

Introduction to Solar Energy

History of Solar Energy

Week 1.4

Arno Smets

7th century BC



7th Century BC

18th Century

19th Century

20th Century

21st Century

18th century



7th Century BC

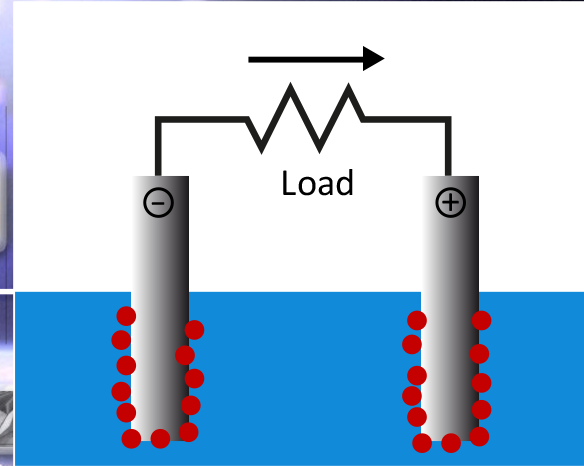
18th Century

19th Century

20th Century

21st Century

1839



7th Century BC

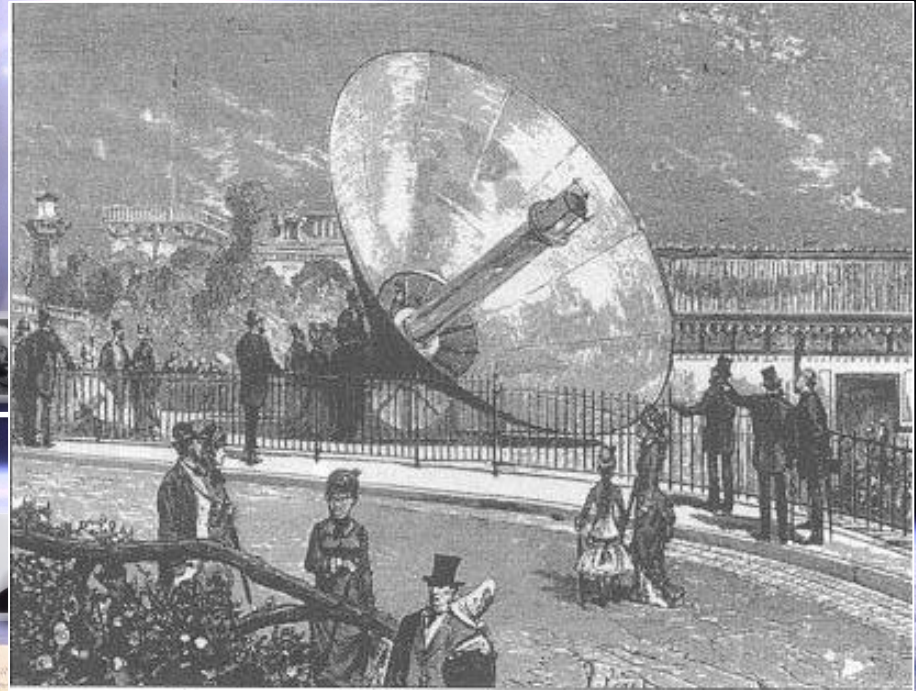
18th Century

19th Century

20th Century

21st Century

1860-1870



7th Century BC

18th Century

19th Century

20th Century

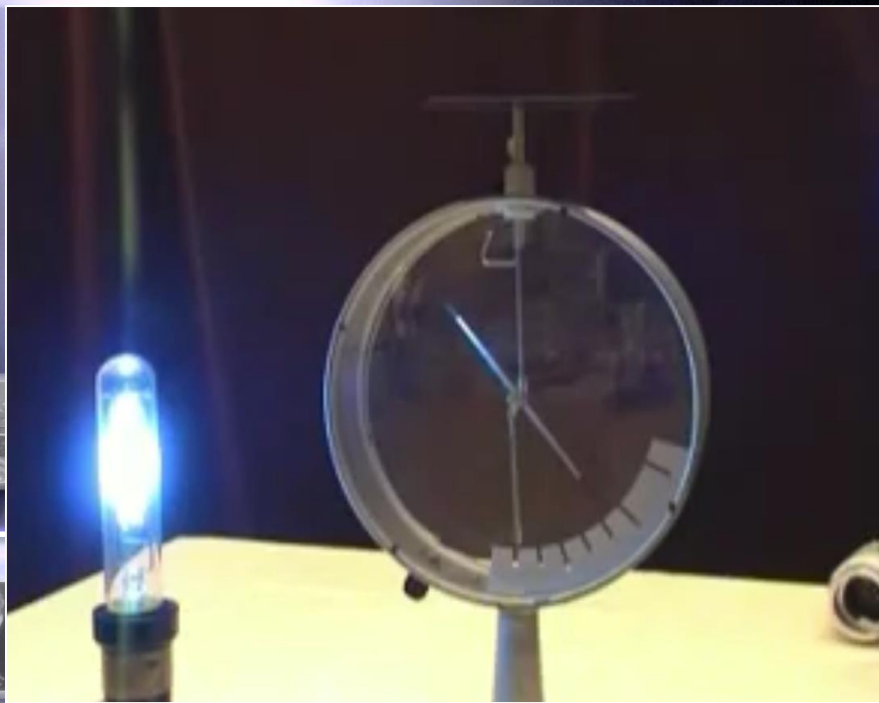
21st Century

1876 -1883

hydrogen 1 H 1.0079																	beryllium 4 Be 9.0122	helium 2 He 4.0026																						
lithium 3 Li 6.941	beryllium 4 Be 9.0122																	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180																	
sodium 11 Na 22.990	magnesium 12 Mg 24.305																	aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948																	
