



Federation of Myanmar Engineering Societies Technical Division of Electrical Power Engineering

FLOATING SOLAR POWER SYSTEM

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Floating solar power system

Floating Solar or Floating photovoltaics (FPV)

Solar Panels mounted on a structure that floats on a body of water, typically a reservoir or a lake such as drinking water reservoirs, hydropower reservoirs, quarry lake, irrigation canals or remediation and tailing ponds.

History

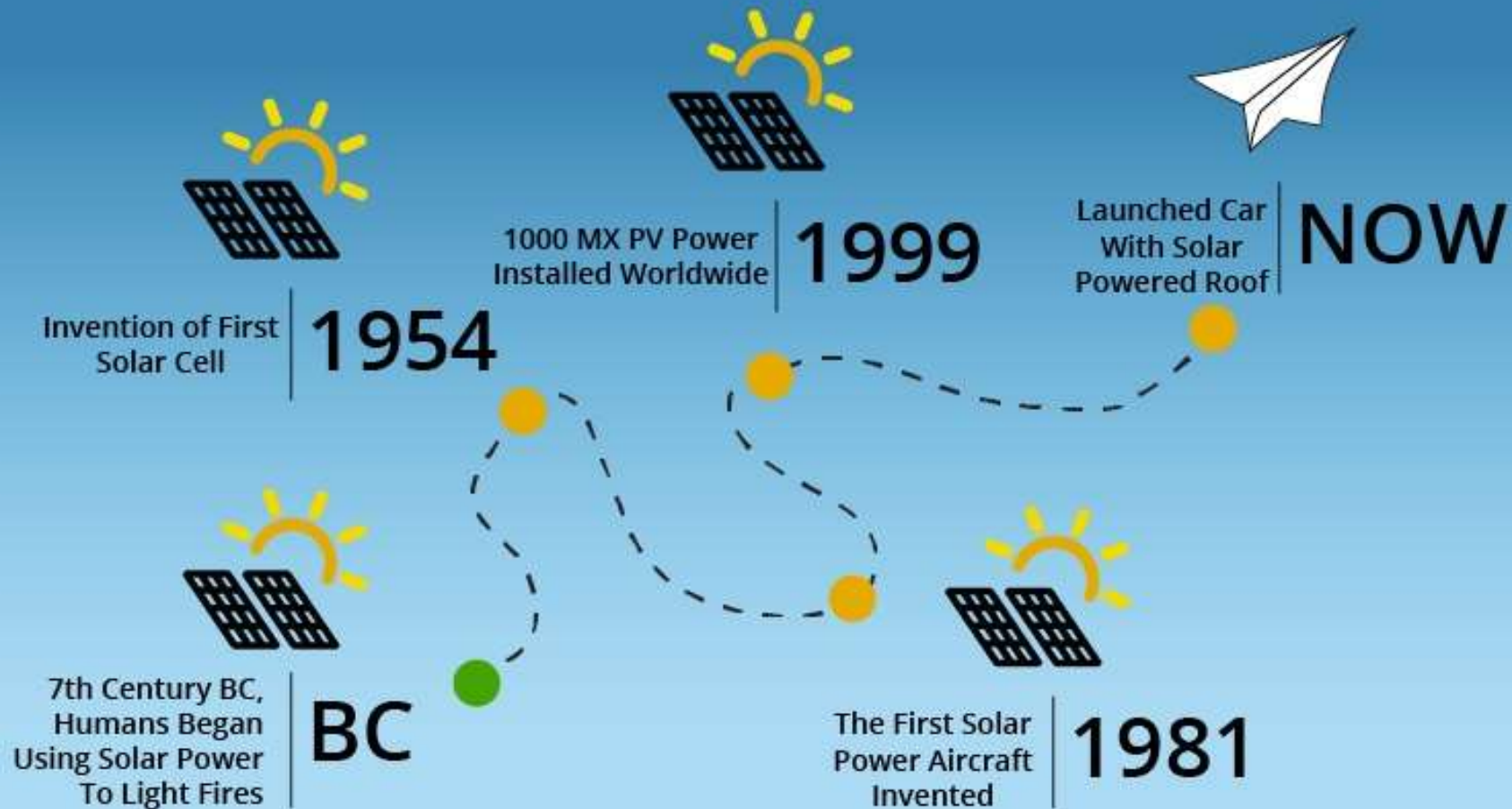


- ▶ American, Danish, French, Italian and Japanese nationals were the first to register patents for floating solar. Italy was the first registered patent in February 2008.

