

POWER SUPPLY FOR SKA: a technological challenge.

◆ INAF

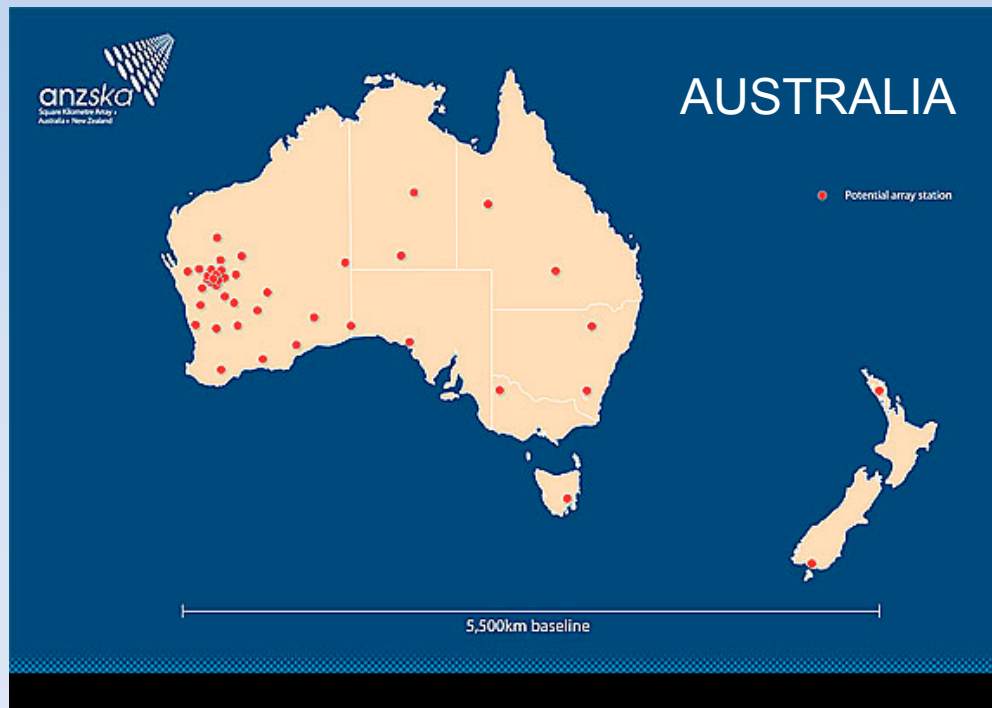
ISTITUTO NAZIONALE
DI ASTROFISICA

NATIONAL INSTITUTE
FOR ASTROPHYSICS

Dr. Germano Bianchi INAF-IRA

Rome SKA Meeting, 19-20 June 2012

The win win solution will bring the construction of the SKA radiotelescope in two remote areas (South Africa and Australia). The system power supply will represent a technological challenge.



Low frequency band



Medium-High frequency band

Power generation technologies

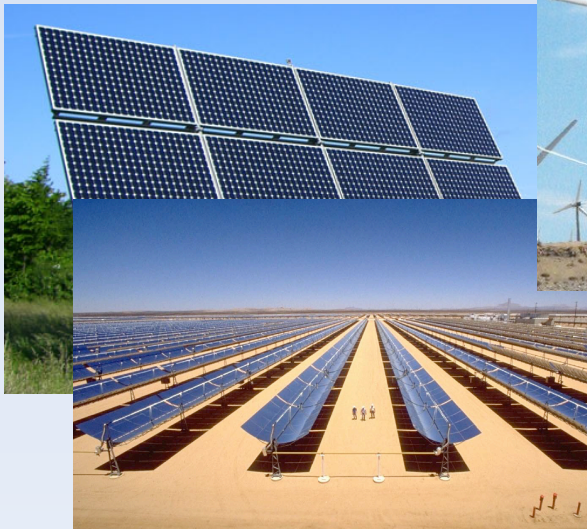
Green energy:

- PV solar panel
- Solar thermodynamic
- Wind turbines
- Hydroelectric
- Biomasses

Nuclear

Hydrocarbons

- Gas
- Petrol
- Carbon



Green energy solution

The more suitable solution is the green energy.

