

PLATFORMS  
4CPS



2014/10/01/NEADVANCE

EUROPEAN COMMISSION

## Market Landscape Workshop

### (Renewable) Energy Perspective



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Amsterdam

## Renewable Sources (1)

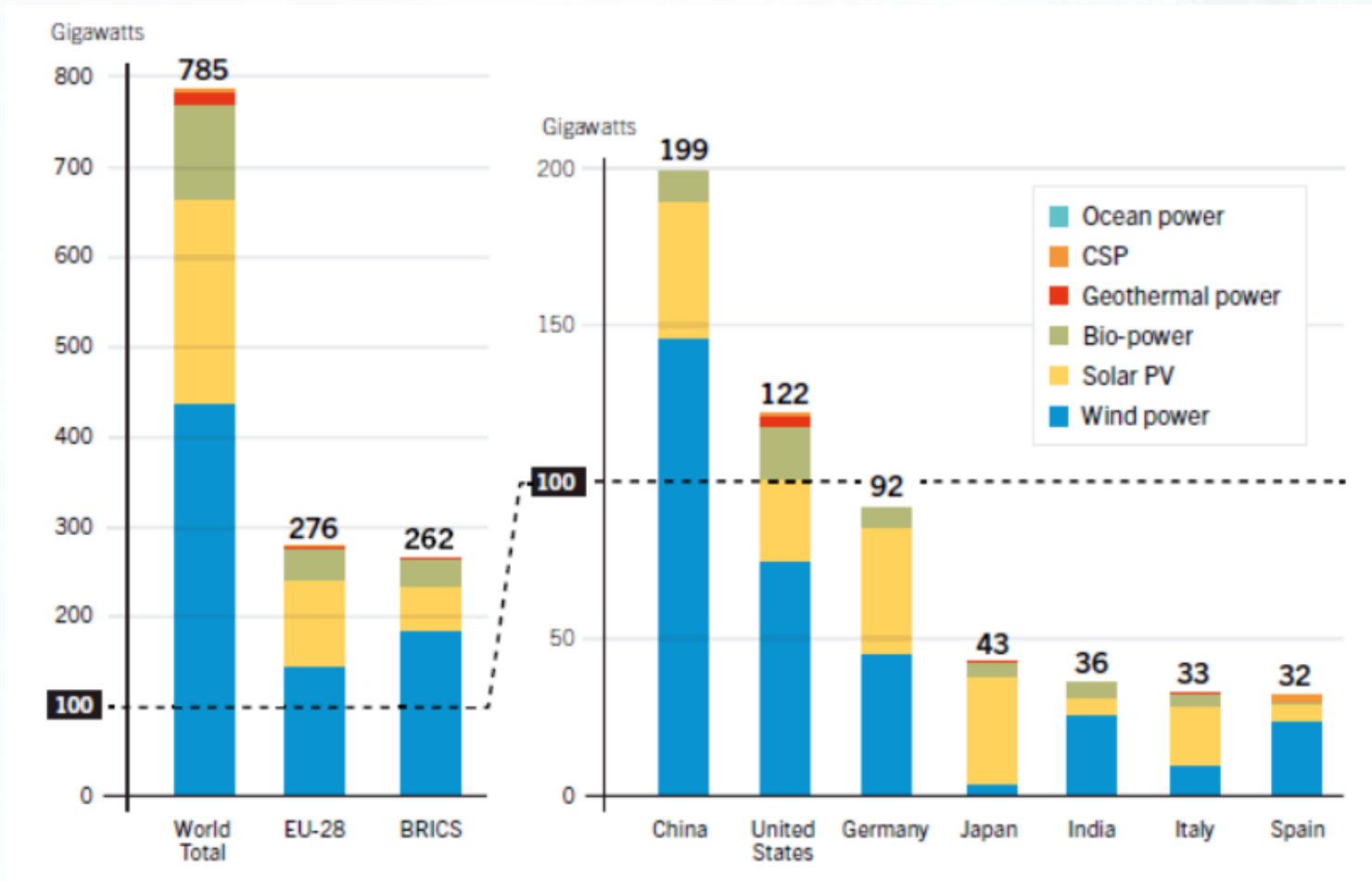
**Investment in renewable energy at record levels and has outpaced fossil fuels for the last six years.**

**Predominantly Wind and Solar PV power.**

**Despite challenges such as :**

- **falling global prices for fossil fuels**
- **ongoing fossil fuel subsidies**
- **the integration of rising shares of renewable generation**
- **policy and political instability**
- **regulatory barriers**
- **fiscal constraints**

