Renewable Energy

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Contents

What is Renewable Energy?

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

Key Renewable Energy Sources

Solar Power

- Photovoltaic
- Solar-thermal

Wind Power

- Onshore
- Offshore

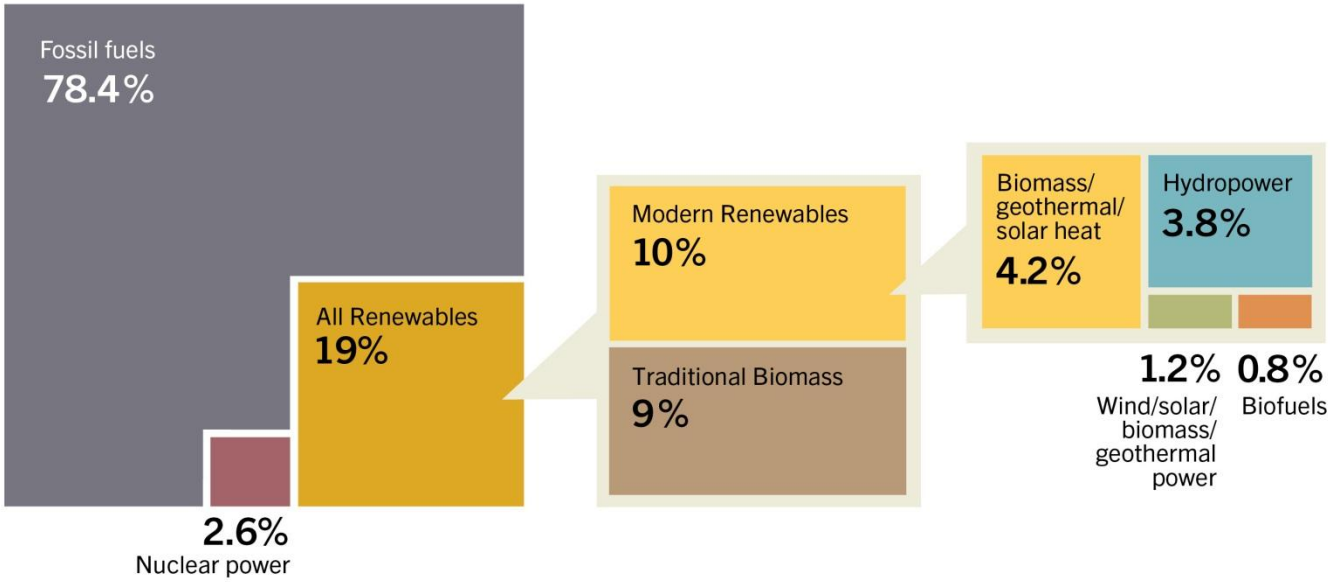
Biofuels

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

Hydro Power

Key Renewable Energy Sources

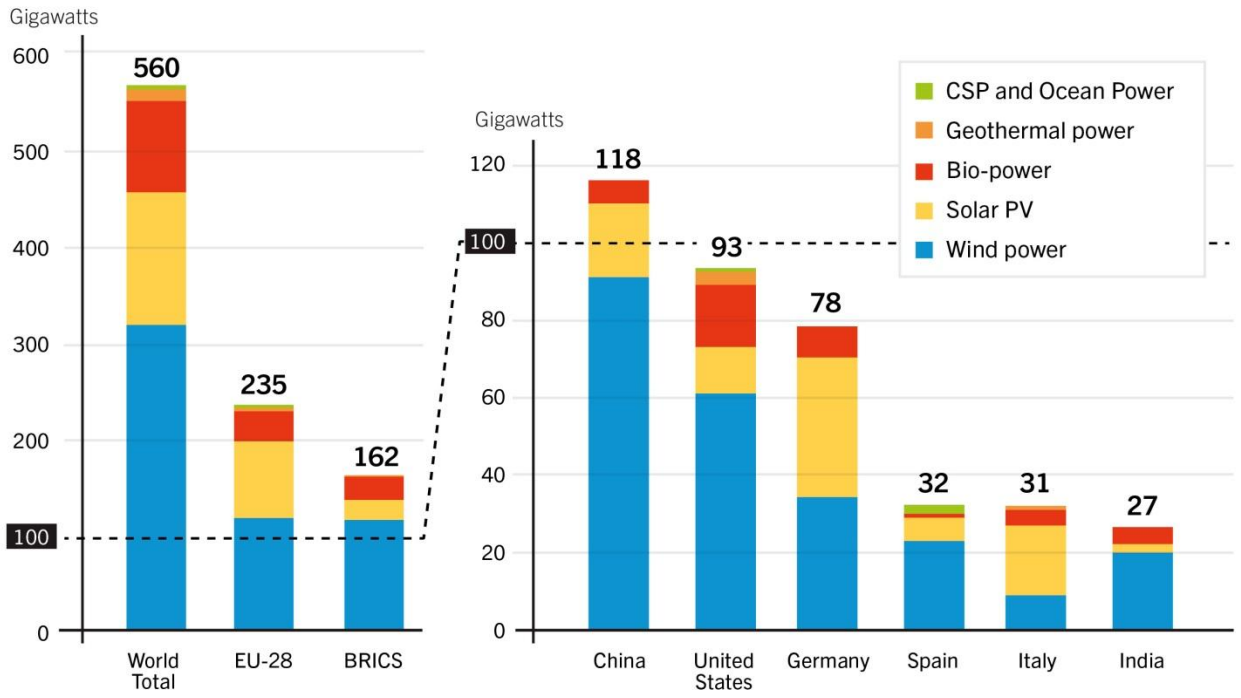
Estimated Renewable Energy Share of Global Final Energy Consumption, 2012



