

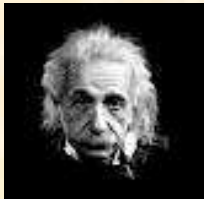
Source: The McKinsey Global Institute



**Sohail Hasnie**  
Principal Energy Specialist, CWEN



We **cannot solve** our problems  
(Climate Change)  
with the  
**same thinking**  
we used  
when  
we created them.



# Disruptive Innovation

An **innovation** that helps create a new market and value network, and eventually disrupts an existing market and value network (over a few years or decades), displacing an earlier **technology**.

Report | McKinsey Global Institute

Disruptive technologies: Advances that will transform life, business, and the global economy

May 2013 | by James Manyika, Michael Chui, Jacques Bughin, Richard Dobbs, Peter Bisson, and Alex Marrs

ADB

**1982**

**40 KB**

**1988**

**1.4 MB or 1,400 KB**



**Disruptive Innovation**



after **34** years

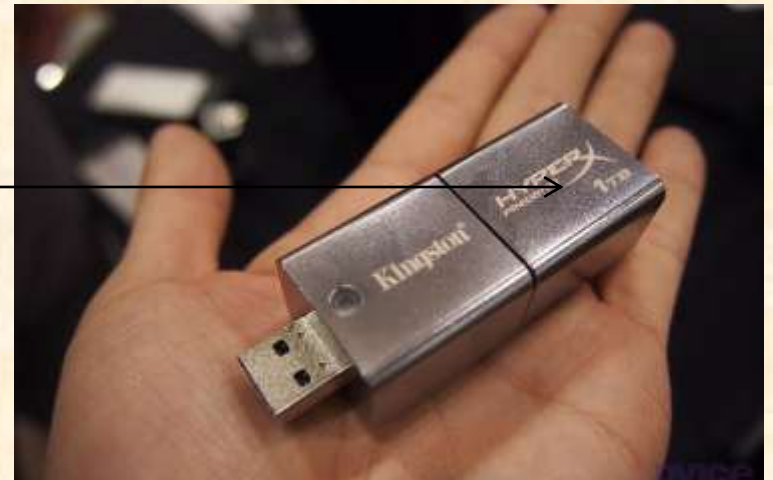


**2012**

**256 GB or 256,000,000 KB**  
(**6,400,000** times capacity increase!!!)

**2015**

**1 TB or 1,000 GB**  
**or 1,000,000,000 KB**



1992

Disruptive Innovation



after 20 years

**\$3398**  
**10MB**

**THE HARD DISK YOU'VE BEEN WAITING FOR**

**XCOMP** introduces a complete micro-size disk subsystem with more...

- MORE STORAGE
- MORE SPEED
- MORE VALUE
- MORE SUPPORT

The XCOMP subsystem is now 10 megabytes of storage, 5 megabytes of storage, 5 megabytes of storage, 5 megabytes of storage. Compare the price and performance of this 8-inch subsystem with other hard disk drives.

**MORE SOFTWARE**  
Included with the system is software for testing, formatting, I/O drivers for CP/M<sup>®</sup>, plus an automatic CP/M driver attach program. Support software and drivers for MP/M<sup>®</sup> and Oasis<sup>®</sup> are also available. A sophisticated formatting program assigns alternate sectors for any weak sectors detected during formatting, assuring the lowest possible error rate -- at least ten times better than floppies.

