

جلسه ۲۳:

انرژی خورشیدی (۲)

درس: انرژی و توسعه پایدار

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سیستم خانگی



راندمان

- برای اندازه گیری راندمان شرایط استاندارد عبارت است از:
 - توان ورودی: $1000\text{W}/\text{m}^2$ و دمای 25 درجه
 - هوای صاف در عرض جغرافیایی متوسط، و خورشید در زاویه 43 درجه افق

$$\eta = \frac{P_{\max}}{P_{\text{in}}}$$

- P_{\max} وابسته به ولتاژ و شدت جریان است
- ماکزیمم هرگز حاصل نمی شود
- به عنوان مثال راندمان تئوریک یک سلول ممکن است 28% باشد، در آزمایشگاه 25% ثبت شود، و در عمل به 19% هم نرسد

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نور به برق

Year	Type of Solar Cell	Efficiency	Developer
1883	selenium (photocell)	nearly 1 %	Charles Fritts
1953/4	monocrystalline silicon	4.5-6 %	Bell Labs, USA
1957	monocrystalline silicon	8 %	Hoffmann Electronics, USA
1958	monocrystalline silicon	9 %	Hoffmann Electronics, USA
1959	monocrystalline silicon	10 %	Hoffmann Electronics, USA
1960	monocrystalline silicon	14 %	Hoffmann Electronics, USA
1976	amorphous silicon	1.1 %	RCA Laboratories, USA
1985	monocrystalline silicon	20 %	University of New South Wales, Australia
1994	gallium indium phosphide/ gallium arsenide, with concentrator	over 30 %	National Sustainable Energy Lab (NREL), USA
1996	photoelectrochemical, Grätzel cell	11.2 %	ETH Lausanne, Switzerland
2003	CIS, thin-film cell	19.2 %	NREL, USA
2004	polycrystalline silicon	20.3 %	Fraunhofer ISE, Freiburg, Germany
2009	gallium indium phosphide/ gallium gallium indium arsenide/ germanium; tandem cells	41.1 %	Fraunhofer ISE

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پنل های فیلم نازک



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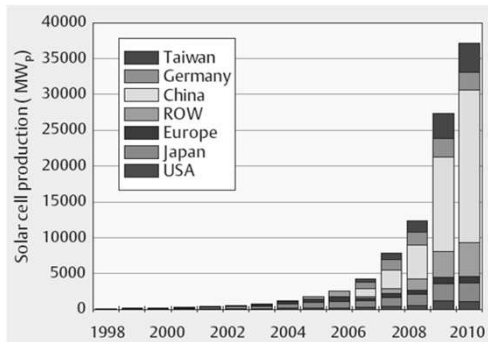
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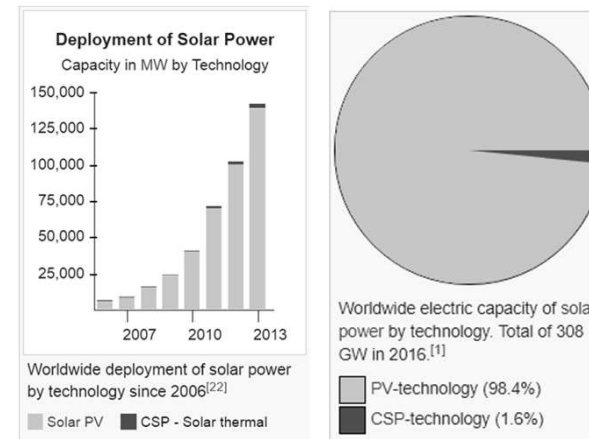
کشورهای تولید کننده