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_2 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

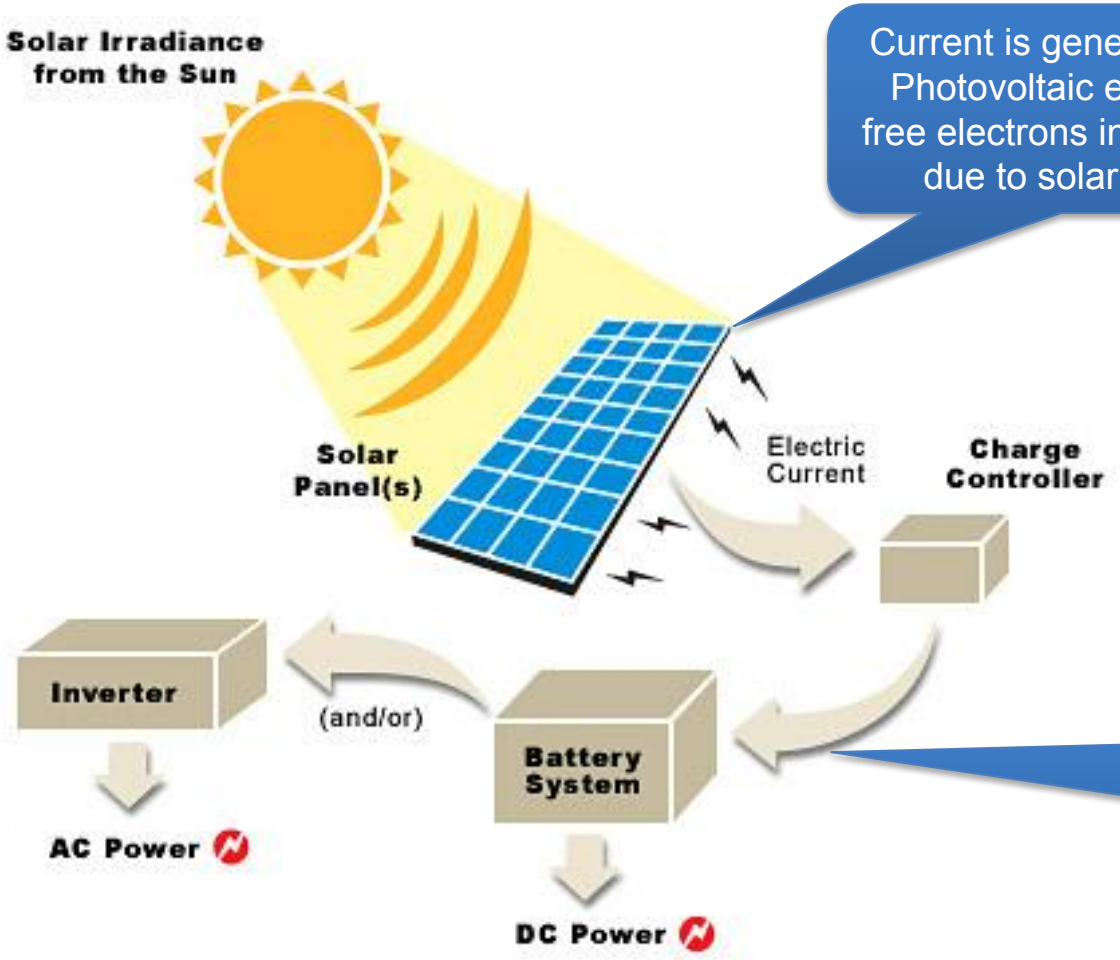
COUNTRIES HAVE DEFINED RENEWABLE ENERGY TARGETS

Solar Power

Solar Power