**WARRANTY**  
The system has a full one-year warranty on parts and labor.

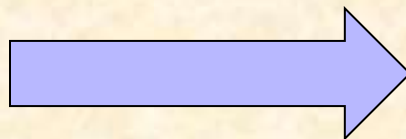
2012

**Kingston**  
TECHNOLOGY

**DT310** 256GB

**\$86**  
**256GB**

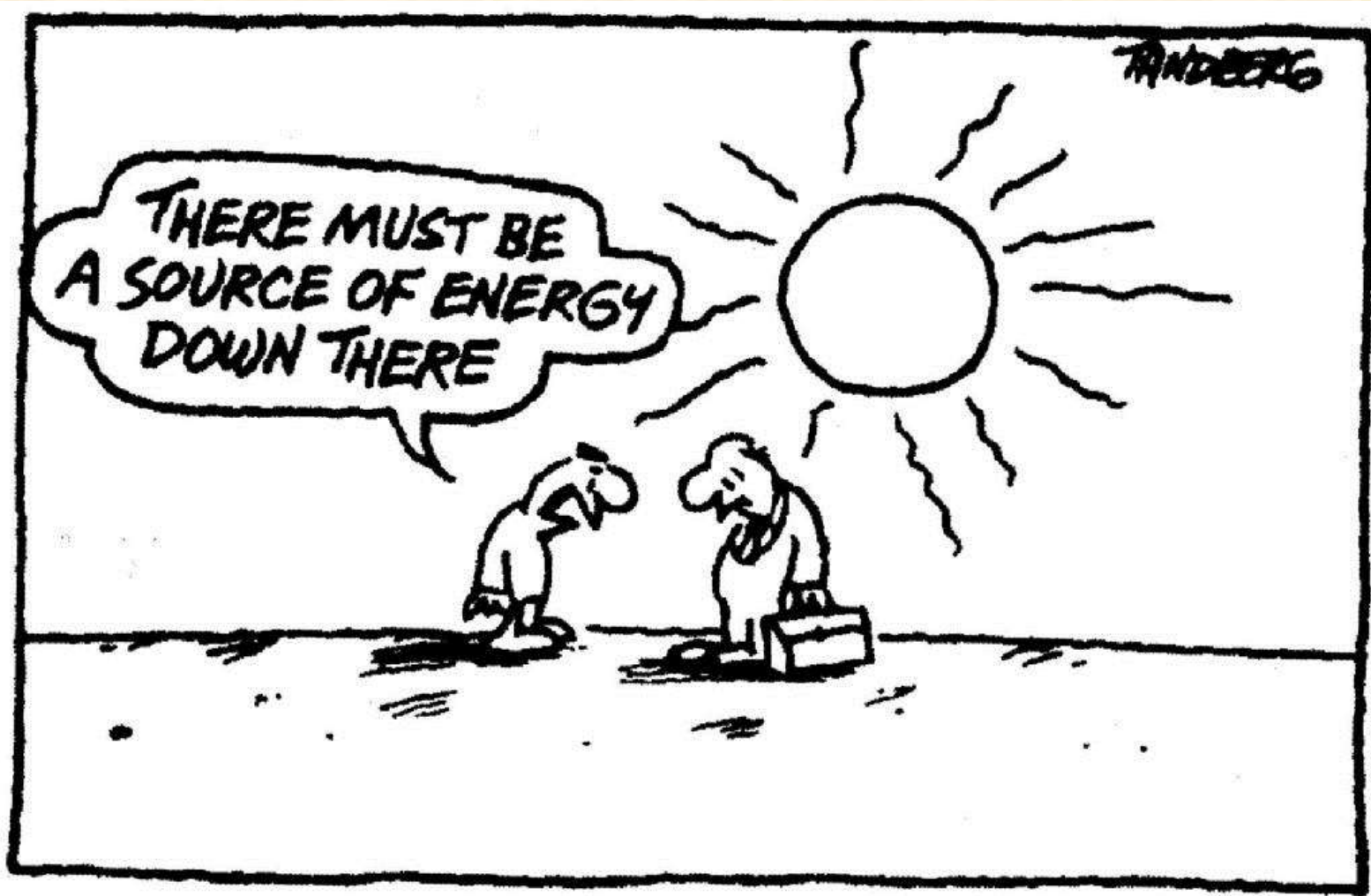
**\$340 /MB**



**0.3 c/MB**

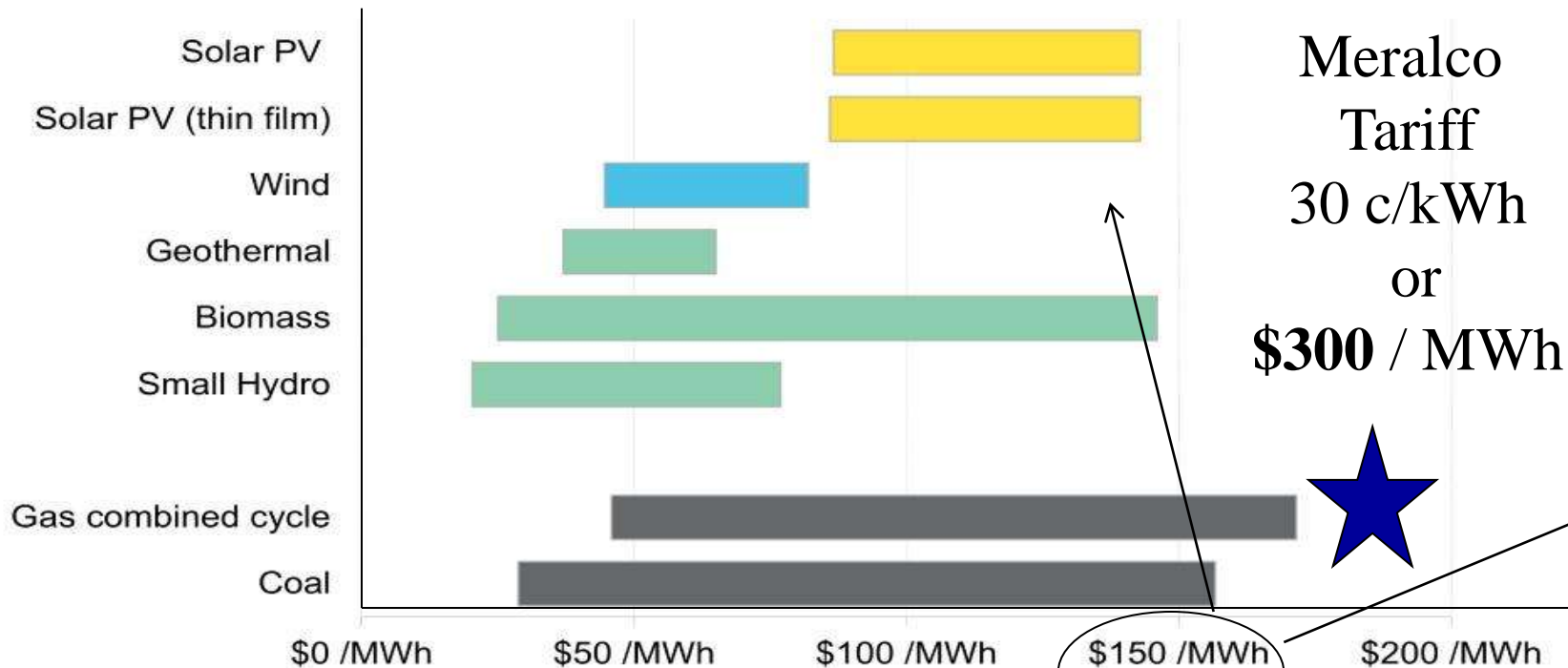
Source: <http://www.kotzendes-einhorn.de/blog/2011-06/the-hard-disk-youve-been-waiting-for-na-endlich/>