# Renewable Sources (2)

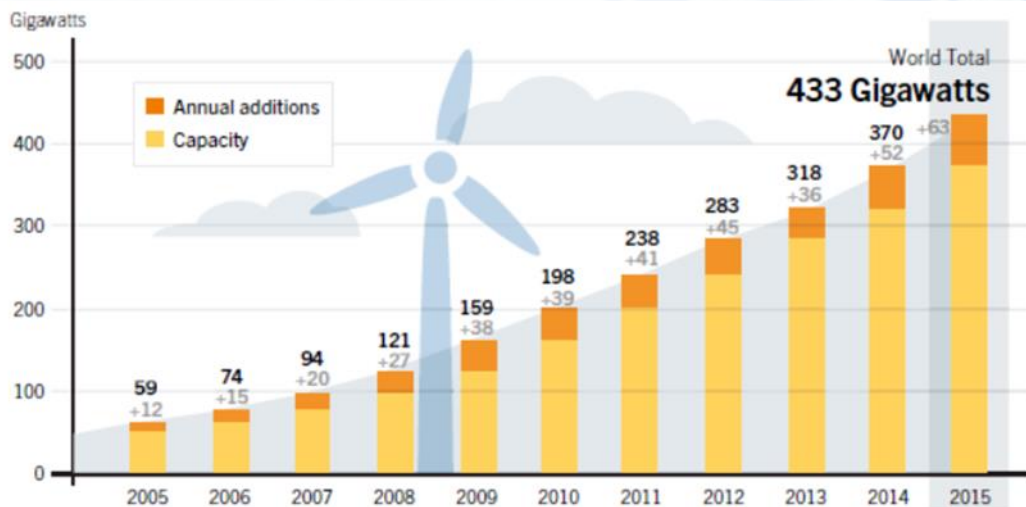


# Wind Power Leading the Renewables

More than 700% capacity has been added in the last 11 years.

In 2015 there was a record increase of 22% in power capacity added.

The market value is expected to have a CAGR of 9.28% between 2016 and 2021, reaching USD 12.17 Billion.



## Leading Companies

<b>12.5%</b>	<b>Goldwin (China)</b>
<b>11.8 %</b>	<b>Vestas (Denmark)</b>
<b>9.5 %</b>	<b>GE Wind (USA)</b>
<b>8.0 %</b>	<b>Siemens (Germany)</b>
<b>5.4 %</b>	<b>Gamesa (Spain)</b>
<b>5.0 %</b>	<b>Enercon (Germany)</b>
<b>4.9 %</b>	<b>United Power (China)</b>
<b>4.1 %</b>	<b>Mingyang (China)</b>
<b>4.0 %</b>	<b>Envision (China)</b>
<b>3.4 %</b>	<b>CSIC Haizhuang (China)</b>



## Forecast for 2030 of power generation from wind

**Binding target set by EU that renewable energy provide at minimum 27% of generated power – wind is expected to account for over 20% of this.**

**This will mean an expected increase of 2/3 from expected capacity for 2020.**

**As a result, medium estimates indicate:**

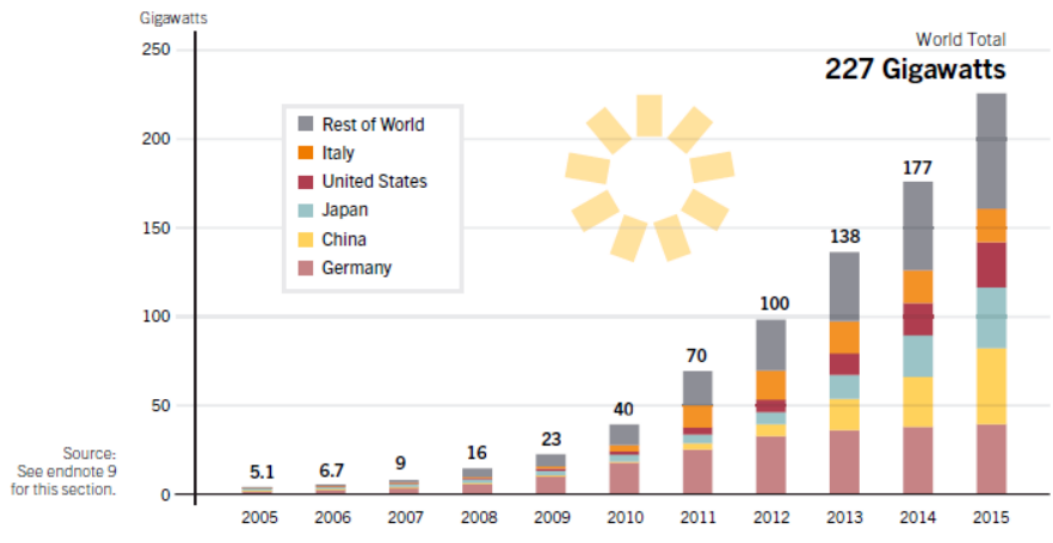
- **334,000 addition direct/indirect jobs.**
- **436 million tonnes of CO<sub>2</sub> emissions cut**

