



# Renewable Energy

Ana Romaliischi

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# What is Renewable Energy?

- Derived from natural processes that are replenished constantly.
- Resources exist over wide geographical areas.
- Provides energy in four important areas.



# Key Renewable Energy Sources



## Solar Power

- Photovoltaic
- Solar-thermal



## Wind Power

- Onshore
- Offshore



## Biofuels

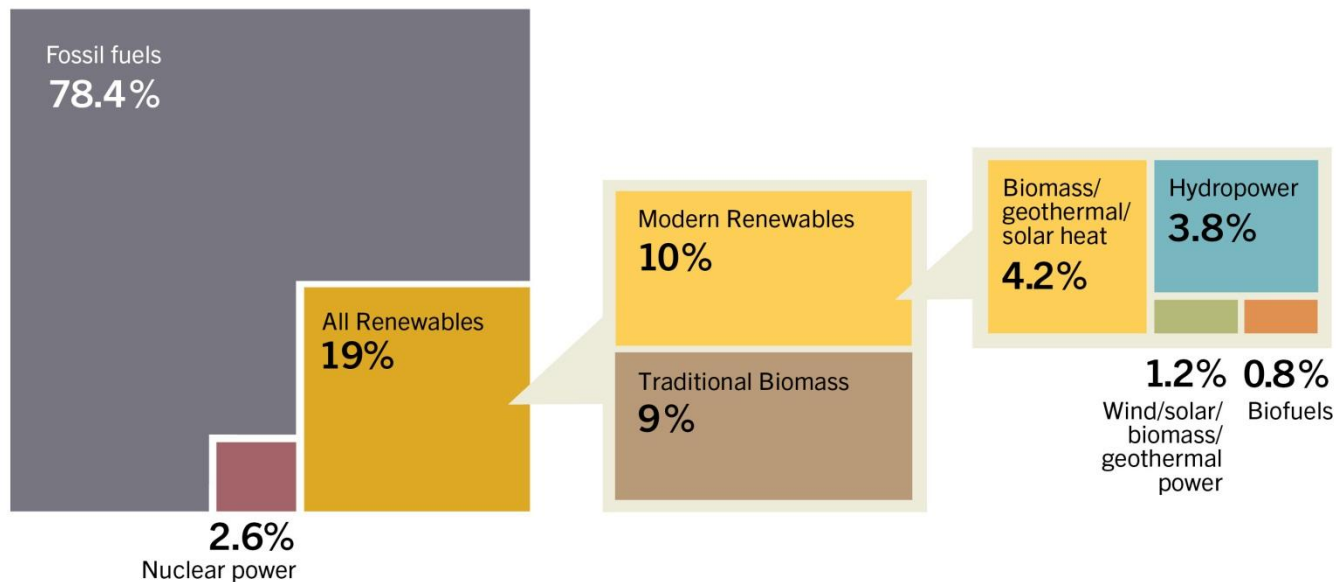
- Agricultural crops (1<sup>st</sup> Gen)
- Cellulosic feedstock (2<sup>nd</sup> Gen)
- New feedstock such as Algae (3<sup>rd</sup> Gen)



## Hydro Power

# Key Renewable Energy Sources

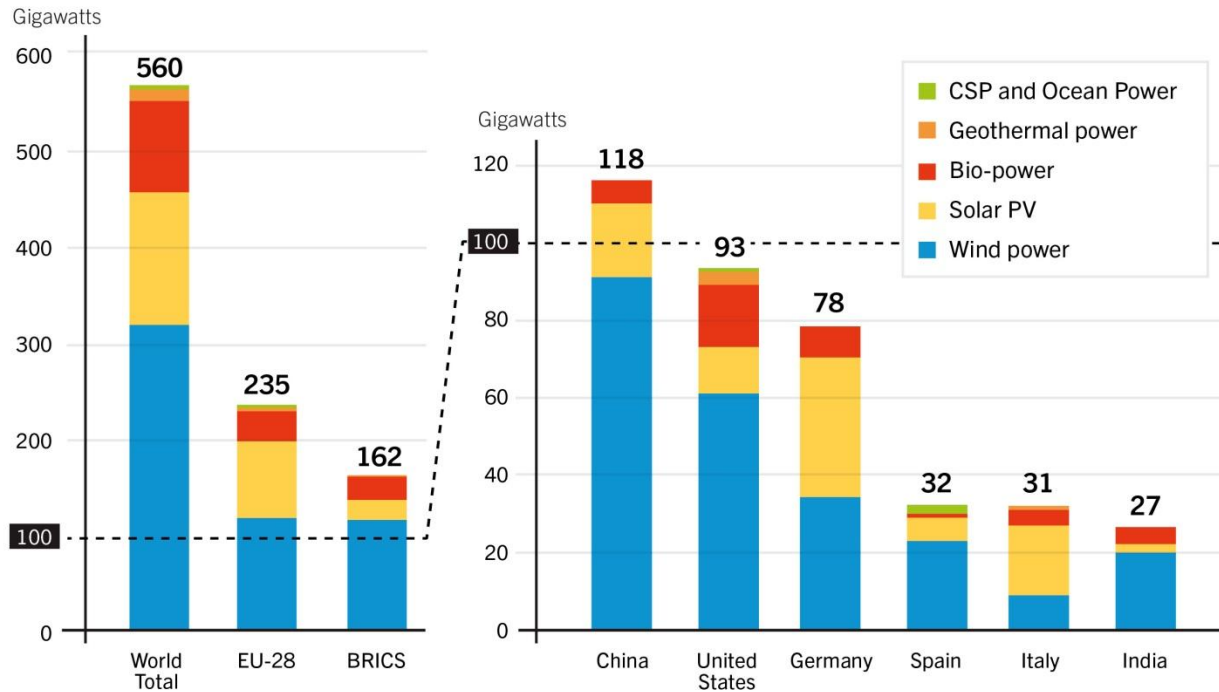
Estimated Renewable Energy Share of Global Final Energy Consumption, 2012