# Disruptive Technology #1



# RENEWABLE GENERATION NOW DIRECTLY COMPETES ON COSTS WITH FOSSIL FUEL-FIRED POWER.

Levelised cost of energy (central scenario), H2 2014



Meralco  
Tariff  
30 c/kWh  
or  
**\$300 / MWh**



**\$300 / MWh**

Source: Bloomberg New Energy Finance

# Global Module Average Selling Price

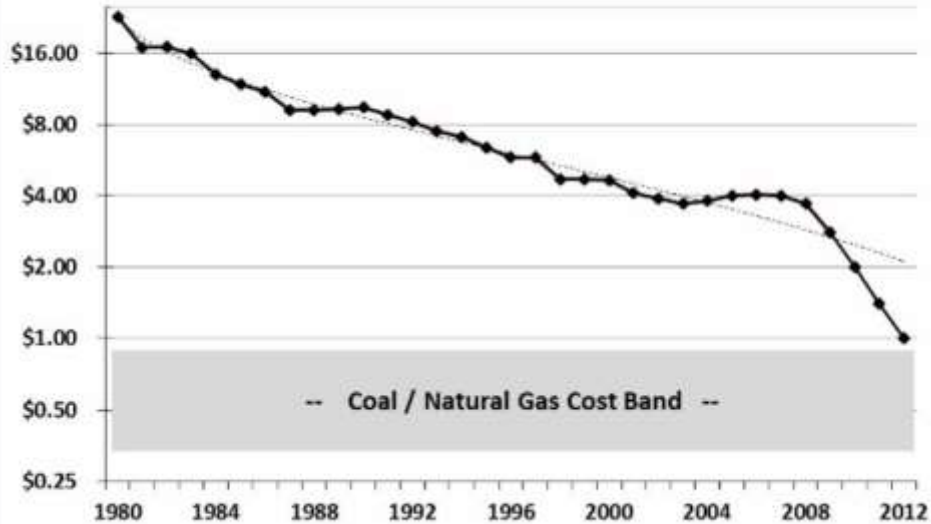
Disruptive Innovation



after **24** years

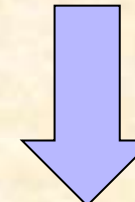
### Plummeting Cost of Solar Modules

(Cost Per Watt in 2012 Dollars)