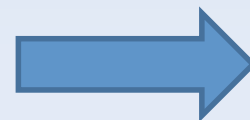
Advantages:

1. It is a free energy
2. Local generation:
 - It does not need power grid
 - No fuel transportation
3. No CO₂ emission



Disadvantages:

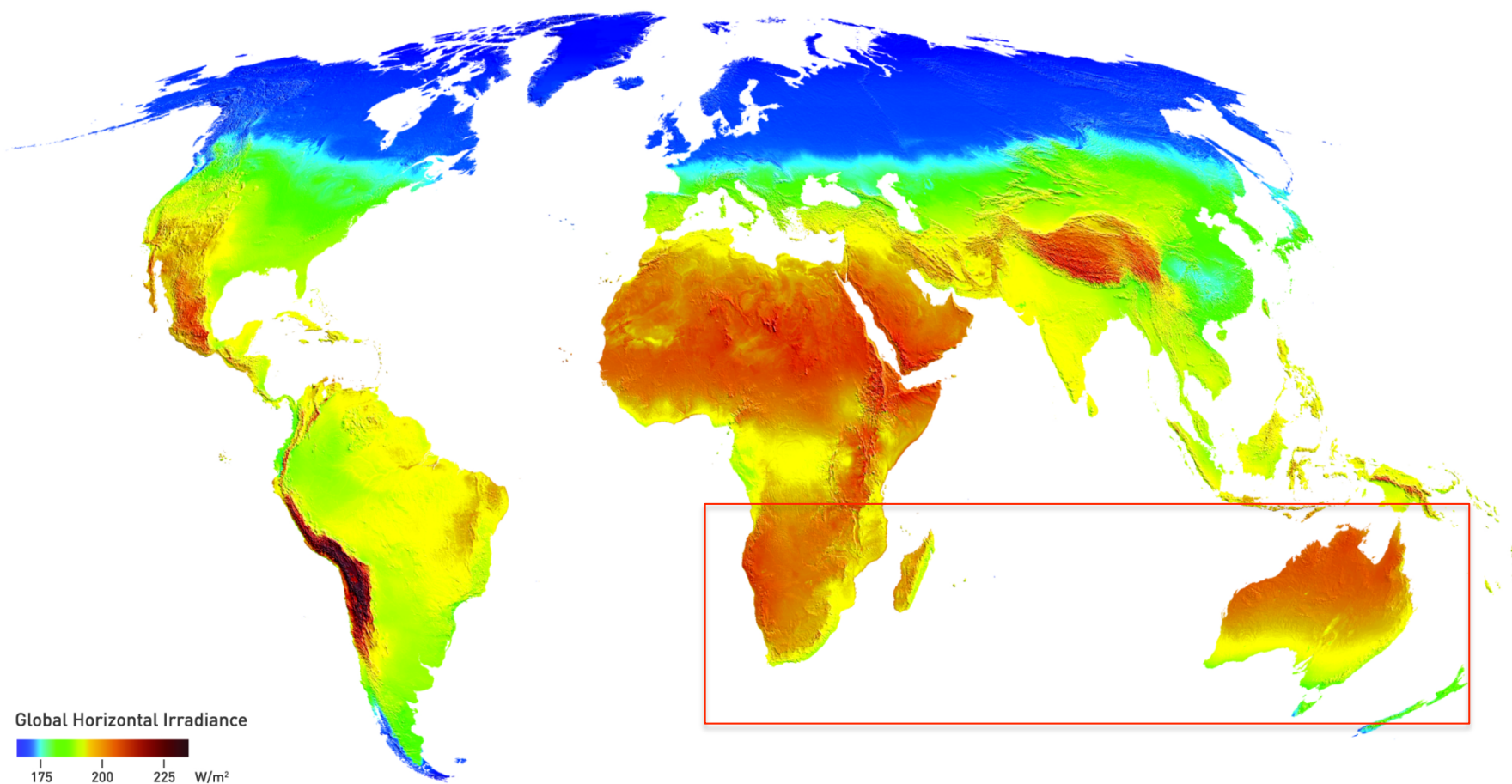
1. Discontinuous generation



POWER STORAGE

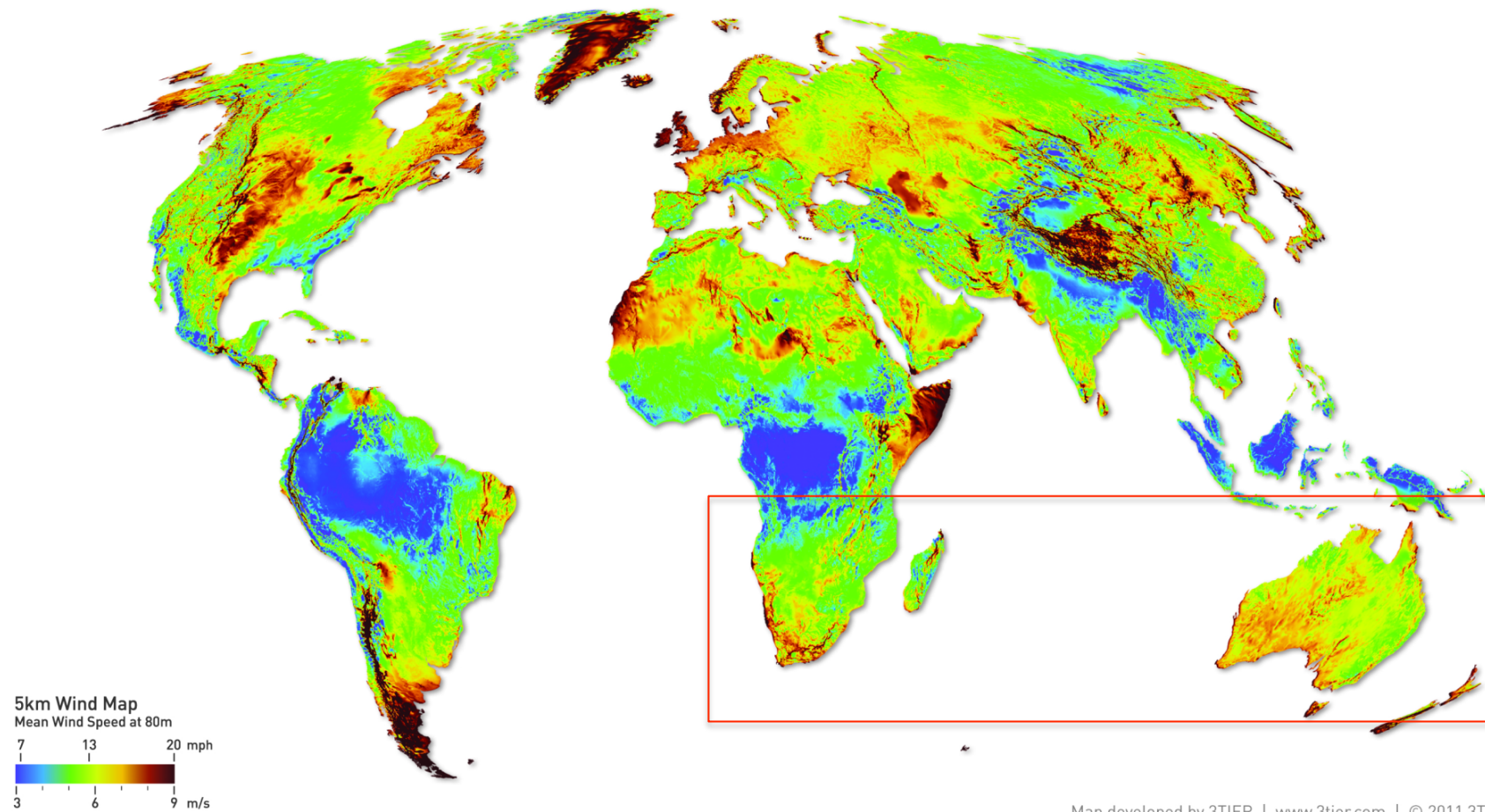


Global Mean Solar Irradiance



Map developed by 3TIER | www.3tier.com | © 2011 3TIER Inc.