# Solar Power PV

Current capacity is over ten times that from 11 years ago.

In 2015 there was an increase of 25% in power capacity added.

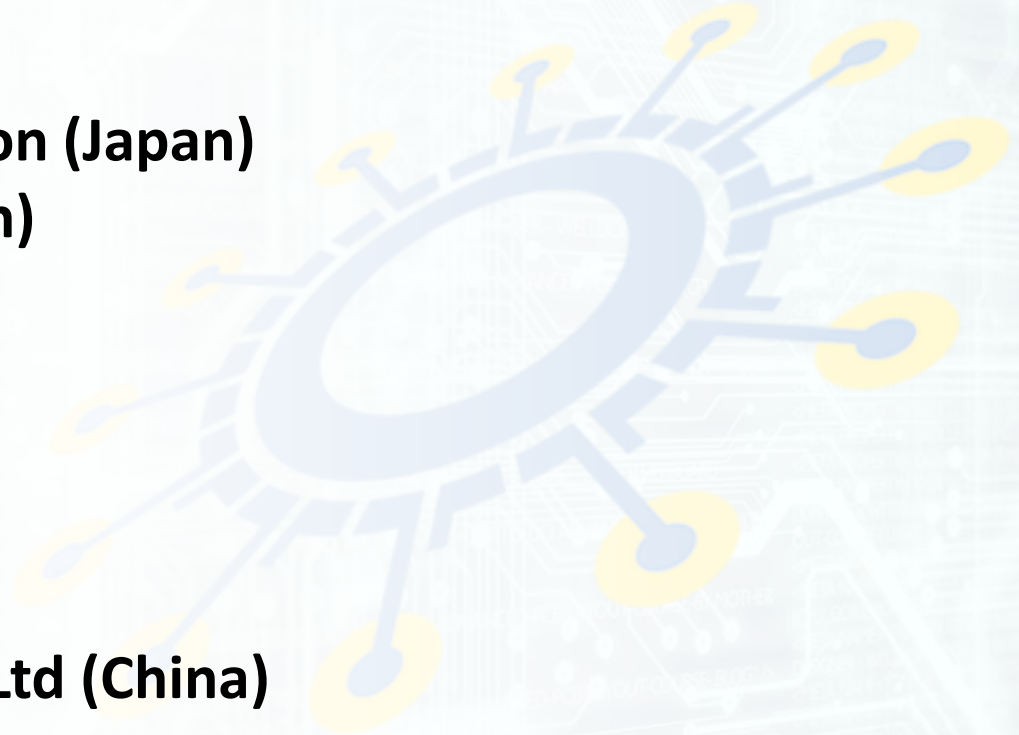
The market growth is expected to have a CAGR of 18.30% between 2014 and 2020, reaching 345.59 billion by 2020.



## Leading Companies

**Kaneka Corporation (Japan)**  
**Kyocera Corporation (Japan)**  
**Mitsubishi Electric Corporation (Japan)**  
**Panasonic Corporation (Japan)**  
**Sharp Corporation (Japan)**  
**JA solar Co. Ltd (China)**

**Jinko Solar (China)**  
**ReneSola Co. Ltd (China)**  
**Suntech Power Holdings Co. Ltd (China)**  
**Trina Solar (China)**  
**Yingli Green (China)**  
**Canadian Solar (Canada)**