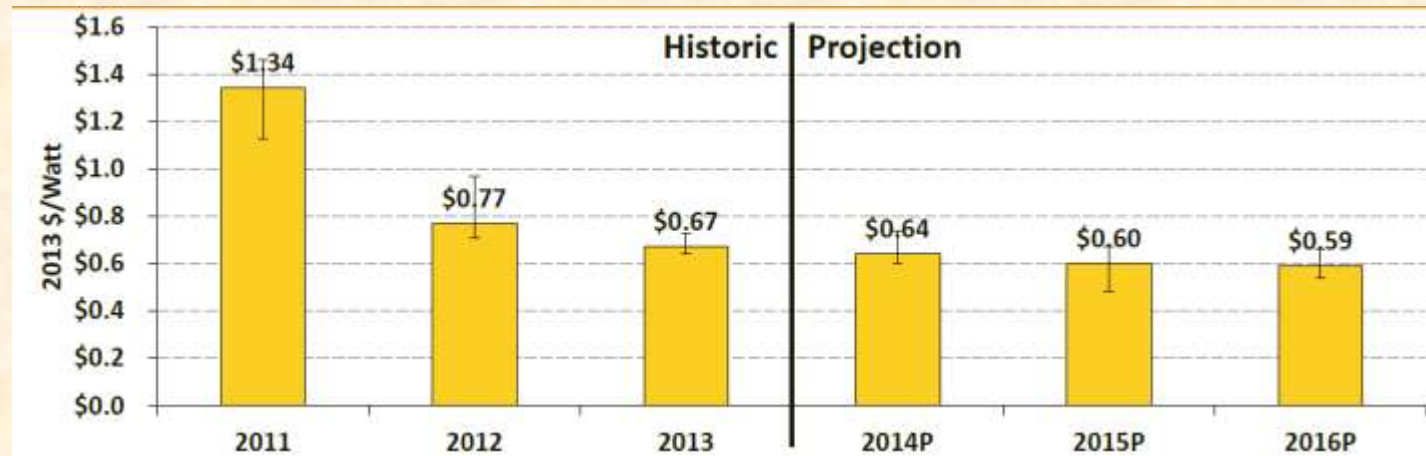


Sources: DOE NREL Solar Market Report, SolarBuzz Retail Price Environment

**\$16.00** /Per Watt



**\$0.65** /Per Watt



# Local Module Price



3 images

**100 watts solar panel**

**₱ 4,200.00**

🕒 Posted February 18, 2015

📍 Cavite



5 images

**100 Watts Solar Panel**

**₱ 5,500.00**

🕒 Posted February 22, 2015

📍 Batangas



# Disruptive Technology #2



Technology Quarterly: Q2 2002 ▾

## CASE HISTORY

### Hooked on lithium

Without the lithium-ion battery, introduced a decade ago, portable gadgets—from mobile phones and video cameras to laptops and palmtops—would have remained brick-like objects best left on the desk or at home. But the innovation would have floundered had electro-chemists in America not teamed up with a Japanese firm

THE Mobira Senator, launched in 1982 by Nokia, was the grand-daddy of today's mobile phones. It consisted of a small handset connected to a brick-like battery pack, with a hefty handle on top—a vital feature, since the whole thing weighed 9.8kg. Today, a typical mobile phone is a hundredth of this (ie, 100 grams or less) and can be tucked discreetly into a shirt pocket. This 99% weight reduction has been achieved largely through advances in battery technology. Above all, it is down to one particular breakthrough: the advent of the lithium-ion rechargeable battery.