History



History of Solar (Evolution of Alternate Energy)



Solar photovoltaic module price in USD/Watt

Sr .	Entity	Year	Price		Sr.	Entity	Year	Price
1	World	1975	125.83		7	World	2005	4.39
2	World	1980	34.79		8	World	2010	2.32
3	World	1985	16.37		9	World	2015	0.68
4	World	1990	11.49		10	World	2020	0.34
5	World	1995	8.11		11	World	2021	0.26
6	World	2000	6.17		12	World	2022	0.25

Advantages



- ▶ Efficient Use of Space
- ▶ Enhanced Energy Production (Faster Installation, Less maintenance)
- ▶ Reduced Water Evaporation (30% evapo covered)
- ▶ Increased panel efficiency due to cooling & mirror-like surface (Gain 5% to 15%)
- ▶ Tracking (gain 15% to 25%)
- ▶ Environmental control (Algal blooms 40% reduced)
- ▶ Hybridization with hydroelectric power plants (using the existing transmission lines and distribution infra)

Disadvantages

- ▶ **Higher Initial Cost**
- ▶ **Maintenance Challenges** (Potential corrosion from water and tear, the impact of wave and current)
- ▶ **Limited Suitable Locations** (Water depth, wave action, and accessibility must be considered)
- ▶ **Environmental Impact** (pose risks to aquatic ecosystems and local wildlife and habitats)
- ▶ **Floating technology & Anchoring complexity**
(Not initially developed, need to be designed specifically)

Protection for Floating Solar



Electrical measurements for DC Subsystem

- # Continuity of grounding and equipotential bonding conductor
- # Polarity
- # String short-circuit current
- # String open-circuit voltage
- # Insulation resistance of DC circuit