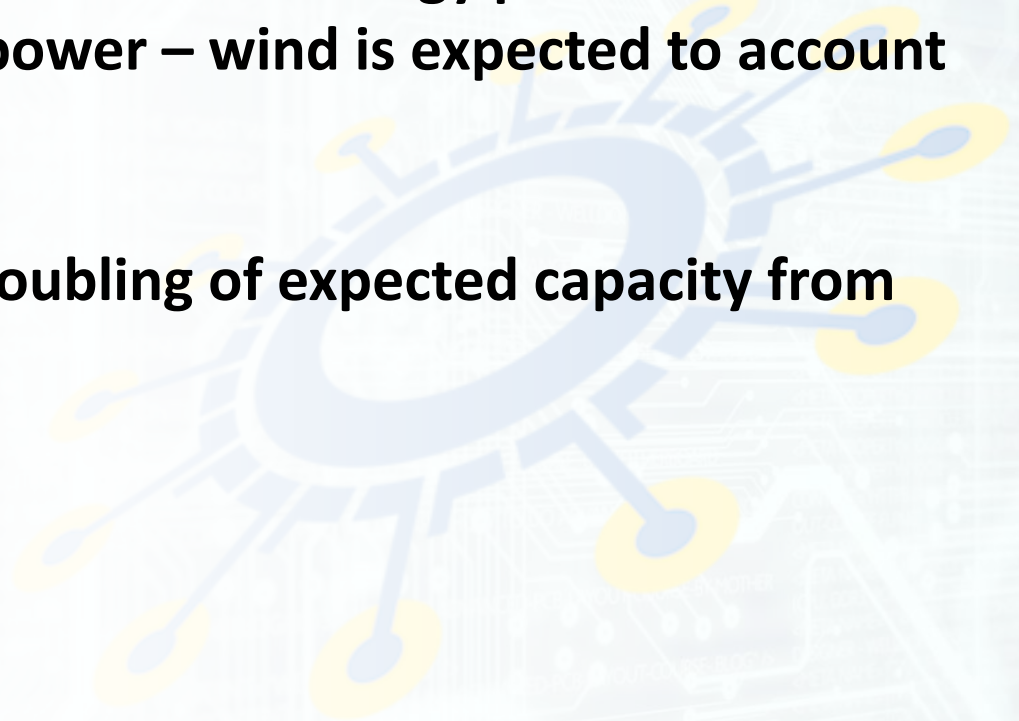




# Forecast for 2030 of power generation from solar PV

**Binding target set by EU that renewable energy provide at minimum 27% of generated power – wind is expected to account for over 10% of this.**

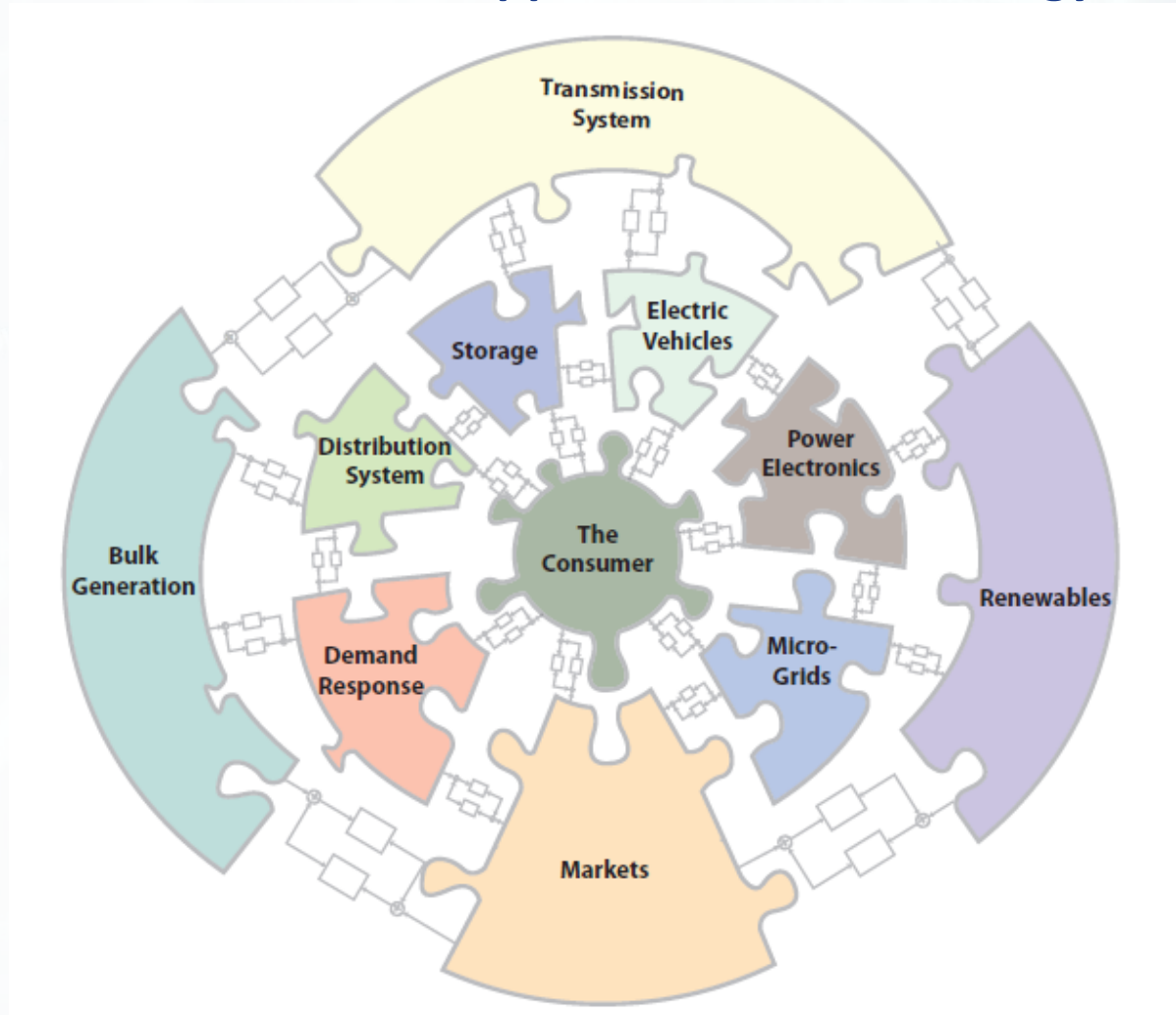
**This will mean an expected doubling of expected capacity from 2020.**