Nokia Senator 1982

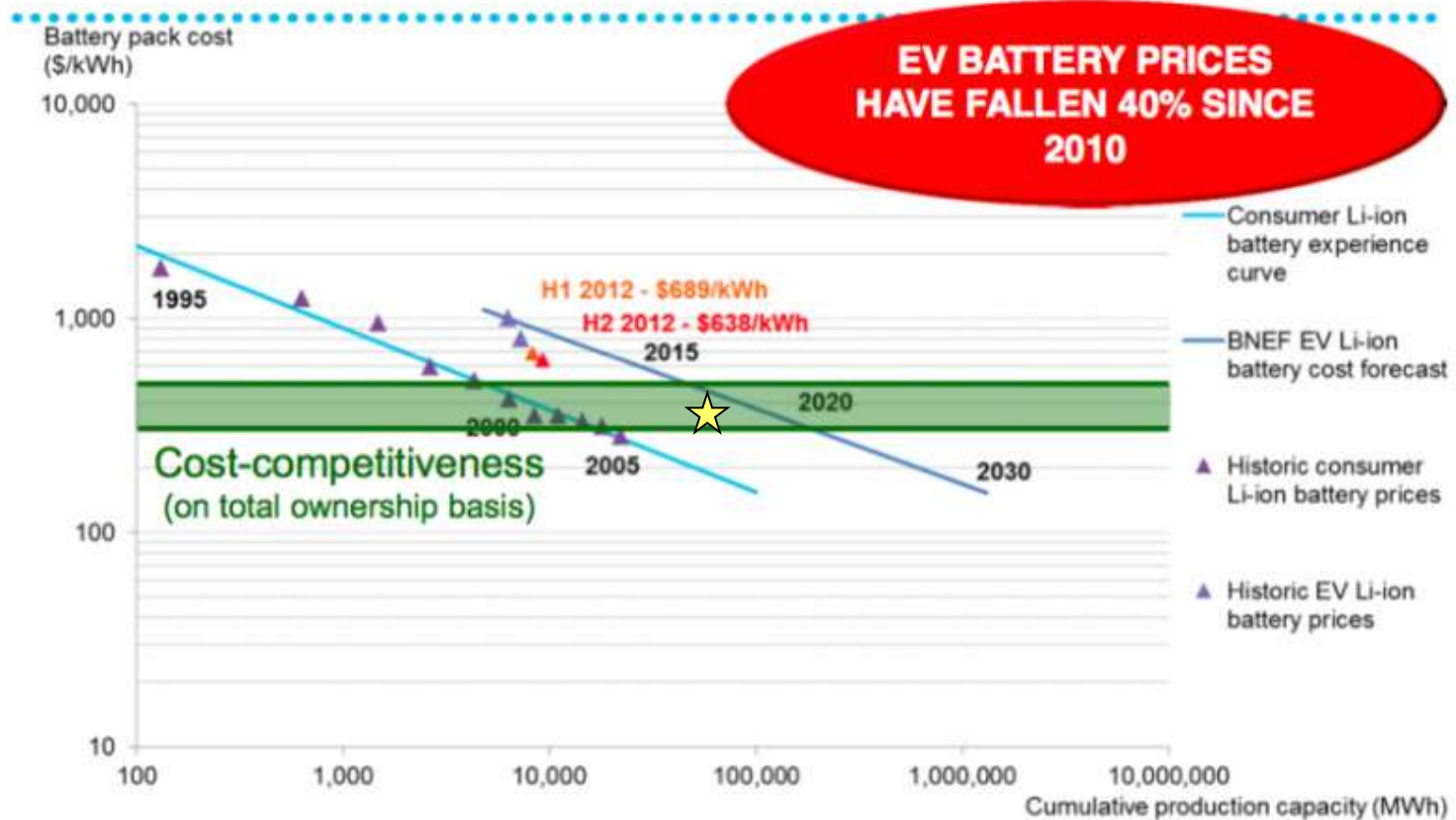
Battery **9.8 kg**

Today **112 gm**

**98%** reduction!!

# Prices are falling ...

## LITHIUM-ION BATTERY EXPERIENCE CURVE



Source: Battery University, MIT, IIT, Bloomberg New Energy Finance

# Battery Price

**\$500 / kWh**

**to**

**\$50 / kWh**

**Tesla  
Model S**



Battery: **85 kWh**  
Motor: **310 kW**

**\$38,000**

**Nissan  
LEAF**



Battery: **24 kWh**  
Motor: **80 kW**

**\$11,000**

**Mitsubishi  
iMiEV**



Battery: **16 kWh**  
Motor: **47 kW**

**\$7,000**

**E-Trike**



Battery: **3 kWh**  
Motor: **3 kW**

**\$1,300**



# Disruptive Technology #3

**Incandescent**

**CFL**

**LED**



**13** Watt

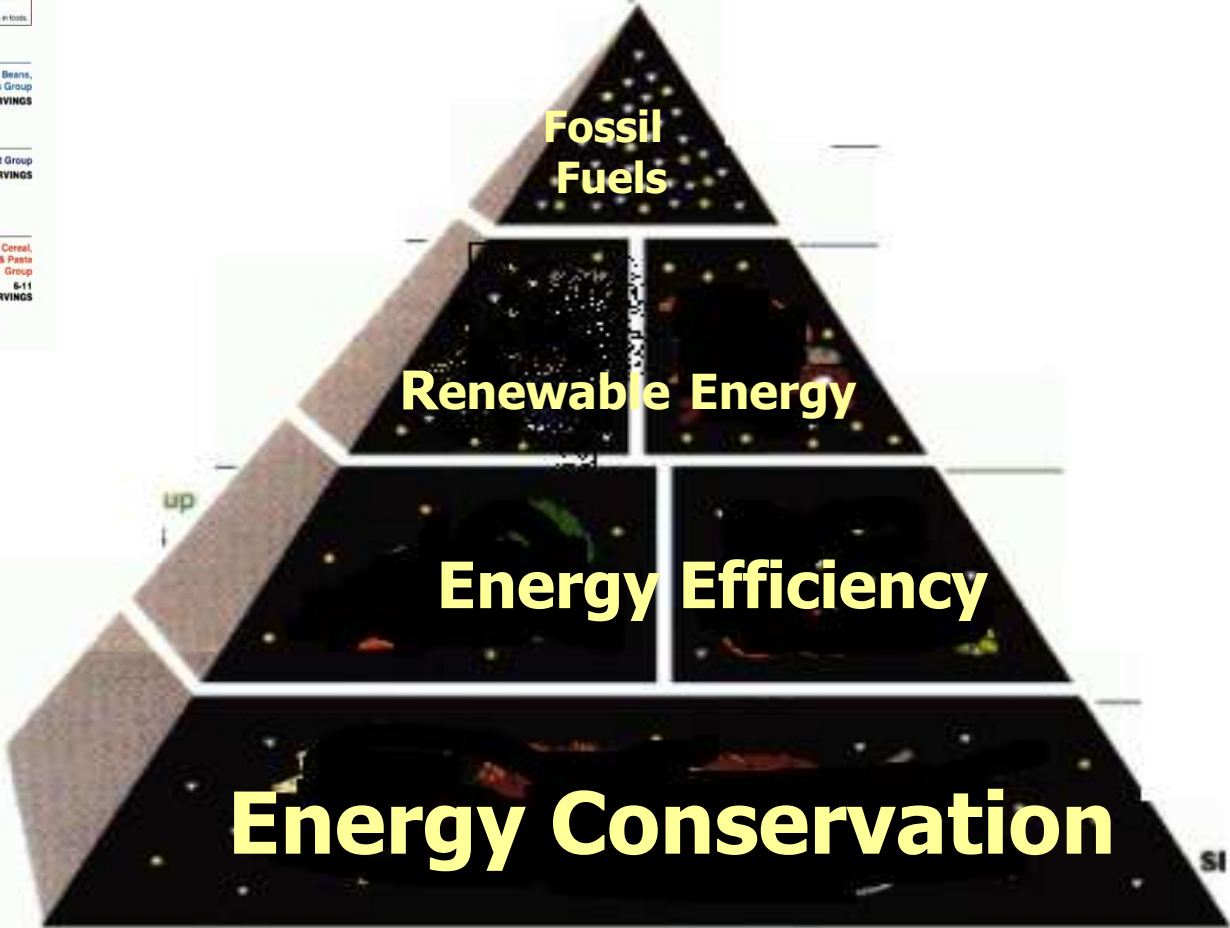
**60** Watt

**7** Watt

# Lights

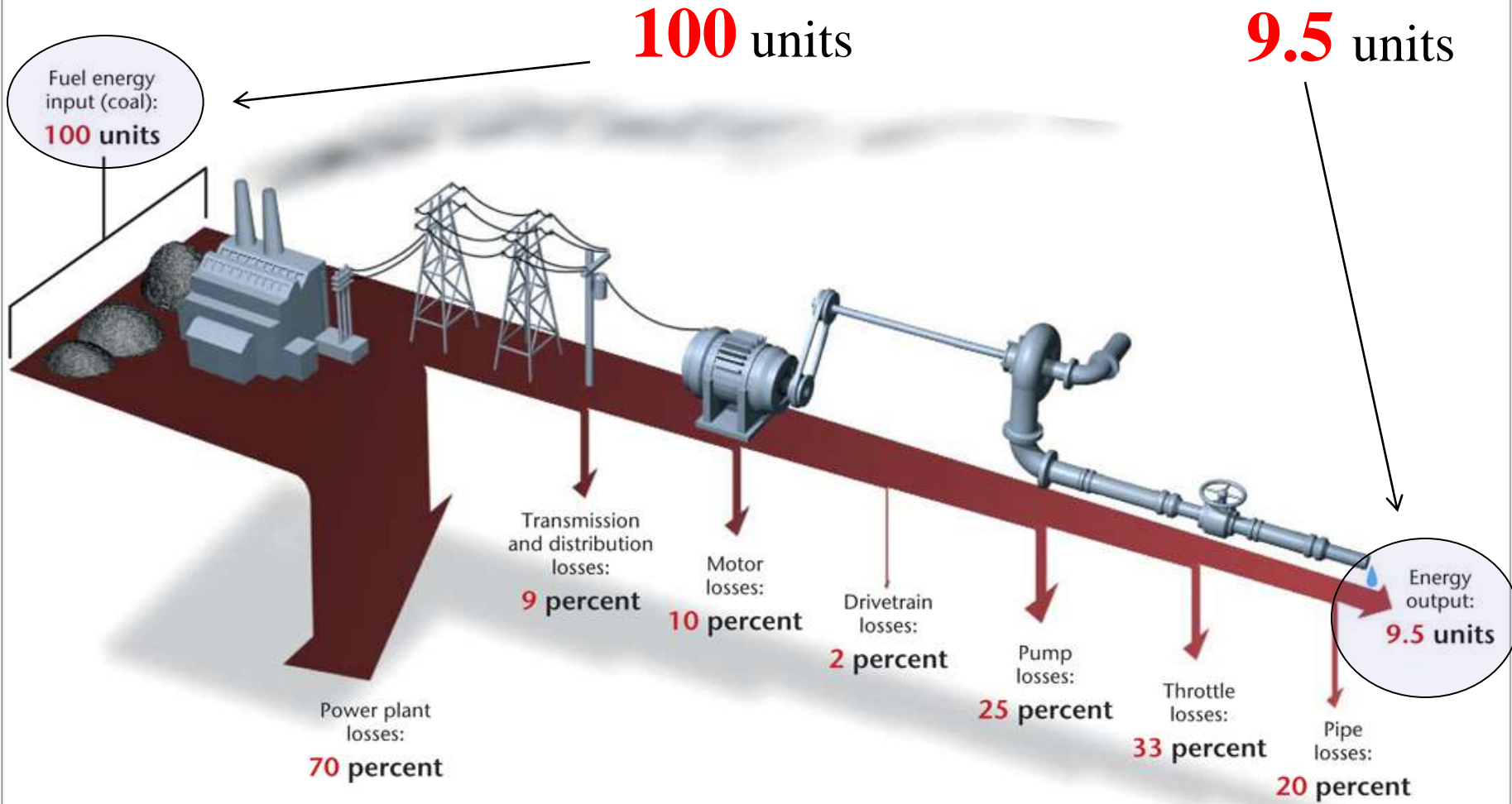


# Saving Energy



“More than 90% of energy extracted from the ground is wasted before it becomes useful work.”

## Why energy efficiency?



# TV

230 Watt

88 Watt

30 Watt