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996																	zinc 30 Zn 65.38	gallium 31 Ga 69.723	germanium 32 Ge 72.64	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.796												
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94																	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29												
cesium 55 Cs 132.91	barium 56 Ba 137.33	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84																	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]													
francium 87 Fr [223]	radium 88 Ra [226]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [277]	meitnerium 109 Mt [268]	darmstadtium 110 Ds [271]	roentgenium 111 Rg [272]																	bertholium 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.05	lutetium 71 Lu 174.97
		actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]	lawrencium 103 Lr [262]																								

7th Century BC 18th Century 19th Century 20th Century 21st Century

1887



7th Century BC

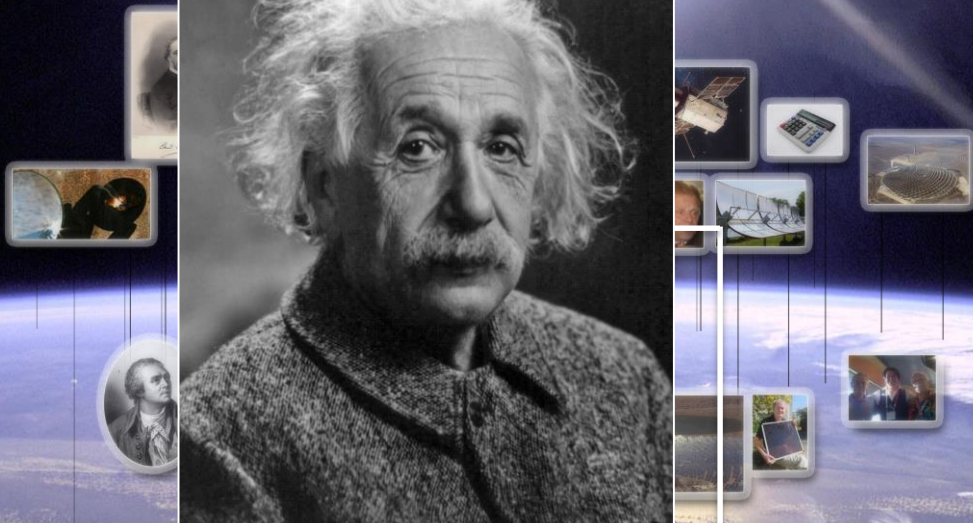
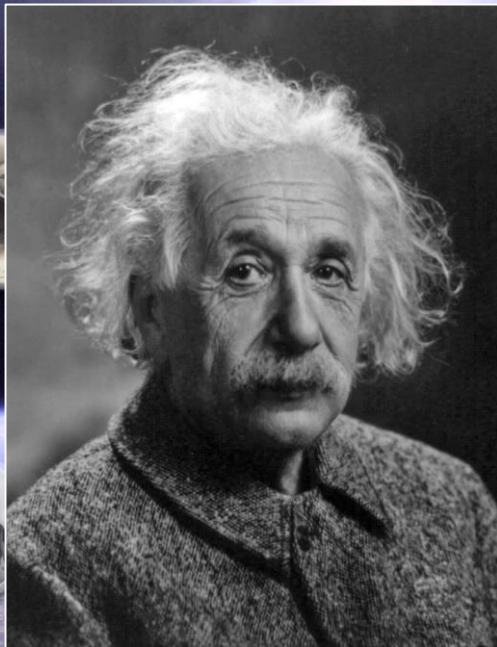
18th Century