REN21. 2014. *Renewables 2014 Global Status Report* (Paris: REN21 Secretariat).

# Key Renewable Energy Sources

Renewable Power Capacities in World, EU-28, BRICS, and Top Six Countries, 2013



Not including hydropower

REN21. 2014. *Renewables 2014 Global Status Report* (Paris: REN21 Secretariat).



# Why Renewables?

- Do not deplete natural resources.
- Effective method to reduce CO<sub>2</sub> emissions.
- Economic benefits
- Reliable energy source
- Guarantee energy security for countries deploying it.
- Legislation being passed making renewables more attractive.

## POLICY MAPS

Countries with Renewable Energy Policies, Early 2014



Countries with Renewable Energy Policies, 2005



**144**  
COUNTRIES  
HAVE DEFINED  
RENEWABLE  
ENERGY TARGETS



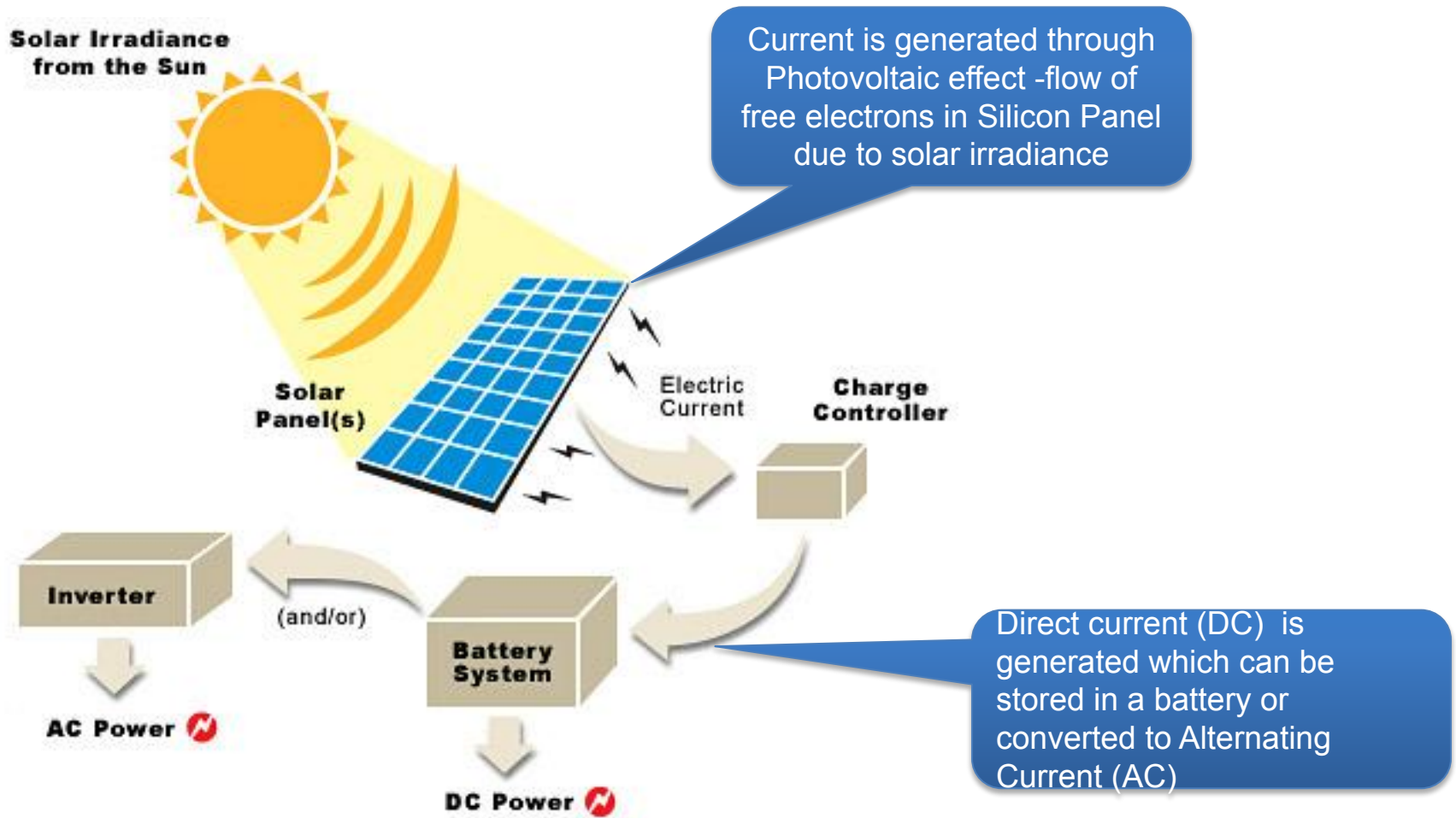
# Solar Power

# Solar Power

- Generally captured in two forms.
- Remains an expensive method of generating electricity.
- Advances in technology and support from certain governments.