### CRT TVs (2005)



	In use	In standby
Sony KD-32DX51U	87.6W	13.9W
Panasonic TX-28DTX11	96.0W	0.9W
<b>JVC HV-32D40BK</b>	<b>164.0W</b>	<b>2.1W</b>



LG  
42LB5800

MSRP	\$699
Screen Size	42
Resolution	1920 x 1080
Display Type	LCD
Automatic Brightness Control?	Yes
Annual Energy Use (kWh)*	55
Annual Cost to Operate**	\$6





Image: Kleenmaid



www.shutterstock.com · 120115255

## SINGLE BURNER INDUCTION HEAT COOKER

kWh per hour	1.51
Cost per hour with 1 hours/day usage	P17
Cost per day with 7 days/week usage	P17
Cost per month with 56 hours/month usage	P464

**SAVE** P 6 4 5

PER MONTH VS. GAS STOVE



## GAS STOVE

kWh per hour	3.61
Cost per hour with 1 hours/day usage	P40
Cost per day with 7 days/week usage	P40
Cost per month with 56 hours/month usage	P1109

Based on Meralco Power Lab tests and on Consumer Panel Research-Appliance Ownership and Usage.

## Efficient Electric Cooking





# Hypothesis—Free Replacements

7 year old one with new



Room Air-Conditioner (RAC)