Global Mean Wind Speed at 80m



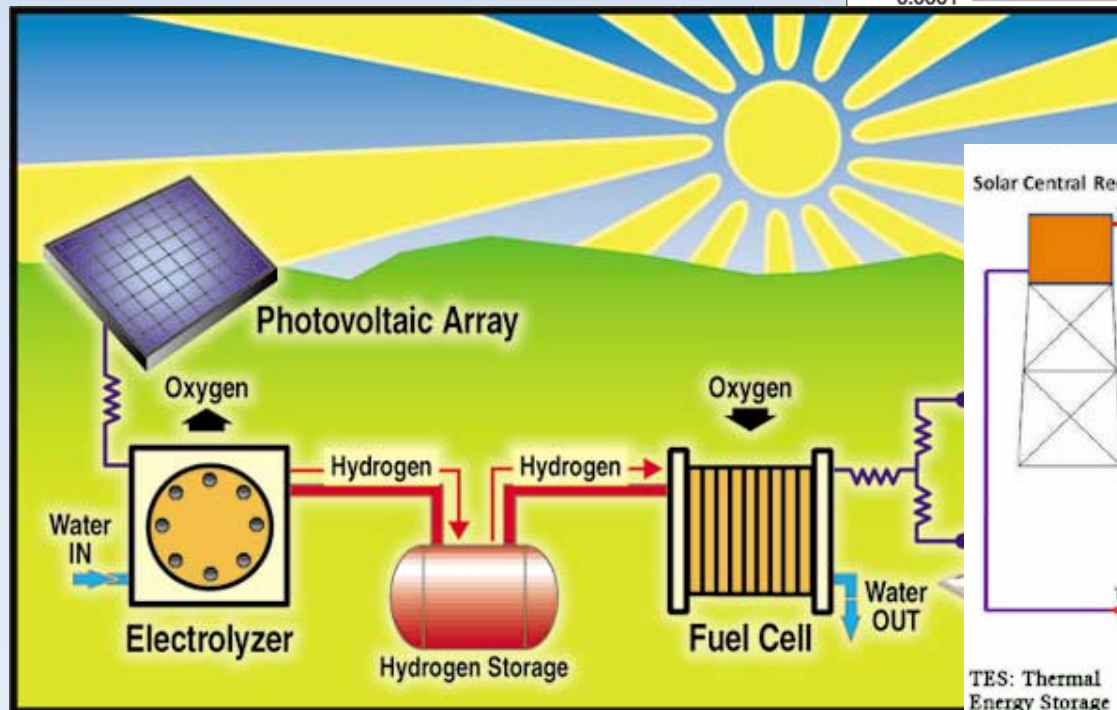
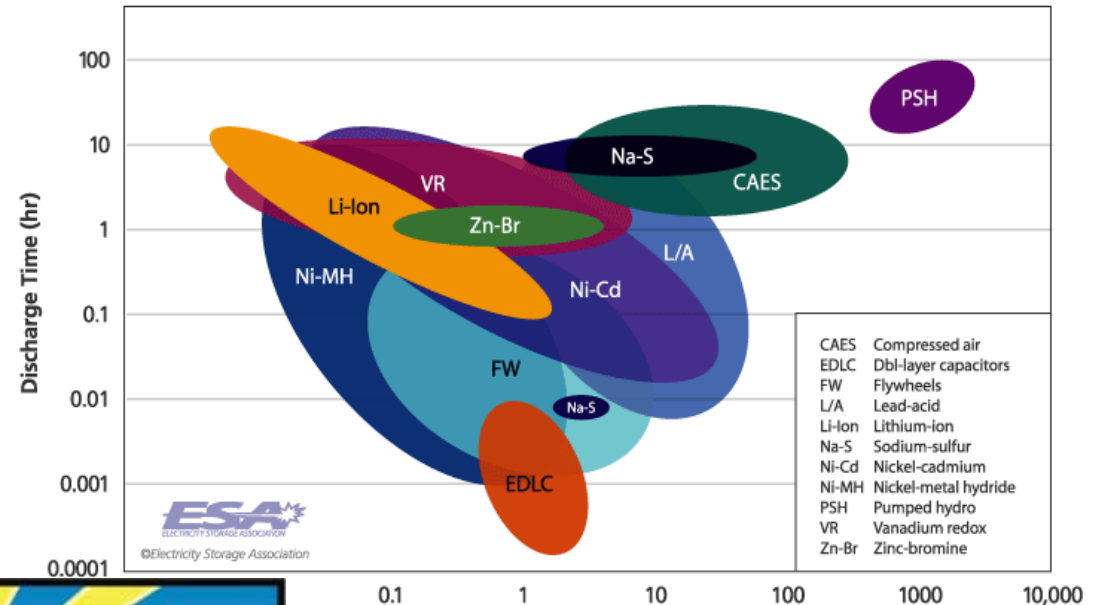
Map developed by 3TIER | www.3tier.com | © 2011 3TIER Inc.