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

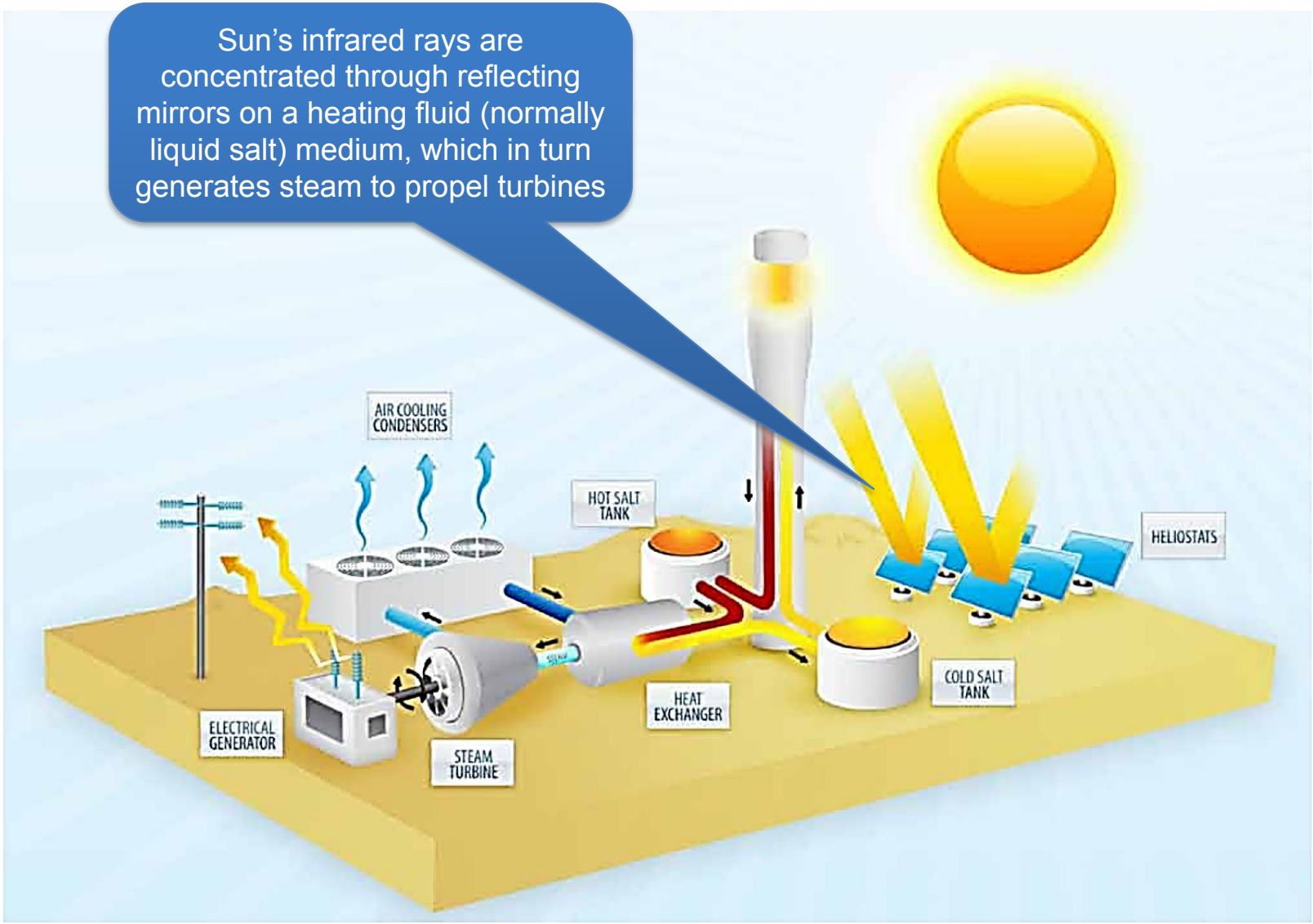
Solar Power: Photovoltaic



Current is generated through Photovoltaic effect -flow of free electrons in Silicon Panel due to solar irradiance