# Summary of Energy CPS Requirements (NSF)

Domain	Trend or Paradigm Change	Future Requirements
Sources	<ul style="list-style-type: none"> <li>• From fossil fuel to renewable</li> <li>• From bulk centralized to partially distributed</li> <li>• Highly Variable</li> </ul>	Green Distributed Stochastic
Information	<ul style="list-style-type: none"> <li>• Can control entire system through software</li> <li>• Increased digital control</li> <li>• Cyber-security issues</li> <li>• Personal information, privacy concerns</li> <li>• Available sensing and data</li> </ul>	Cyber-Controlled Cyber-Physical Cyber-Secure Private Big Data
Actors	<ul style="list-style-type: none"> <li>• Consumers can also produce and store</li> <li>• Consumers seek their own objectives</li> <li>• Massive number of actors and devices</li> <li>• Traditional actors have new roles of interacting with new actors</li> </ul>	Producer/consumer (Prosumer)-based Decision-Makers Decentralized, Layered Architecture
Professional Carriers	<ul style="list-style-type: none"> <li>• New dynamics of legacy systems</li> <li>• Interdependencies with other systems</li> </ul>	Integrated background

# Interplay Between Communication and Control: Control of Smart Grids – New Opportunities in an Energy CPS (NSF)



# PUTTING RENEWABLE ENERGY INTO PERSPECTIVE

**Renewable energy excluding large hydro made up 53.6%** of the new power generating capacity installed in 2015, the first time it has ever represented the majority of additions.

Global electricity generated was 10.3% in 2015. This prevented the emission of an **estimated 1.5 gigatonnes of CO2** last year.

Improved figures for dollar investment show **that renewables attracted more than double the \$130 billion committed to new coal-, gas- and oil-fired power stations in 2015**. This was the largest differential in favour of renewables to date.

Nevertheless, the fact that **most of the world's power generation fleet consists of fossil fuel plants**, and that more of these are being added every year, means that the outlook for emissions and the climate remains worrying.

Leading forecasting organisations **project that power sector emissions will grow more than 10% between now and 2040**, with no prospect of a peak being reached until the late 2020s at the earliest. The **CO2 content of the atmosphere looks set to rise sharply beyond the 2015** average of 401 parts per million.

One **factor** that could affect **both emissions and electricity** demand over the next 25 years is the growth of **electric vehicle sales**. These **jumped 60% in 2015** to a new record of **462,000**. EVs, via the recharging of their batteries, could also offer **new opportunities for balancing renewables output**.

**Ref: Global Trends in Renewable Energy Investment 2016**

# Questions



Next Topic:  
Health  
Transport  
Manufacturing  
**Energy (Part 2)**