Present storage solutions

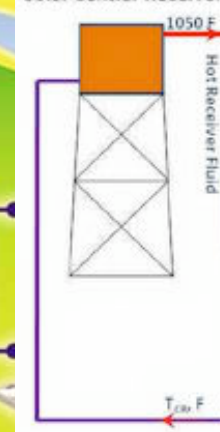
1. Batteries
2. Hydrogen
3. Thermal (chemical salt)
4. Flywheel

System Ratings

Installed systems as of November 2008

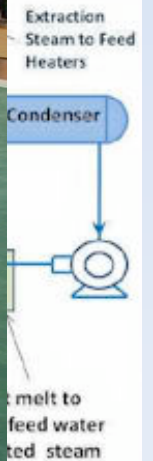
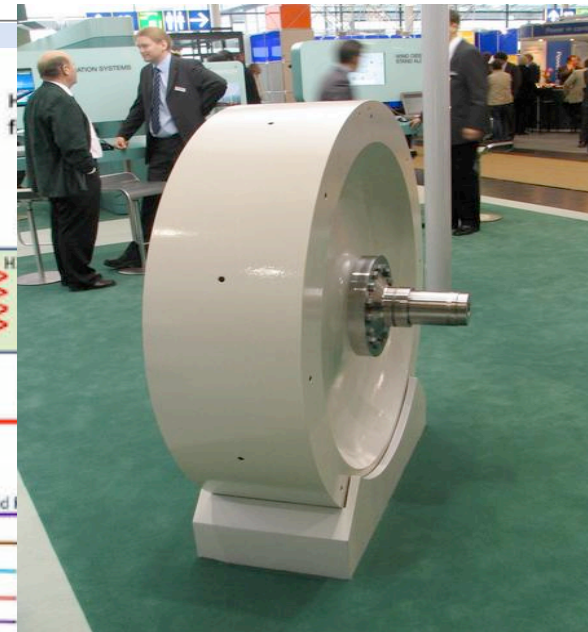


Solar Central Receiver



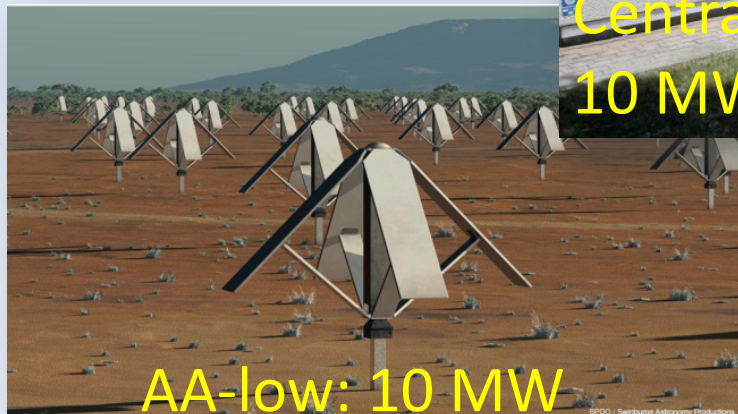
TES: Thermal Energy Storage

Rated Power (MW)