Largest floating solar facilities

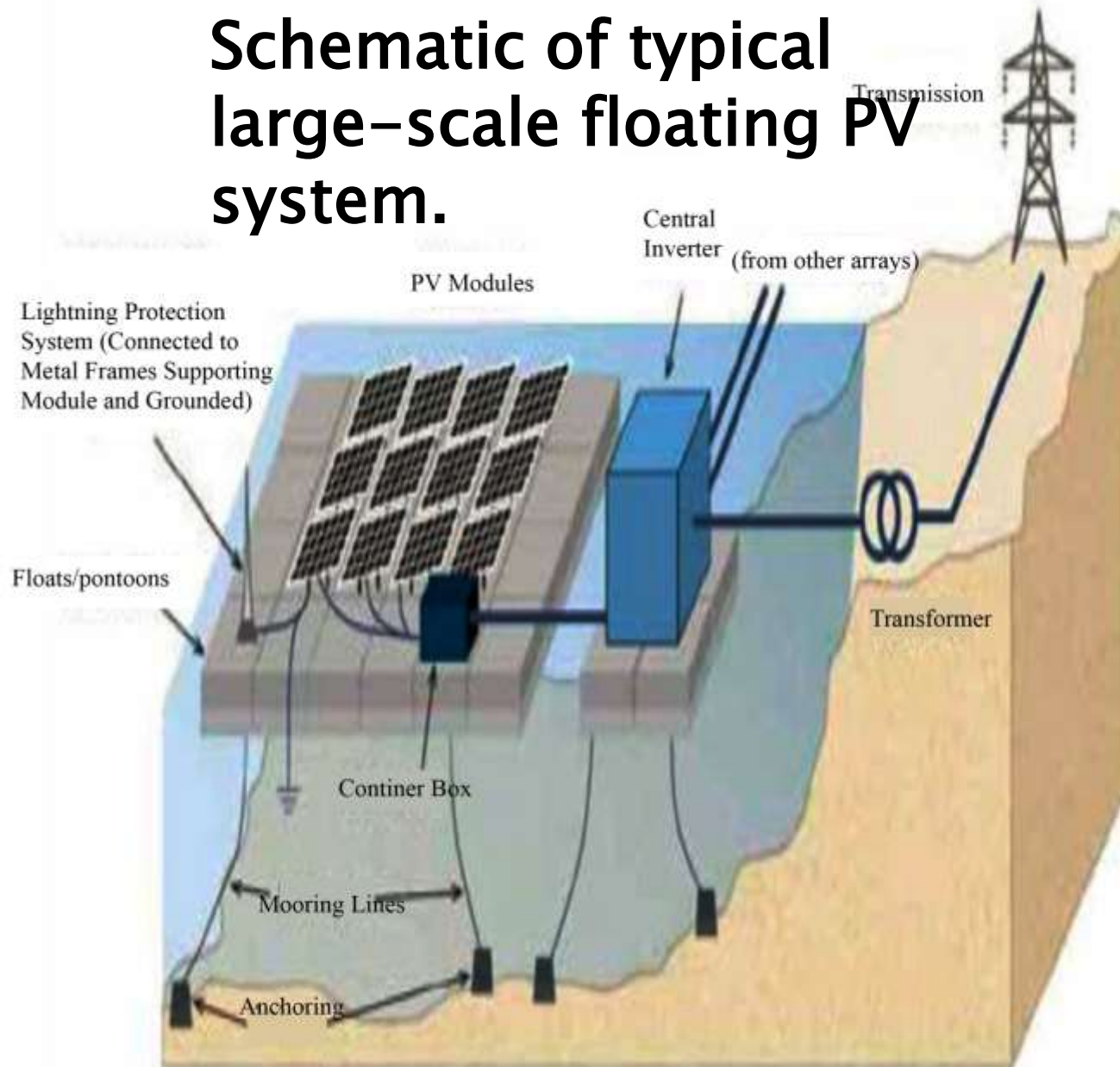
PV Power Station	Location	Country	Power (MWp)	Year
Anhui Fuyang	Fuyang, Anhui	China	650	2023
Wenzhou, Taihan	Wenzhou, Zhejiang	China	550	2021
Changbing	Changhua	Taiwan	440	
Dezhou, Dingzhuang	Dezhou, Shandong	China	320	
Cirata	Purwakarta, West Java	Indonesia	192	2023
Three Gorges	Huainan City, Anhui	China	150	2019
NTPC Ramagundam (BHEL)	Peddapalli, Telangana	India	145	
Xinji Huainan	Xinji Huainan	China	102	2017
Yuanjiang Yiyang	Yiyang, Hunan	China	100	2019
NTPC Kayamkulam	Kayamkulam, Kerala	India	92	
CECEP	Suzhou, Anhui	China	70	2019
Tengeh	Tengeh	Singapore	60	2023

RISK & CONSEQUENCES OF WRONG DESIGNS OR EXECUTION



- ▶ Loss of generation due to :
 - Micro cracks on module: torsion, water splash
 - Poor cable management
 - Wrong module tilt
- ▶ Extra OPEX due to components replacement
 - Such as PV panels and DC cables
- ▶ Water pollution
 - Wrong polymer formulation
 - Use of contaminated PCR

Schematic of typical large-scale floating PV system.



Key Components



- ▶ Pontoon/Floating Structure
- ▶ Mooring Structure
- ▶ Solar Module
- ▶ Land neutral
- ▶ Reduction in water evaporation
- ▶ Possibility of sharing exiting electrical infrastructure
- ▶ Complementary operation with hydroelectric power plants
- ▶ Reduction in algae growth
- ▶ FSPV as anew source of revenue
- ▶ Less soiling loss
- ▶ Ease of cleaning
- ▶ Easy installation and deployment