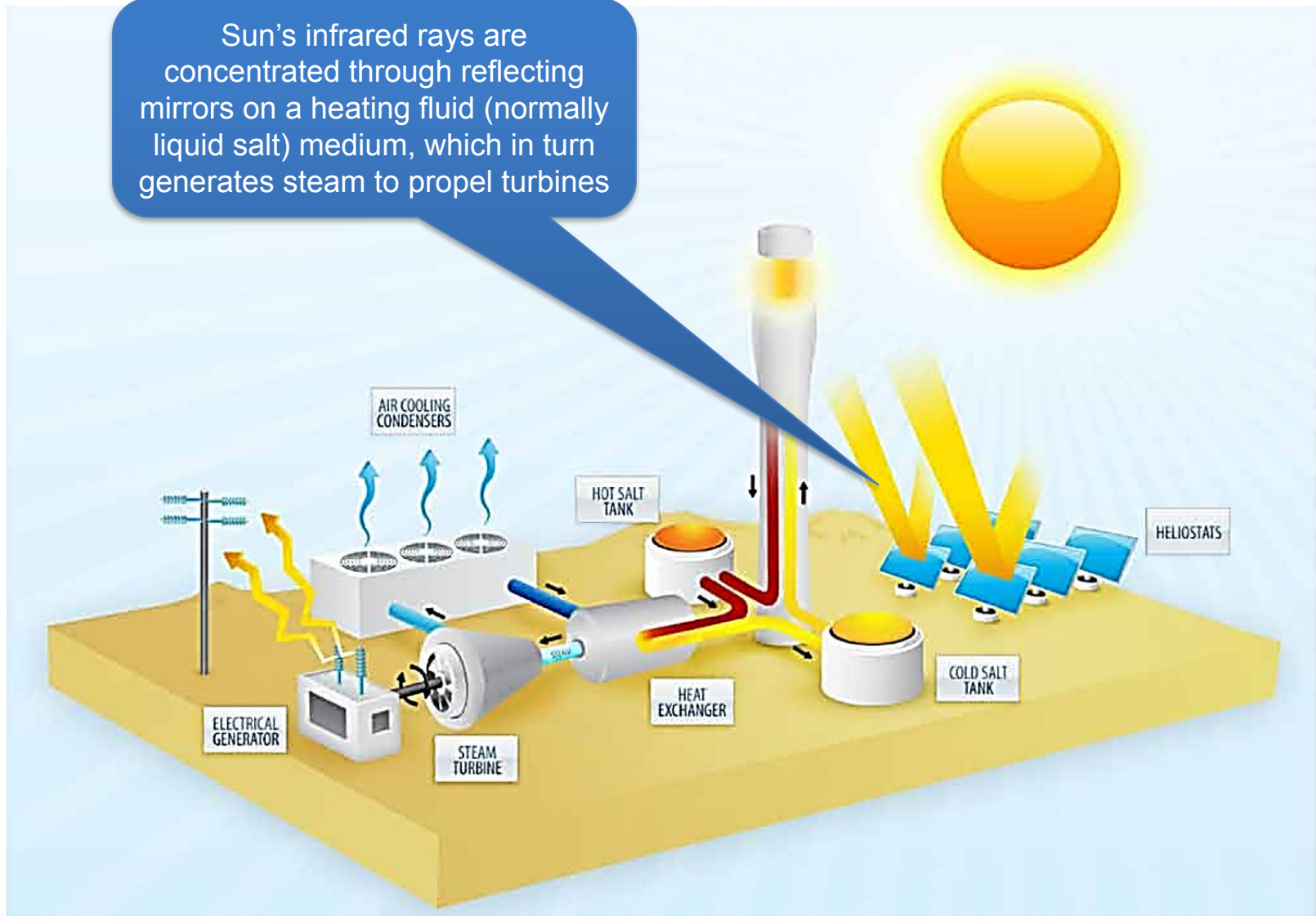


# Solar Power: Photovoltaic



# Solar Power: Solar Thermal

Sun's infrared rays are concentrated through reflecting mirrors on a heating fluid (normally liquid salt) medium, which in turn generates steam to propel turbines




# Pros and Cons – Solar


 Environmentally friendly

 Minimal maintenance

 Maximum reliability

 Systems are easily expanded