Direct current (DC) is generated which can be stored in a battery or converted to Alternating Current (AC)

Solar Power: Solar Thermal



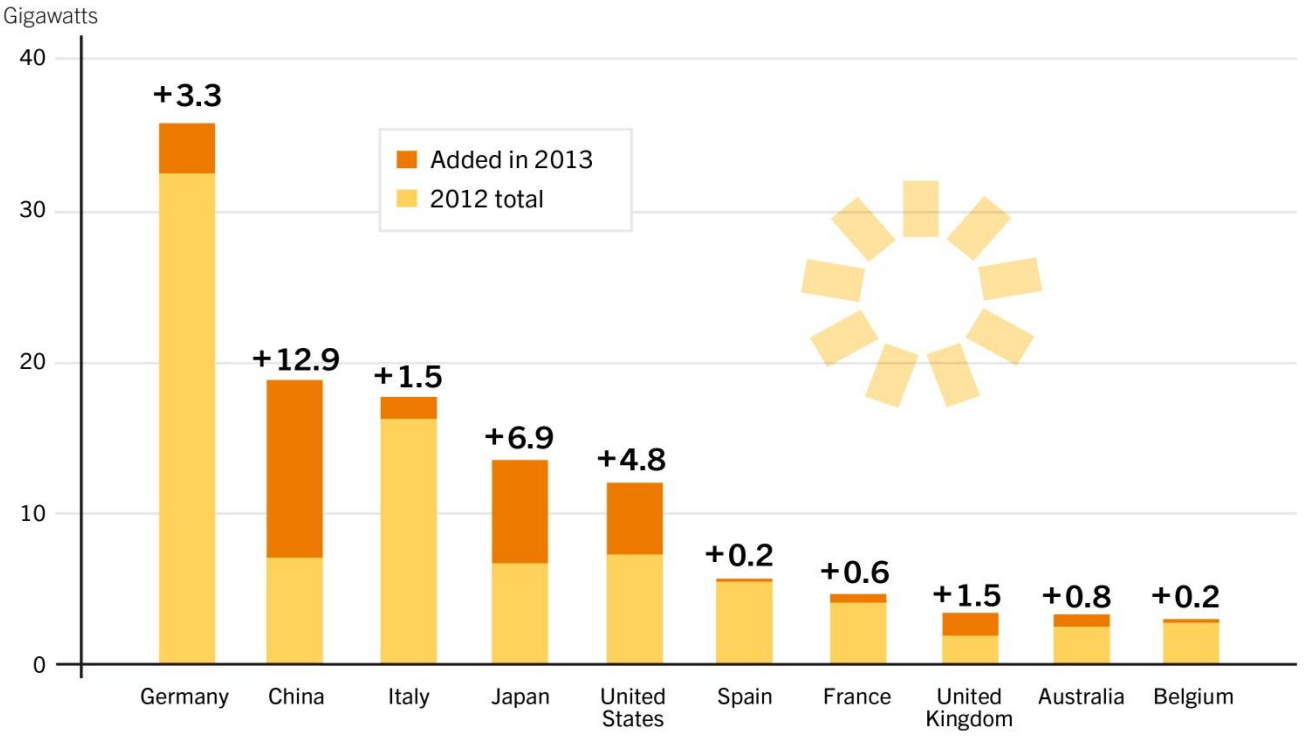
Pros and Cons – Solar

- 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 sollar 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).