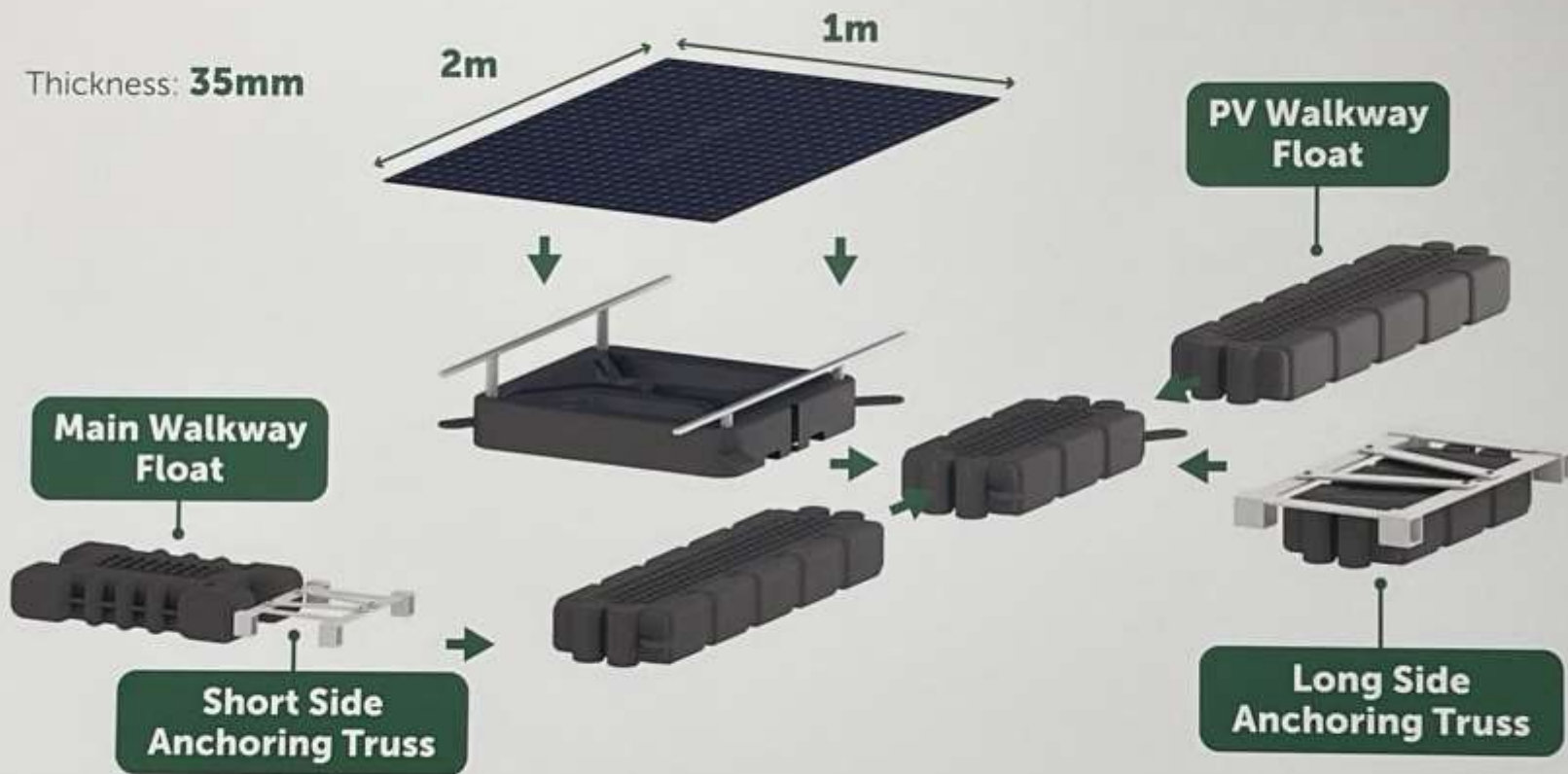
Type of waterbodies on which floating solar in top four countries

Country	Water body type	Typical range of % of water surface area covered by FSPV plants	Typical range of depth of water body on which FSPV plants are installed (in meters)	Typical range of water level variation (in meters)
China	Irrigation ponds	10% – 30%	3.5 – 14.1	3.5 – 8.0
	Mining ponds	10% – 20%	3 – 12.5	4.8
Japan	Irrigation ponds	10% – 70%	1.8 – 15.1	1.8 – 15.1
	Water storage reservoirs	15% – 86%	3.0 – 5.0	3.0 – 5.0
Taiwan	Irrigation ponds	11% – 28%	3.6 – 4.6	2.4 – 4.6
	Industrial ponds	15%	14	5
UK	Irrigation	2% – 15%	4.0 – 18.4	4.0 – 18.4

Sembcorp Tengeh Floating Solar Farm



A Look at the Assembly System



The floats deployed consist of a few types and dimensions. Each float type serves specific functions: support PV panel, support cables, walkway and connecting floats.



SENBCORP TENGEH FLOATING SOLAR FARM









THE STRAITS TIMES



Clara Chong
Journalist



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THANK YOU

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