19th Century

20th Century

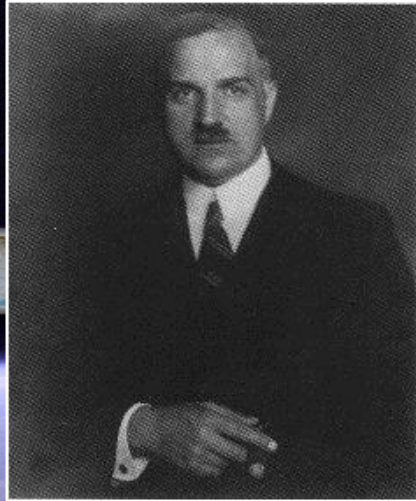
21st Century

1905



7th Century BC 18th Century 19th Century **20th Century** 21st Century

1918



7th Century BC

18th Century

19th Century

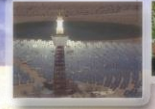
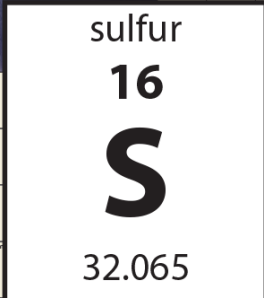
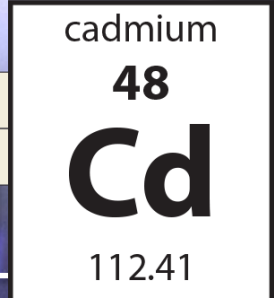
20th Century