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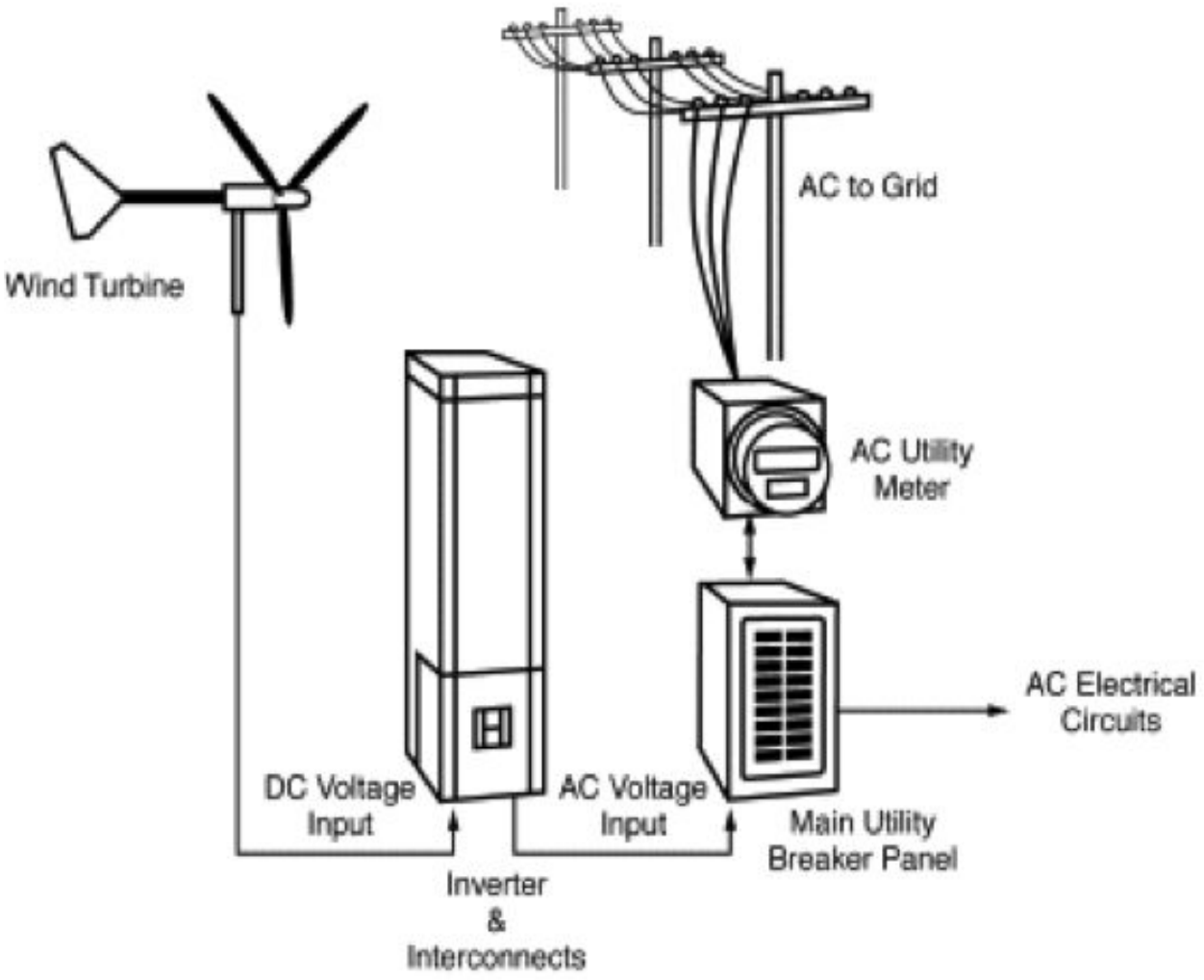
Wind Power

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


Wind Turbine
AC to Grid
AC Utility Meter
AC Electrical Circuits
DC Voltage Input
AC Voltage Input
Main Utility Breaker Panel
Inverter & Interconnects