 Most expensive form of energy

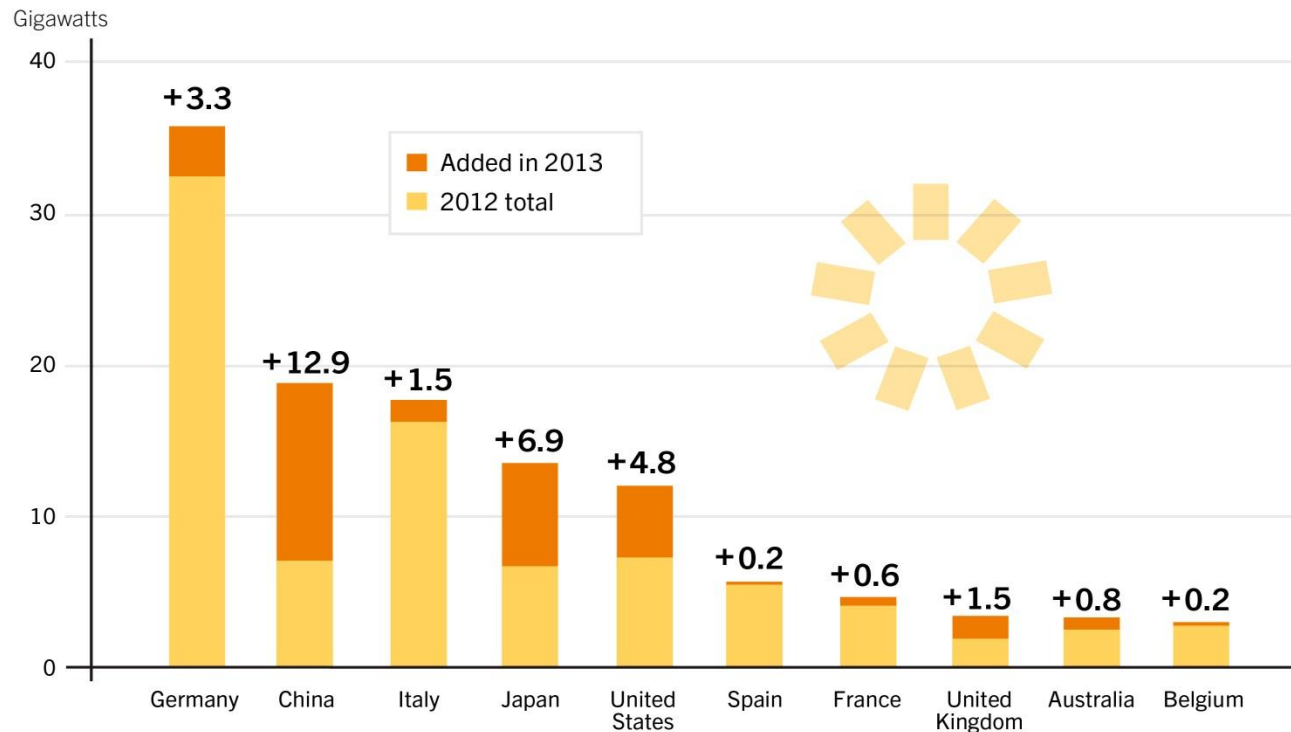
 Produce power only during day

 Need large area for setup

 Pollution level can influence solar cells effectiveness

# Solar Photovoltaic Capacity and Additions

Solar PV Capacity and Additions, Top 10 Countries, 2013



REN21. 2014. *Renewables 2014 Global Status Report* (Paris: REN21 Secretariat).