21st Century

1932

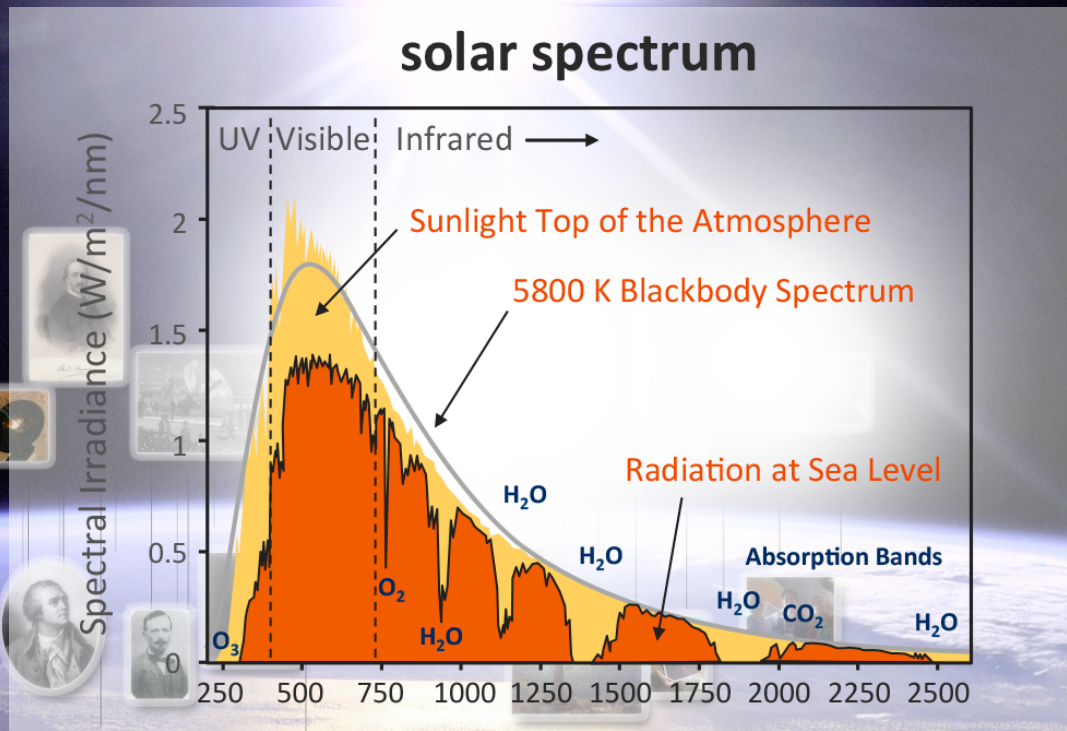


hydrogen 1 H 1.0079	beryllium 4 Be	boron 5 B	carbon 6 C	nitrogen 7 N	oxygen 8 O	fluorine 9 F	neon 10 Ne							
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rubidium 37 Rb 85.468	cesium 55 Cs 132.91	francium 87 Fr [223]	strontium 38 Sr 87.62	yttrium 39 Y 88.906	arsenic 33 As 74.922	selecnium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.798						
cadmium 48 Cd 112.41	barium 56 Ba 137.33	radium 88 Ra [226]	zinc 30 Zn	niobium 41 Nb	antimony 51 Sb	tellurium 52 Te	iodine 53 I	xenon 54 Xe 131.29						
	thorium 90 Th	protactinium 91 Pa	uranium 92 U	neptunium 93 Np	plutonium 94 Pu	americium 95 Am	curium 96 Cm	berkelium 97 Bk	californium 98 Cf	einsteinium 99 Es	fermium 100 Fm	mendelevium 101 Md	nobelium 102 No	lawrencium 103 Lr



7th Century BC 18th Century 19th Century 20th Century 21st Century

1953



7th Century BC

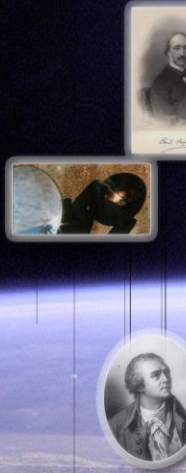
18th Century

19th Century

20th Century

21st Century

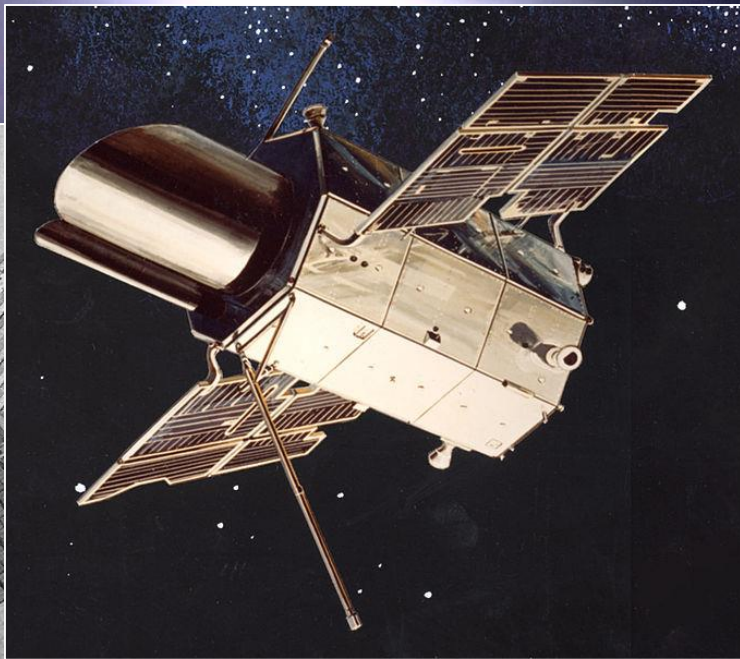
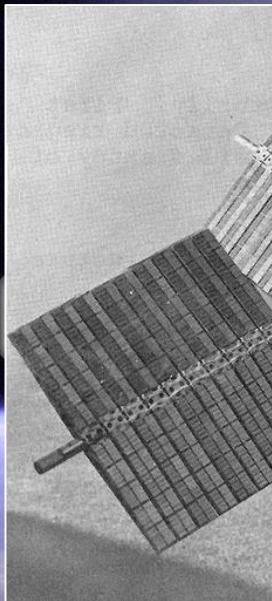
1954