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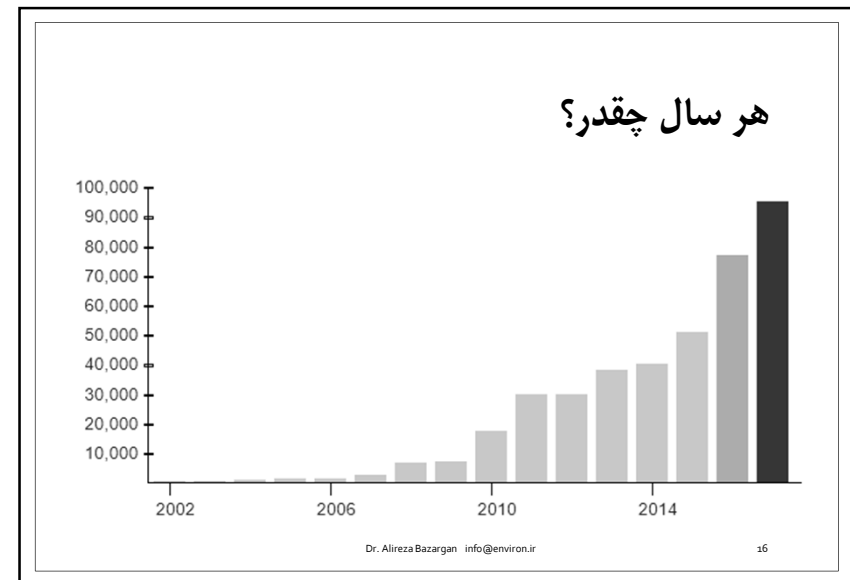
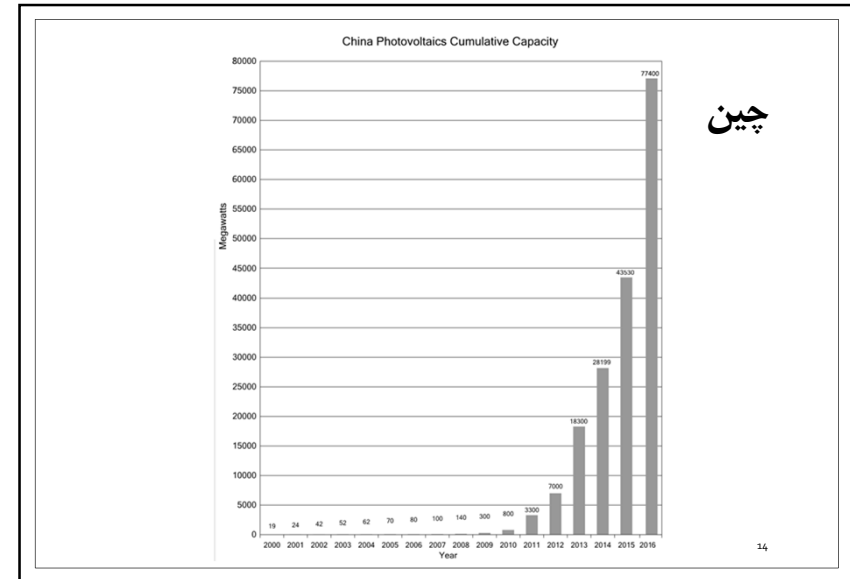
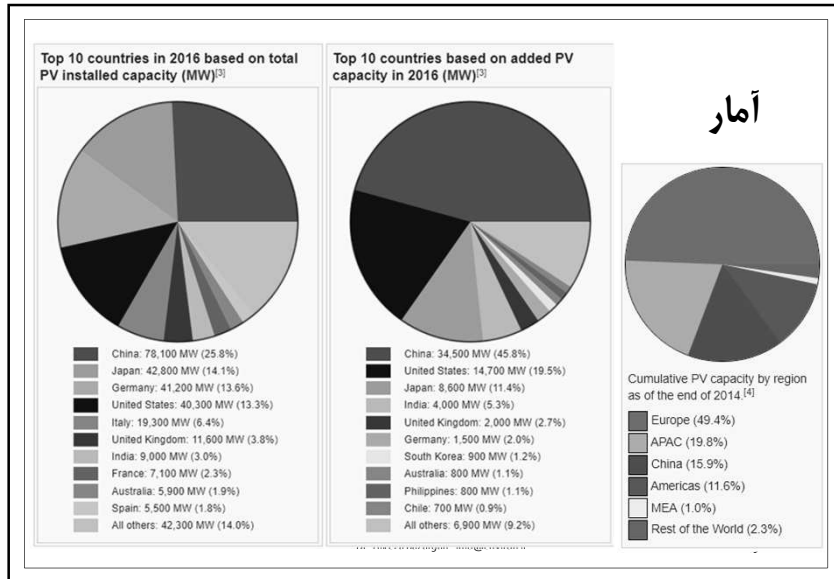
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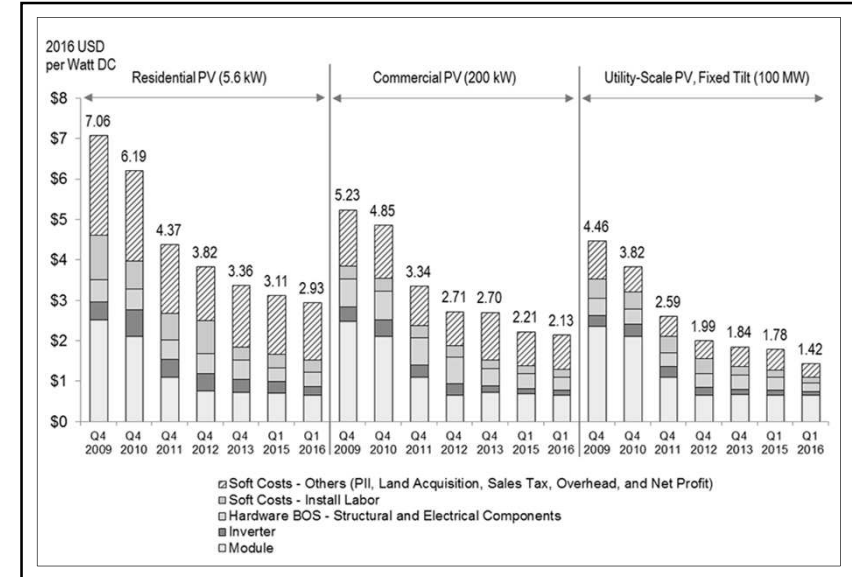
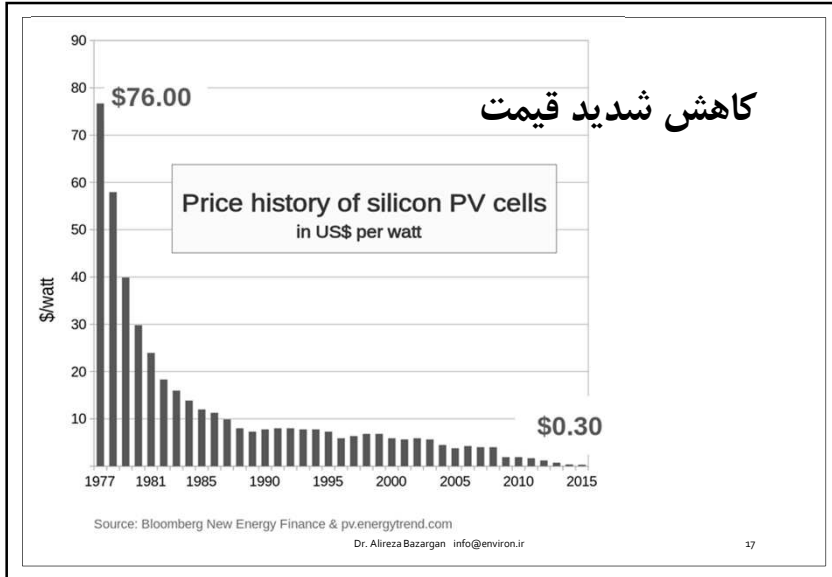
آمار