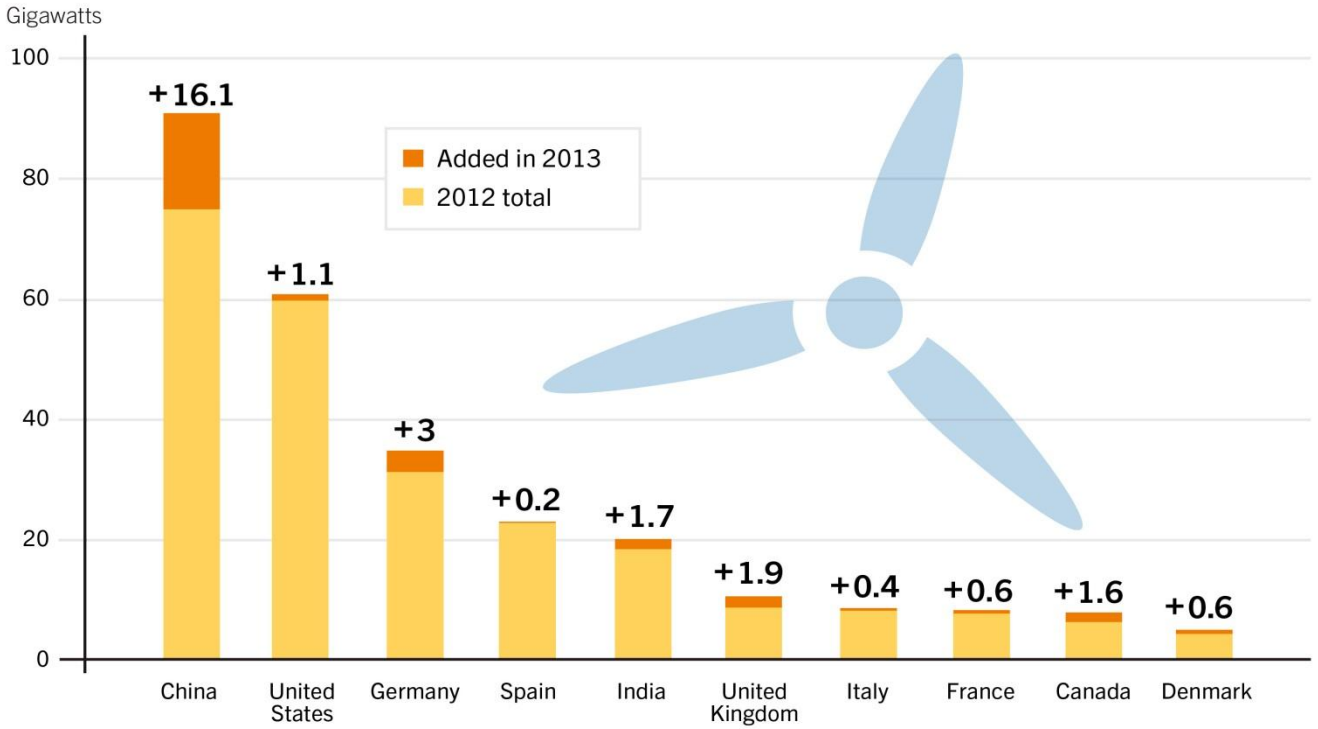
Pros and Cons – Wind

- ✚ 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



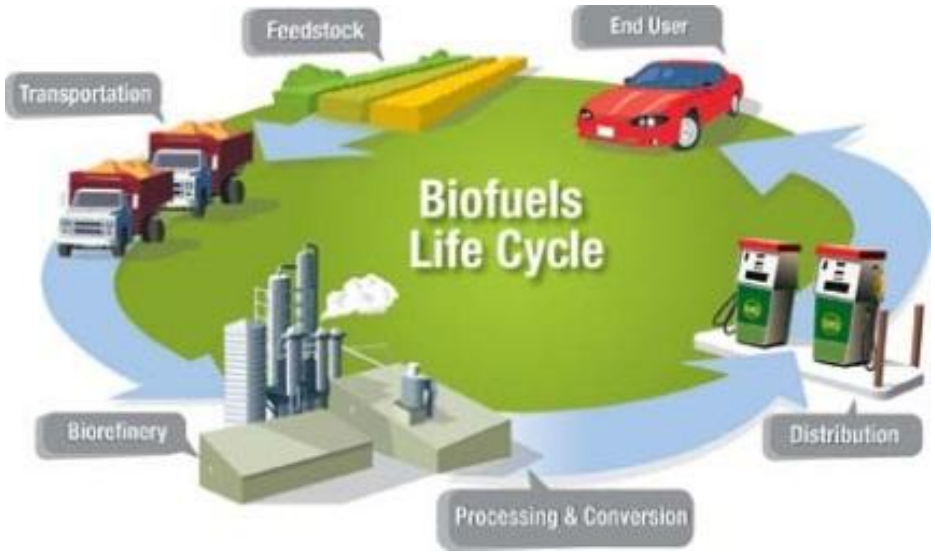
Additions are net of repowering.