7 year old one with new – 1 year pay back

ADB



$$\text{EER} = \frac{\text{output cooling energy in BTU}}{\text{input electrical energy in Wh}}$$

## Capacity

1.2 HP

11200 kJ per hour

**EER 11.7      960** Watt

**EER 8      1400** Watt

# Different type of fans



# Which Electric Fan?



54 Watt



60 Watt



\$300 and 25 Watt

Air Delivery, Power Input and Service Value

Brand	Air Delivery (m <sup>3</sup> /min)	Score out of 10	Service Value (m <sup>3</sup> /min/W)	Score out of 10	Power Input (W)	Score out of 8	Total Score out of 28
Havells	71.9	7.84	1.56	9.75	46	7.47	25.06
Ortem	73.4	8.24	1.38	8.62	53	6.85	23.71
Crompton Greaves	69.68	7.25	1.45	9.06	48	7.31	23.62
Bajaj	70.25	7.4	1.22	7.62	57.2	6.29	21.31
Usha	67.5	6.67	1.27	7.93	53	6.66	21.26
Orpat	65.91	6.25	1.24	7.75	52.8	6.87	20.87
Almonard	92.22	10	0.7	4.37	131.6	5.94	20.31
Orient	69.97	7.33	1.1	6.87	63.2	5.46	19.66
Marc	65.1	6.03	1.2	7.5	54	5.57	19.1
Khaitan	65.25*	6.07	0.61*	3.81	106.4*	6.41	16.29