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7 th Century BC	18 th Century	19 th Century	20 th Century	21 st Century
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1958-1966



7th Century BC

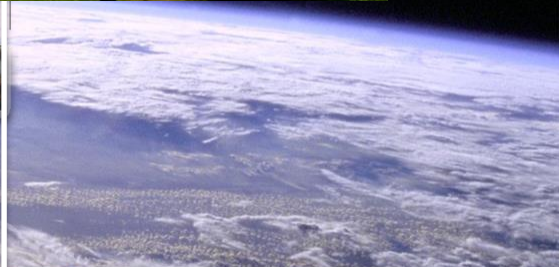
18th Century

19th Century

20th Century

21st Century

1968



7th Century BC

18th Century

19th Century

20th Century

21st Century

1970



7th Century BC 18th Century 19th Century 20th Century 21st Century

1976



7th Century BC

18th Century

19th Century

20th Century

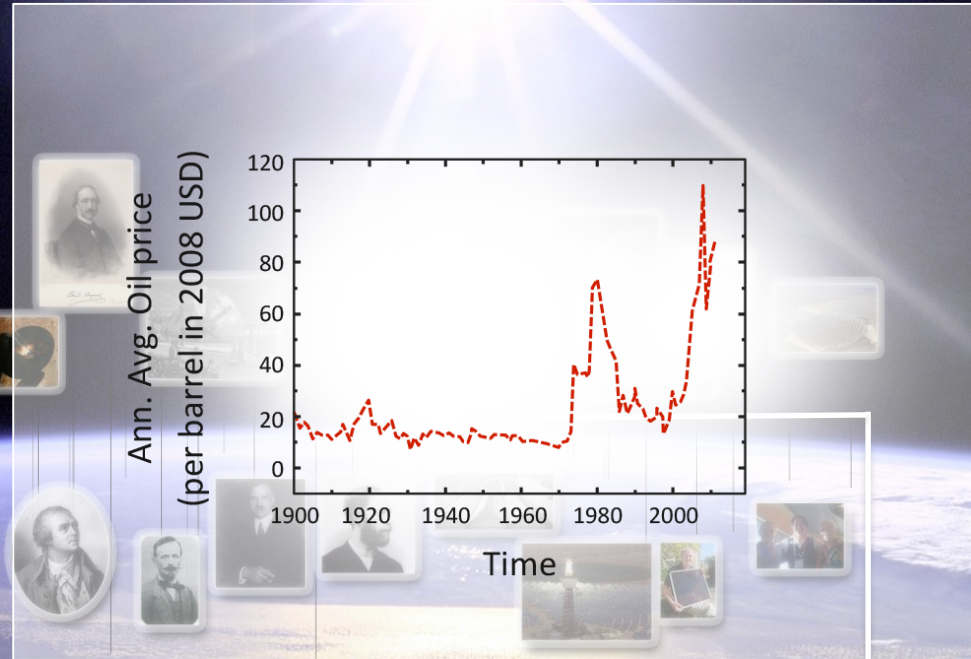
21st Century

1978



7 th Century BC	18 th Century	19 th Century	20 th Century	21 st Century
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Seventies