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

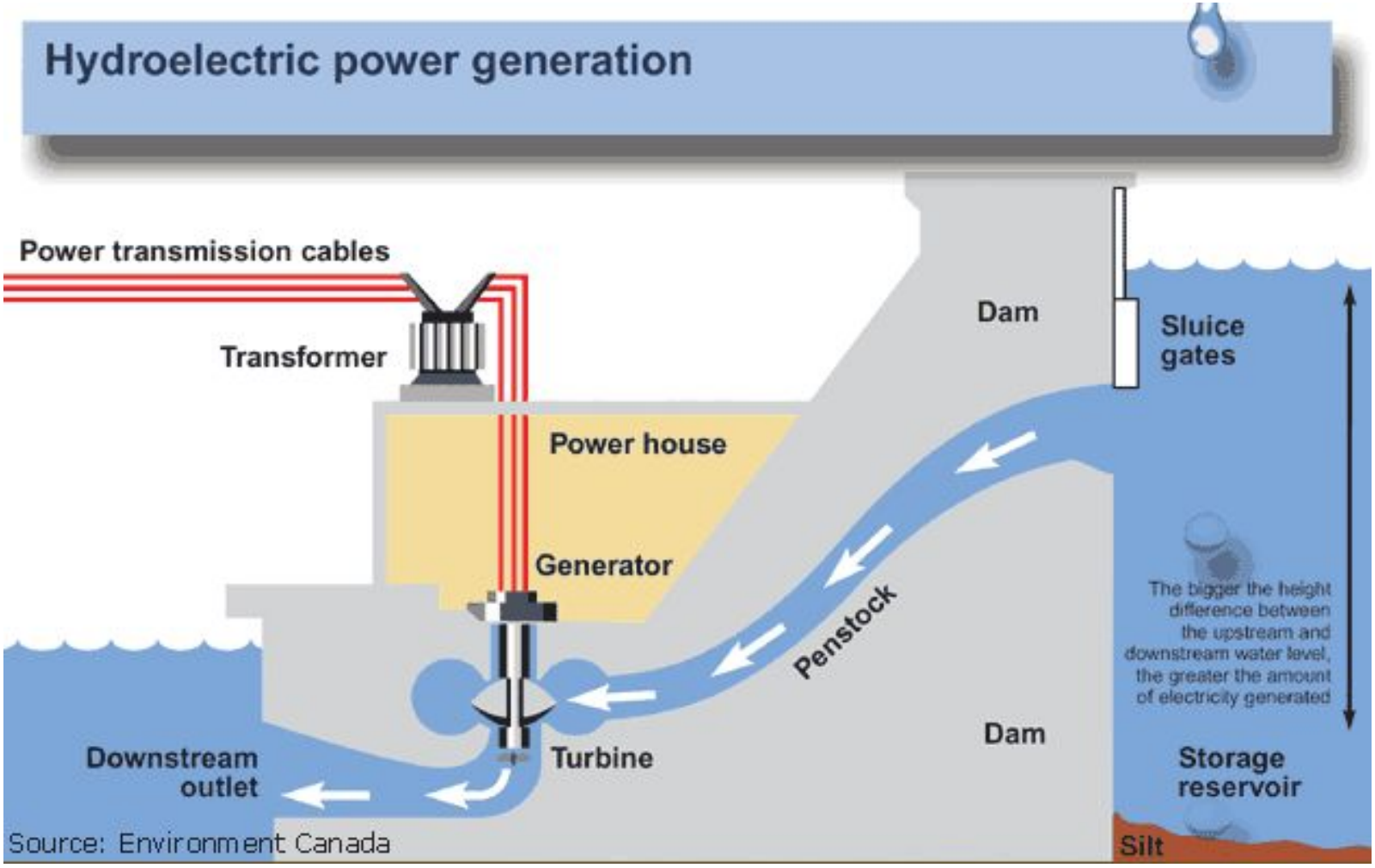
- Recycles waste coffee grounds into biomass fuel pellets and coals.
- In the five-stage system, the grounds are refined, agitated and dried out.
- A 1 tonne pellet-bag is enough to heat a family home for a year.
- Cheaper than wood pellets.