## 5 million LED → 150 MW Power Station



**510 kW for 3 hours a day →**  
**1800 efficient TV 10 hours per day**

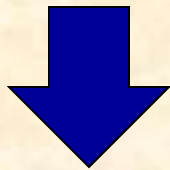


## 3 disruptive technologies

Extremely cheap and lighter batteries

Cheap solar power

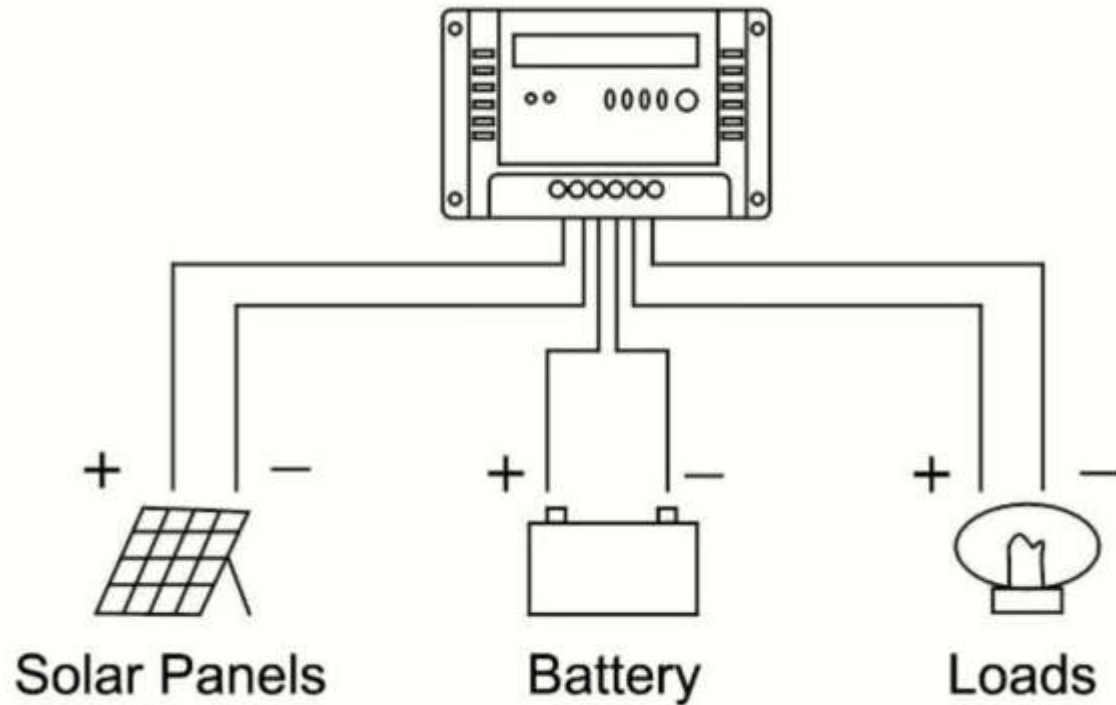
Super efficient appliances



**Low voltage electricity supply**



## SOLAR CONTROLLER



# 12 Volt DC home-system

- Solar Power
- Efficient Appliances including LEDs
- Lithium-ion Battery

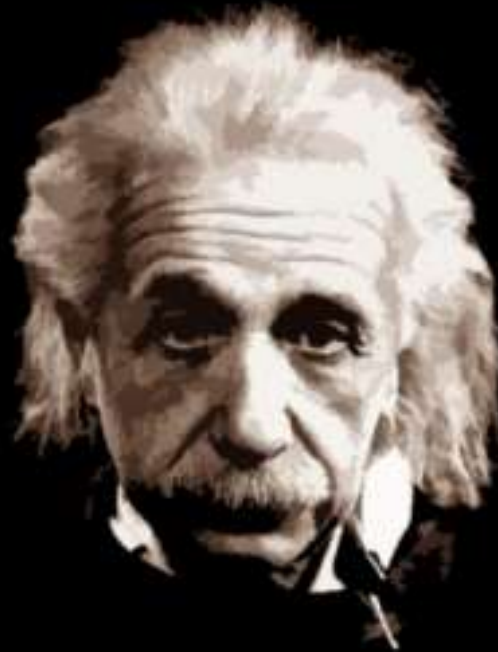


# Off-grid light in the courtyard



“Imagination is more  
important than knowledge.  
Knowledge is limited.  
Imagination encircles the  
world.”

-Albert Einstein



# Megatrends!!

**#1**

**We produce our own electricity, and sell excess power as charged batteries or keep it in the storage for winter use**

# Megatrends!!

**#2**

**Most households have dis-connected from the main power grid, grid (where they exist) only supplies large industries**

# Megatrends!!

**#3**

**All appliance come with its own battery storage and consumes less than 10% of what they used to consume in 2010**

# Megatrends!!

**#4**

**Car became the energy “wallet” for the family and there are many ATMs in the city to supplement home charging**

# Megatrends!!

**#5**

**Many smaller power companies are bankrupt, some old transmission and distribution cables are being sold as scrap metals**

# Megatrends!!

**#6**

**A large power station means a nuclear, hydro, geothermal, solar farms or wind farms**



# Megatrends!!

**#7 Batteries are found in everything  
as small cameras use to be in all  
devices in 2015**

# Megatrends!!

**#8 Every house has integrated solar power in the roof and windows and battery storage inside the walls**

# Megatrends!!

**#9**

**Car with tailpipe are bans from most cities as smoking was not allowed in public places 2015**

# Megatrends!!

**#10**

**Electricity is cheap: remember skype?  
Many products come with promos  
“free electricity for the year”**

# Questions