# Wind Power

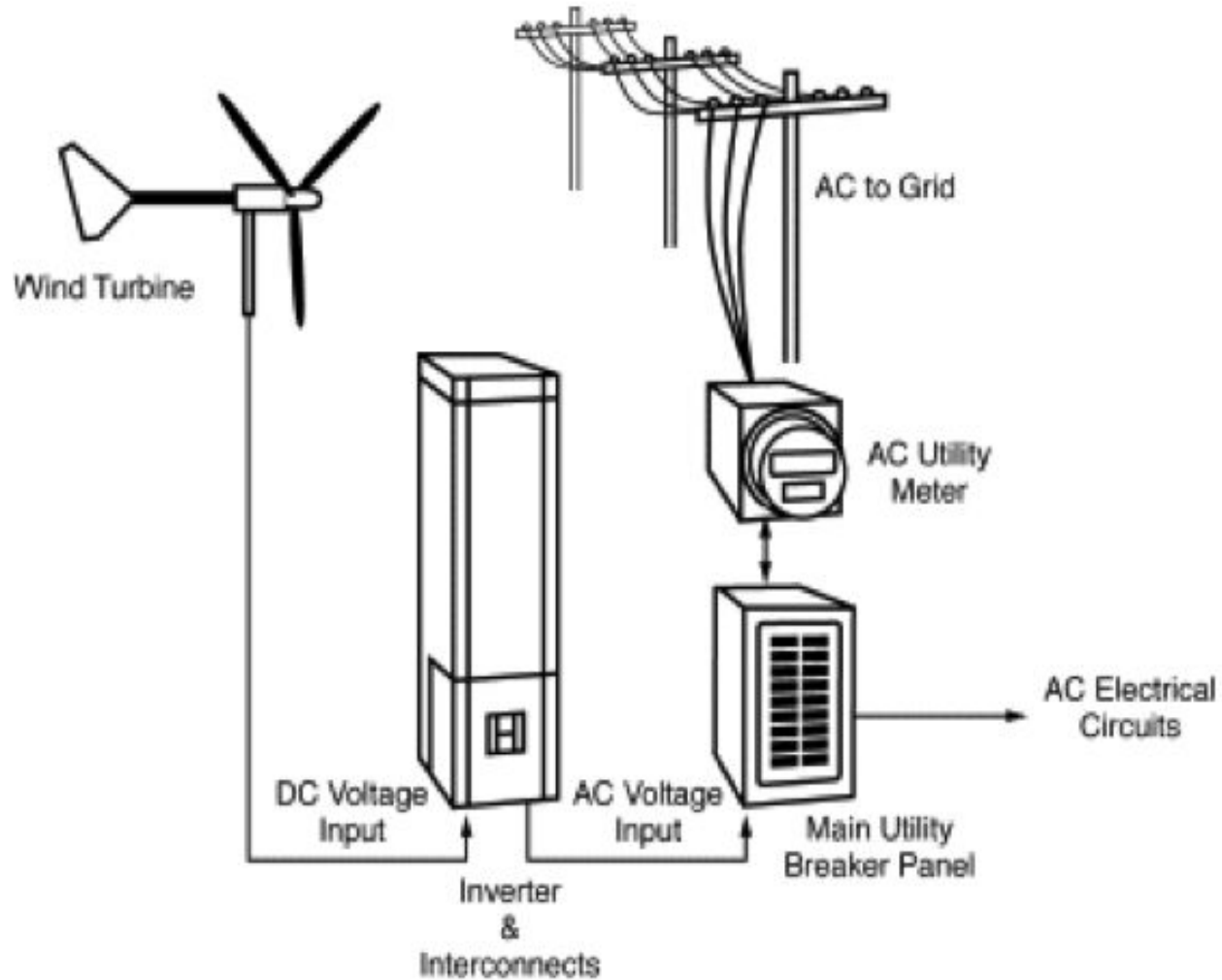
# Wind Power

- Converts kinetic energy of wind to electrical energy.
- Renewable of choice in Europe and the United States.
- Competitive alternative to more traditional methods of power generation.