7th Century BC

18th Century

19th Century

20th Century

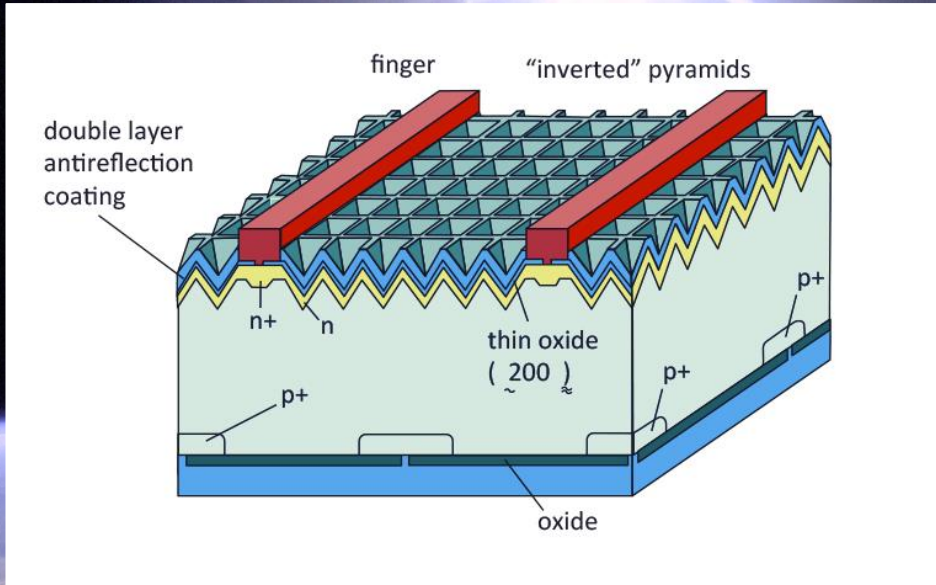
21st Century

1980



7 th Century BC	18 th Century	19 th Century	20 th Century	21 st Century
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1985