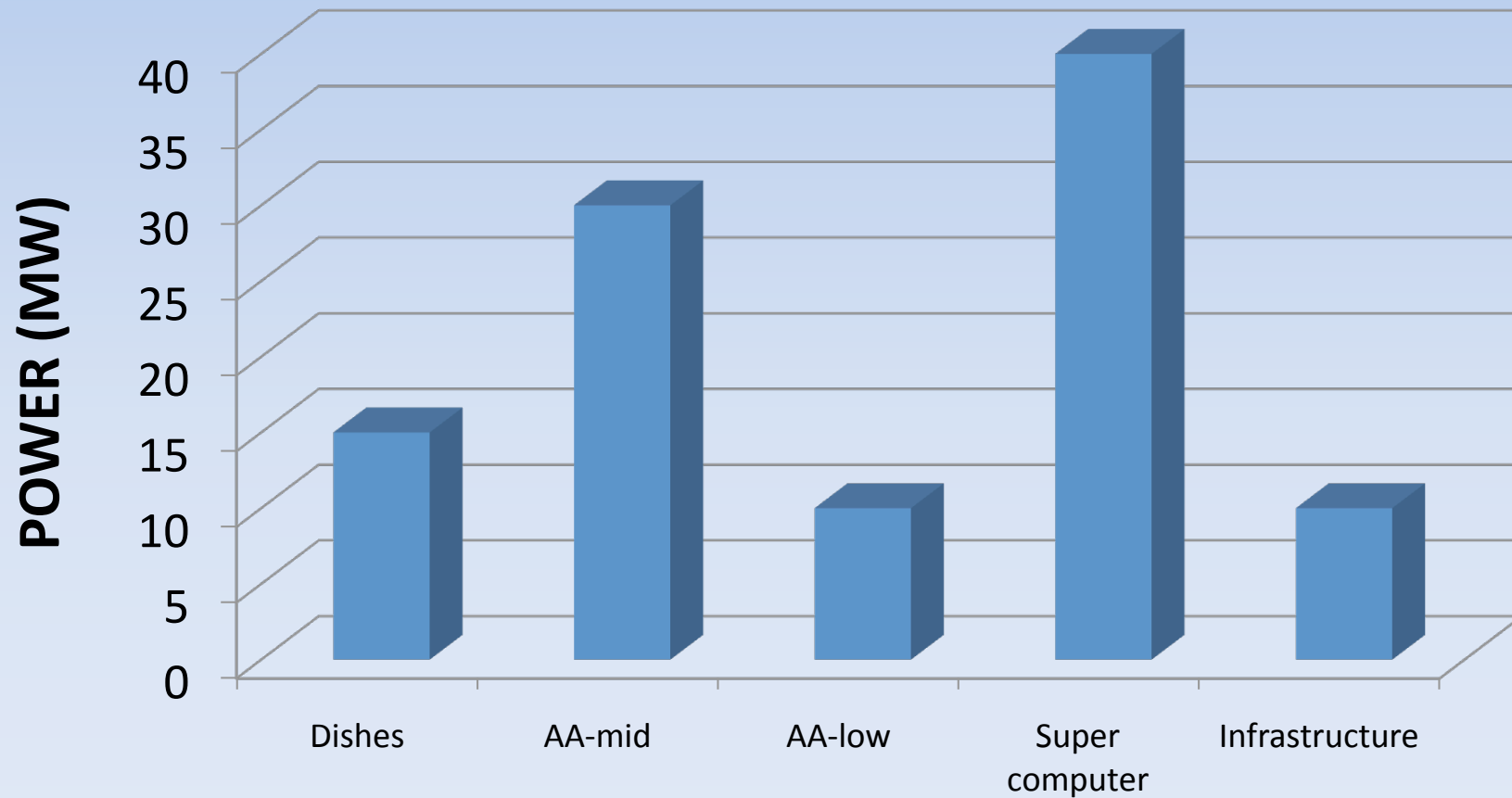


Power Requirements

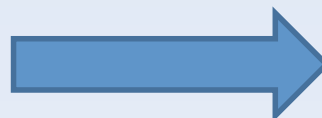
(power consumption estimated in SKA phase II)



