالنظام. ويتوفر لدى الشركة مركز عالي لتدريب الزراعيين وغيرهم.


GAVISH
A JAIN IRRIGATION COMPANY

Costs Associated with SPIS and Government Interventions

- Although the initial investment costs are very high for the solar energy systems, in the long run, the cost for solar energy is cheaper than the diesel-run pumps during their lifetime. However, with government intervention, the support in the form of subsidies to procure the equipment and support during the initial phase of the projects has proven to be very helpful to the farmers in India.
- Within the federal system of governance in India (Centre and States), agriculture and water are the primary responsibilities of the state.
- The Central Government, however, acts as a facilitator and provides broader policy guidelines for sustainable development of the agriculture sector and necessary seed-funds or subsidies for wider adoption of technologies that improve agricultural productivity and natural resource conservation.

- Sudden removal of government provided subsidies may create a social and political imbalance in the farming communities. Hence, the state governments are coming up with newer models to provide subsidies to the farmers for electricity and irrigation generated by means of sustainable resources. In this respect, several pilot projects on Solar Powered Irrigation Systems (SPIS) are in the working phase in isolated pockets of India. Owing to the initial high investment costs, the SPIS' were restricted in the initial stages of introduction. However, more and more states are now looking at SPIS favorably.

Viable Business Models

- One of the most successful models entails the involvement of the **private sector**. The private sector in tandem with the state governments has encouraged the deployment of solar powered irrigation systems at several locations in India.
- After the installation, to promote the use of the SPIS, the private sector is actively conducting capacity building programmes for the farmers for several years.
- In a few large-scale projects, the private sector is mandated to provide after-sale technical support for approximately 7 years.

- In some cases, the progressive farmers are working with the private sector as the **local dealers** of the equipment, for installation as well as the operation and maintenance of the equipment.
- **Contract Farming** is proving to be another successful model where the farmers receive support from the private sector for the entire production value chain. In almost all the success stories, the catalytic role is played by the private sector in India working on manufacturing of solar-based micro-irrigation equipment, tissue culture of various horticultural crops, contract farming and research & development. The private sector is working closely with the farmers, local extension and irrigation officials, and promotes capacity building of farmers.

Business Model

- One of the successful models for the SPIS includes the approach implemented by the Water Technology Centre (WTC), Indian Agricultural Research Institute, an autonomous organization under the Department of Agricultural Research and Education, Ministry of Agriculture & Farmers Welfare, Government of India which has been promoting solar-powered micro-irrigation for onion production in the Alwar region of Rajasthan State.

Business Model

- Government of India which has been promoting solar-powered micro-irrigation for onion production in the Alwar region of Rajasthan State. The North Indian markets currently buy onions from the Western State of Maharashtra involving a significant transport cost. This makes onion production in Rajasthan highly competitive and as a result it has captured 25% of the market in a very short span of time. However, lack of surface water-based irrigation sources require pumping efforts for the groundwater and the adoption of SPIS has led to a dependable water resources regime ensuring adoption of other efficient means of water application in the form of micro-irrigation.

WTC (Water Technology Center)

- WTC has evolved a practical business model by identifying progressive farmers and making them local dealers to sell micro-irrigation equipment supplies in a cluster of 4-5 villages each. Based on interactions during the study visits to several farms, it was observed that farmers were quite satisfied and the wider application of the business model seems very promising. Long-term capacity building efforts have been a key to the entire success where comprehensive assistance was available to the pilot beneficiaries at all times.

Capacity Building

- The capacity development programmes are needed to support farmers, extension workers, local agri-businesses and others, scientific communication is of utmost importance
- Stakeholders in the water sector need scientifically validated climate change information and its potential impact on human life and natural resources including water in a form which is easily understandable and implementable.
- To further develop the technical capacity at the farm and community level, sustained interventions from the governments and the private sector are required. The main agenda of these programmes should be to generate awareness amongst the farmers to use water judiciously with an objective to improve productivity and reduce input costs. Also, at the government level, the policies and regulations should be enforced to monitor and restriction the over-abstraction of ground or surface water.

Conclusions and Recommendations

- While implementing SPIS, two major mutually exclusive objectives that of the government and the individual farmers have to be addressed. The government aims to reduce the subsidies and reduction of natural resources footprint of the operations while the farmers' objectives are to improve the production and increase the income with reduced labour to achieve economic prosperity and meet growing demands of his/her family. Introduction of solar power coupled with the adoption of micro-irrigation systems has shown promising results in this regard in all the pilot projects in India.
- With the careful implementation of the technology and complementary government policies, SPIS provide an excellent alternative to the diesel or electric-run pumps to withdraw water for irrigation. To further the knowledge on the subject and tap the vastly abundant solar potential, global platforms should organize conferences and regional seminar/workshops for knowledge exchange and technology transfer.

Conclusion

- A much-neglected aspect of solar energy application in agriculture is its other applications in agricultural operations at the farm besides water application. Energy availability at the farm level would also be useful in chaff-cutting, dairying, connectivity to mass media and knowledge resources, post-harvest activities such as thrashing, cleaning, heating/cooling and a general sense of energy security in the farm family. Energy availability also enhances drinking water filtration capacity for family members.
- **The main learning outcome of this exercise is the recognition that SPIS is not just a technology-driven activity; it also requires an enabling policy environment, locally-adoptable business models, and adequate capacity of farmers, extension workers and water management professionals, among others.**

Thank you