# Wind Power



# Pros and Cons – Wind

+ Smaller Land requirement when compared to Solar, Hydro

+ Can be built off-shore

+ Cheaper than Solar

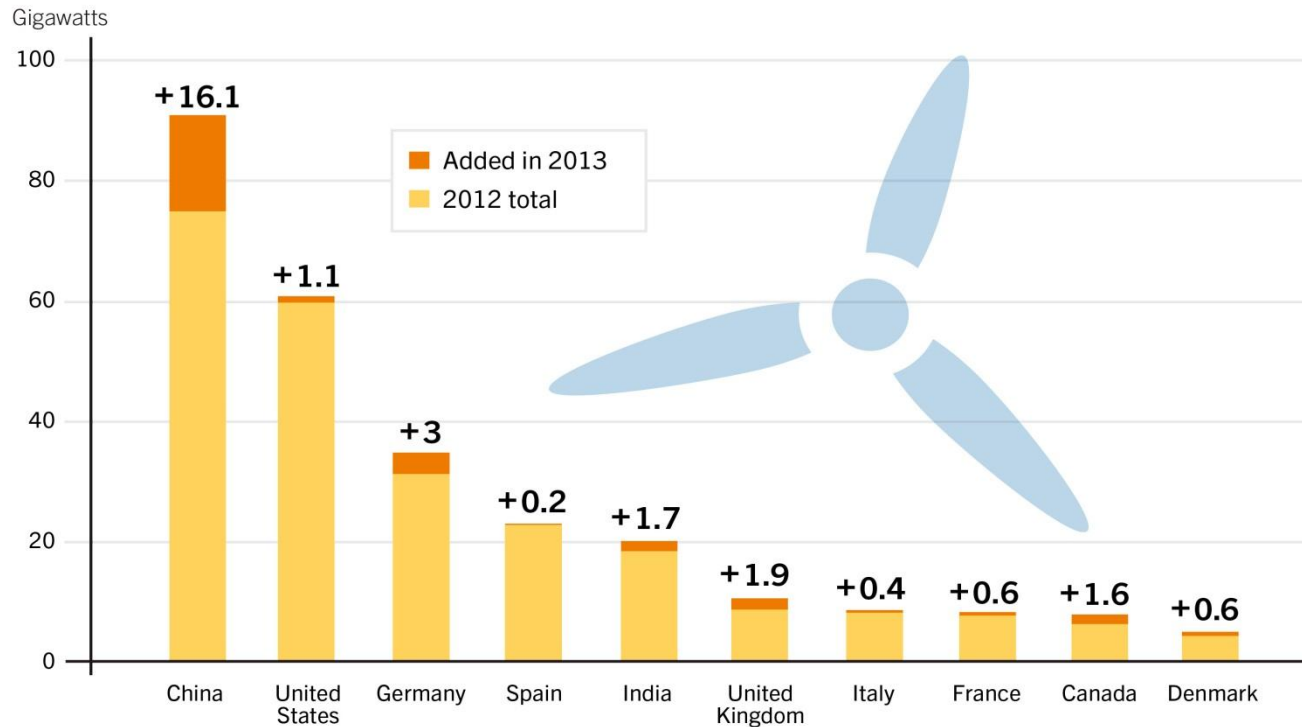
- The strength of the wind is not constant and it varies from zero to storm force

- Wind turbines are noisy

- Wind sites are often located in remote locations, so transmission lines must be built

# Wind Power Capacity and Additions

Wind Power Capacity and Additions, Top 10 Countries, 2013



Additions are net of repowering.

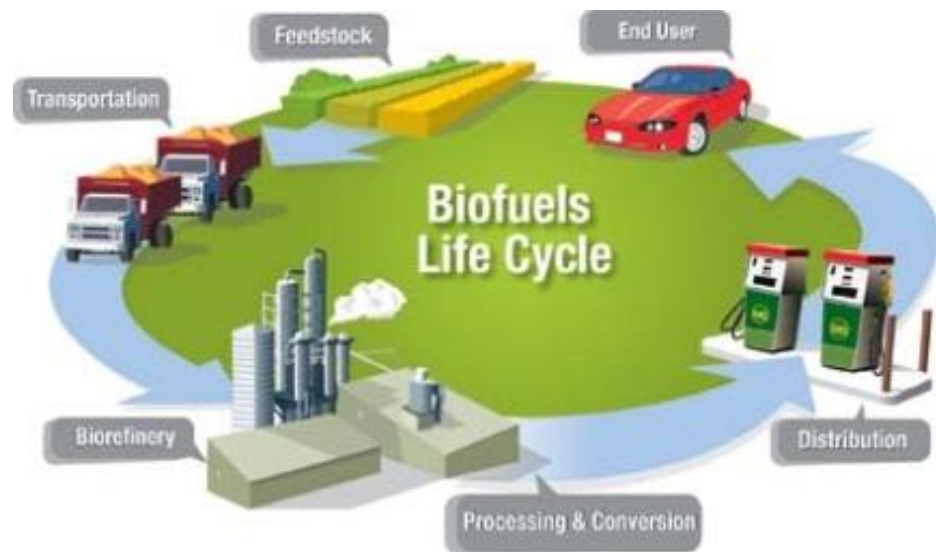
REN21. 2014. *Renewables 2014 Global Status Report* (Paris: REN21 Secretariat).



# Biofuels

# Biofuels

- Produced through contemporary biological processes, such as agriculture.
- Ethanol is an alcohol distilled from plant material (corn in the U.S., sugar cane in Brazil, wheat in Europe) and used as gasoline substitute or blend stock.
- Biodiesel is produced by the transformation of animal fat or vegetable oil into a conventional diesel substitute.