Power Requirements



TOTAL: 105 MW



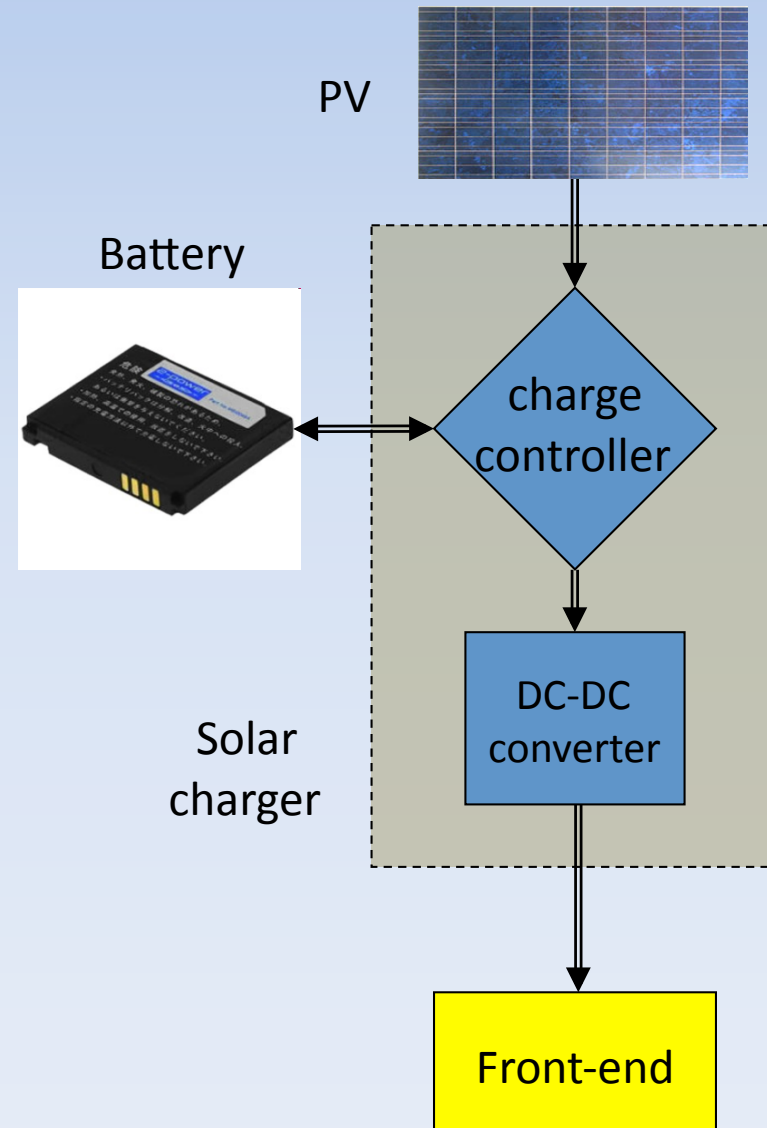
920 GWh/year

Processing Engines currently available

	Performance (GSample/s)				Efficiency (MSample/joule)			
	CPU	GPU	MPPA	FPGA	CPU	GPU	MPPA	FPGA
Uniform	4.26	16.88	8.40	259.07	15.20	140.69	600.00	8635.73
Gaussian	0.89	12.90	0.86	12.10	3.17	107.52	61.48	403.20
Exponential	0.75	11.92	1.29	26.88	2.69	99.36	91.87	896.00
Geo Mean	1.42	13.75	2.10	43.84	5.07	114.55	150.21	1461.20
	Relative Mean Performance				Relative Mean Efficiency			
	CPU	GPU	MPPA	FPGA	CPU	GPU	MPPA	FPGA
CPU	1.00	9.69	1.48	30.91	1.00	9.26	18.00	175.14
GPU	0.10	1.00	0.15	3.19	0.11	1.00	1.95	18.92
MPPA	0.67	6.54	1.00	20.85	0.06	0.51	1.00	9.73
FPGA	0.03	0.31	0.05	1.00	0.006	0.05	0.10	1.00



Self-powered solution



Conclusion

- Solar and wind at present seems to be the more suitable renewable energy to be exploited for SKA
- Storage technologies need to be deeply investigated
- In the design phase, reliability and low power consumption must be one of the more important constraints to be considered.

THANK YOU