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


Hydroelectric power generation
Power transmission cables
Transformer
Power house
Generator
Penstock
Turbine
Downstream outlet
Dam
Sluice gates
Dam
Storage reservoir
Silt
The bigger the height difference between the upstream and downstream water level, the greater the amount of electricity generated
Source: Environment Canada

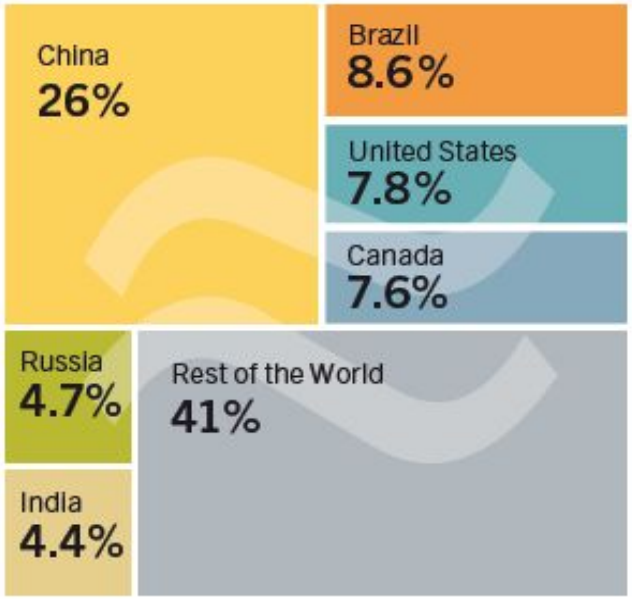
Pros and Cons – Hydropower

- 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



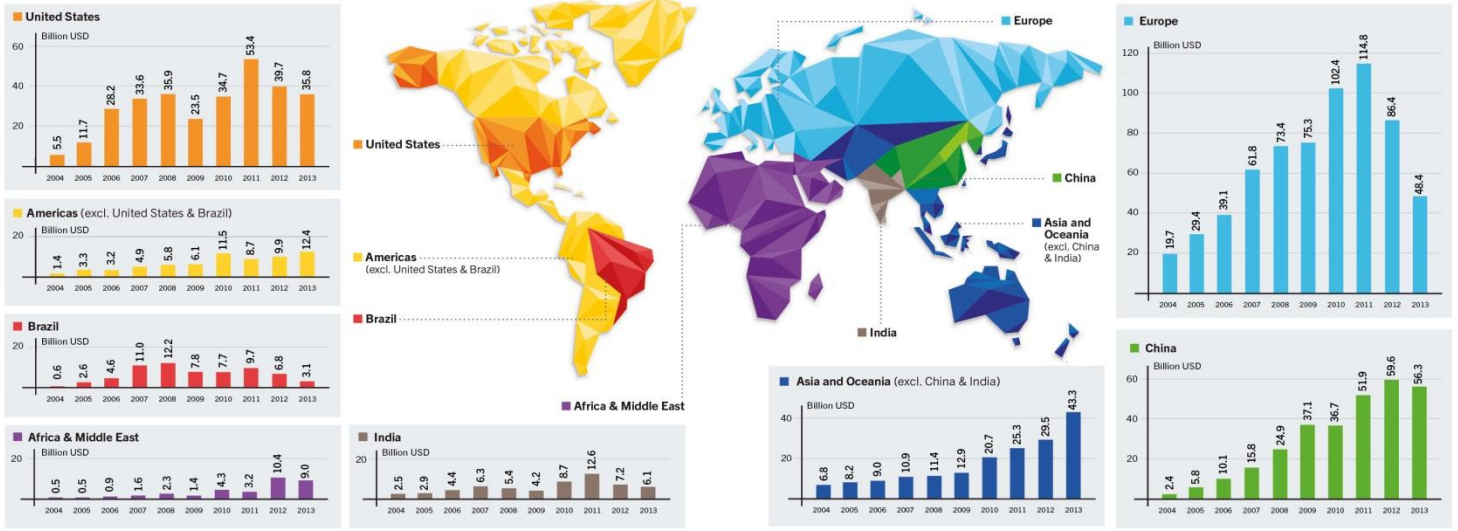
Global capacity reaches

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).

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Quelle: Jm-Projektinvest GmbH &Co. KG

THANK YOU FOR ATTENTION!