7th Century BC

18th Century

19th Century

20th Century

21st Century

1984-1991



7th Century BC

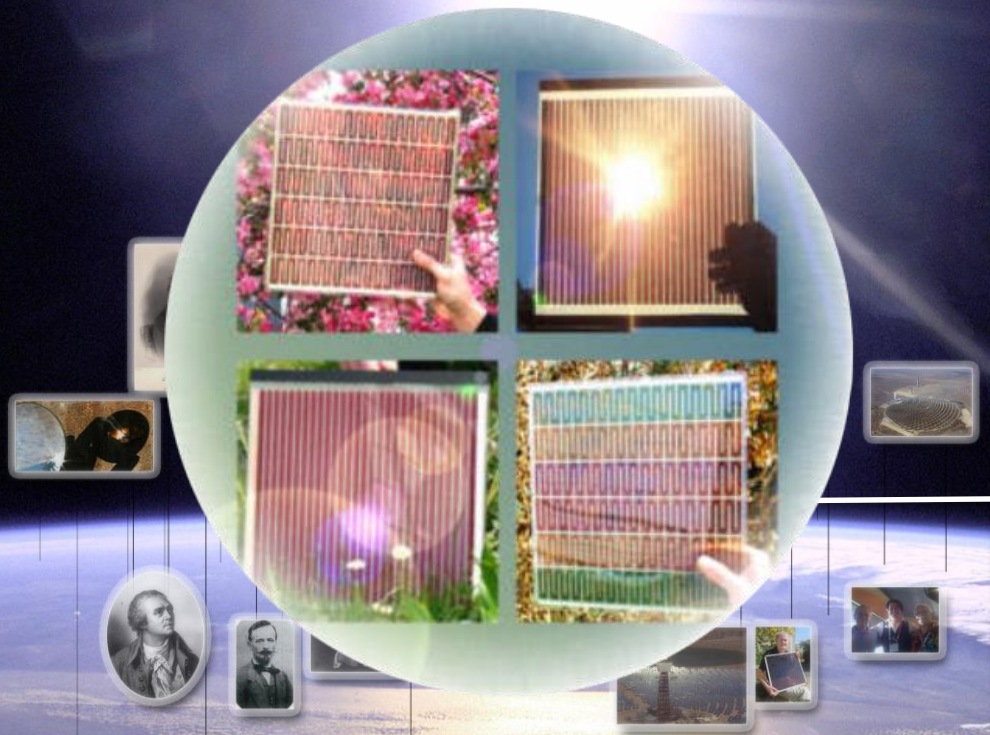
18th Century

19th Century

20th Century

21st Century

1991



7th Century BC

18th Century

19th Century

20th Century

21st Century

1994



NREL

NATIONAL RENEWABLE ENERGY LABORATORY



7th Century BC

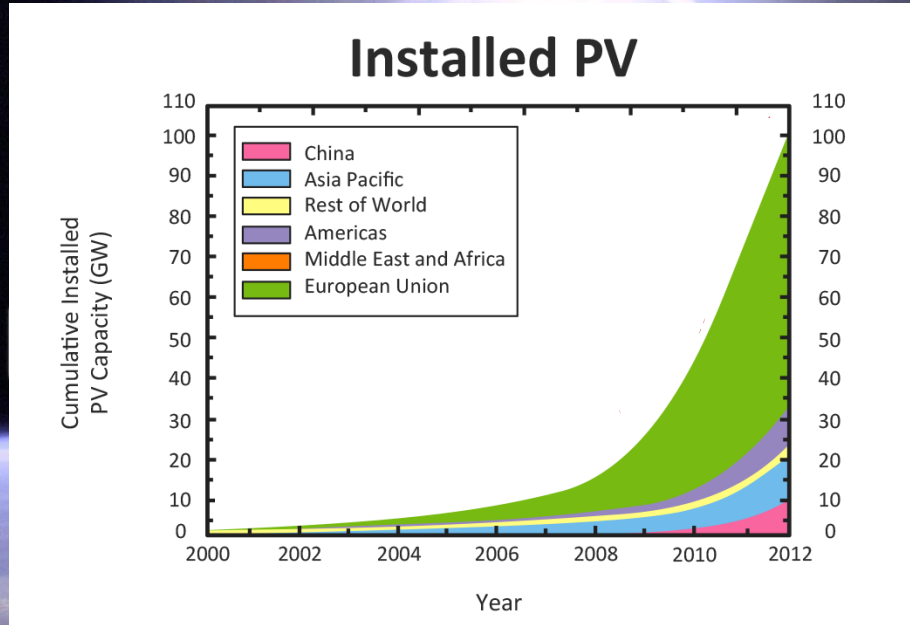
18th Century

19th Century

20th Century

21st Century

2000



7th Century BC

18th Century

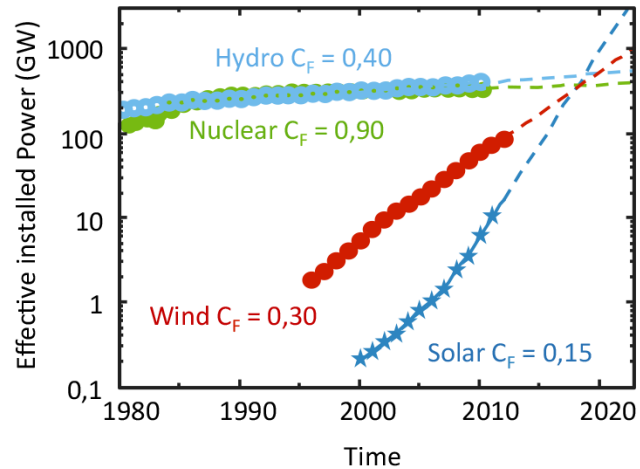
19th Century

20th Century

21st Century

2012

Installed Power (no fossil source)



7th Century BC

18th Century

19th Century

20th Century

21st Century



7th Century BC

18th Century

19th Century

20th Century

21st Century

Thank you for your attention!