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آمار ایران

Power plant type	Number of companies	Capacity (MW)
Wind	26	1389.2
Solar (PV)	120	1358.4
Biomass	3	6
Waste heat recovery	5	64
Total	162	2840

Table 4: Number of companies with renewable & clean power purchase agreement (PPA) up to the end of January 2018 (not necessarily operational yet)

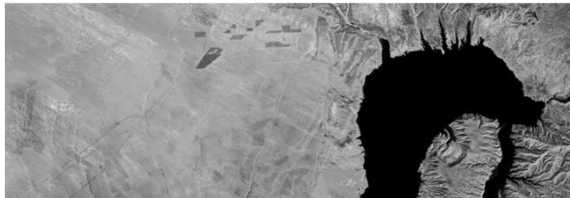
Solar Power Plant				
8	Atrian Parsian	0.514	Malard, Tehran	May-14
9	Pak Bana	0.228	Qom	Sep-16
10	Aftab Mad Rah Abrisham	21	Hamadan	Dec-16
11	Tara Moshaver	0.215	Shams Abad, Alborz	Jan-17
12	Ghadix Energy	10	Jarghoveh, Esfahan	Apr-17
13	Mehran Energy Arvand Co.	1.2	Rafsanjan, Kerman	Jul-17
14	Tose'e Faragix Jask Co.	10	Mahan, Kerman	Jul-17
15	Solar Energy Arka Co.	10	Mahan, Kerman	Jul-17

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Name	Country	Capacity MW _p	Size km ²	Year	Remarks
Tengger Desert Solar Park	 China	1,547	43	2016	1,547 MW solar power was installed in Zhongwei, Ningxia by 2015.
Datong Solar Power Top Runner Base	 China	1,000		2016	1 GW Phase I completed in June 2016. Total capacity will be 3 GW in 3 phases.
Kurnool Ultra Mega Solar Park	 India	1,000	24	2017	1000 MW operational as of December 2017
Longyangxia Dam Solar Park	 China	850	23	2015	320 MW Phase I Completed in December 2013, 530 MW phase II in 2015
Bhadla Solar Park	 India	746	40	2017	The park is proposed to have a capacity of 2,255 MW with 1920 MW auctioned off in four phases till now ^[20] and a tender for additional 750 MW floated in June 2017. A total of 2055 MW installed capacity is expected to be completed by December 2018.
Kamuthi Solar Power Project	 India	648	10.1	2016	Completed on 21 September 2016
Pavagada Solar Park	 India	600	53	2017	In Karnataka state, total planned capacity 2,000 MW

Longyangxia Dam Solar Park



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