# Pros and Cons – Biofuels

- + Inherently renewable
- + Emit less pollution than traditional petroleum based gasoline and diesel fuels
- + Easier to transition to without special infrastructure needs
- Not enough land space to grow crops for biofuel demand
- Producing them actually requires more energy than they generate
- Still polluting when compared to wind or solar

# The Bio-bean Start-up

- Recycles waste coffee grounds into biomass fuel pellets and coals.
- In the five-stage system, the grounds are refined, agitated and dried out.
- A 1 tonne pellet-bag is enough to heat a family home for a year.
- Cheaper than wood pellets.



# Hydropower

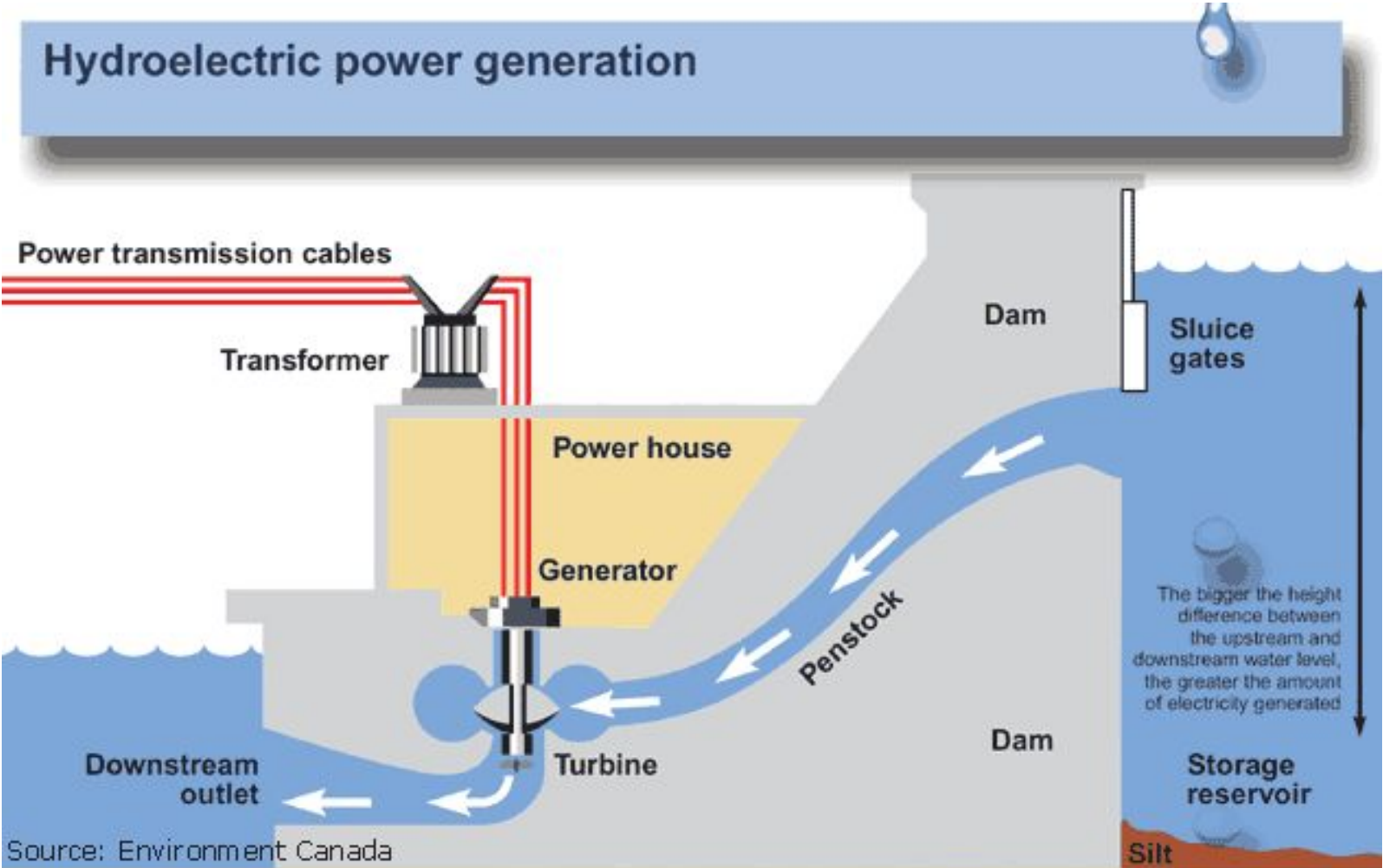


# Hydropower

- Power derived from the energy of falling water or fast running water
- Largest global contributor amongst all renewable energies.
- Most mature of renewable energies




# Hydropower





Source: Environment Canada


# Pros and Cons – Hydropower

 The cheapest way to generate electricity today.

 The flow of water can be controlled to produce electricity on demand.

 Capable of large scale production.

 Dams are extremely expensive to build.

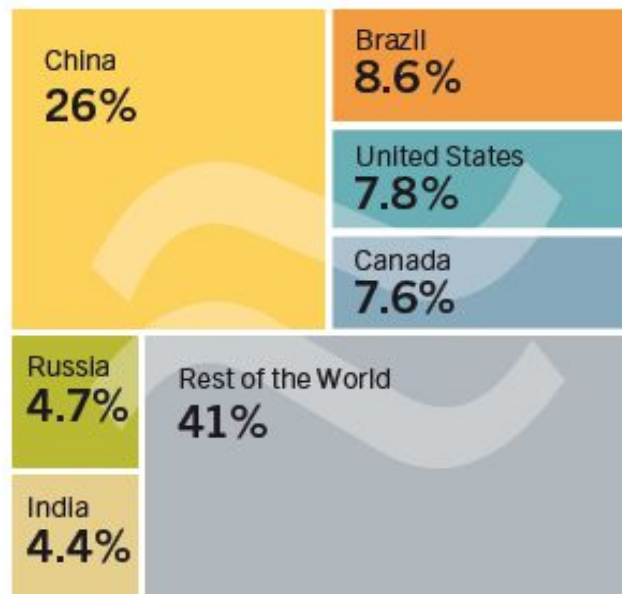
 Limited in number of potential sites/locations.

 Flooding of land.

# Hydropower

## HYDROPOWER

Figure 10. Hydropower Global Capacity, Shares of Top Six Countries, 2013



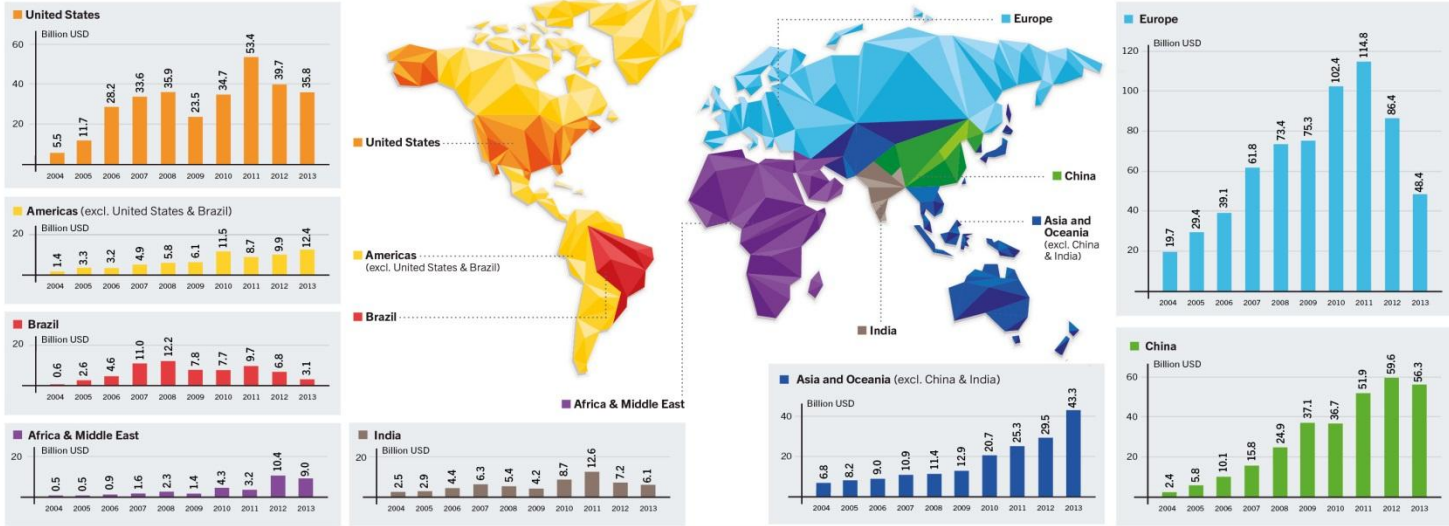
Global capacity reaches  
**1,000 GW**



# Global Investment

# Global Investment

## Global New Investment in Renewable Power and Fuels, by Region, 2004–2013



Data include government and corporate R&D.

Data Source: UNEP FS / BNEF Global Trends in Renewable Energy Investment 2014

REN21. 2014. *Renewables 2014 Global Status Report* (Paris: REN21 Secretariat).



# Sources

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- <http://web.mit.edu/taalebi/www/scitech/pvtutorial.pdf>
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Quelle: Jm-Projektinvest GmbH & Co. KG

**THANK YOU FOR ATTENTION!**