# 4. The IRENA Renewable Energy Template

**IRENE** Renewable Energy Statistics Training





## Outline

- Background
- Challenges: characteristics of renewable energy
- IRENA's approach to data collection
- IRENA energy products and definitions
- IRENA energy balance
- Further developments
- Discussion
  - Issues related to completion of the template
  - Where does IRENA get the data?



IRENA has been asked by members to collect renewables data, while not duplicating the work of others.

Data is used to measure:

- Energy sector transformation (targets)
- Energy SDG: access; renewables; efficiency
- Market developments, investments, etc.

But renewables are about more than just MW!

# **Challenges with RE data**



#### **Renewable energy**

- Thermal and non-thermal
- Great variation in scale
- Off-grid more common
- Many producers
- Biofuels very variable
- Considerable innovation

#### Nonrenewable energy

- Thermal energy
- Often large-scale
- Mostly grid-connected
- Industrial/utility production
- Fuels well specified
- Stable technologies
- Less familiarity with measurement conventions
- Hybrid systems, co-firing, accounting for heat

### **IRENA** data collection



- IRENA questionnaire: RE balance; heat and electricity production; capacities
- About 70 countries reply, estimates for others

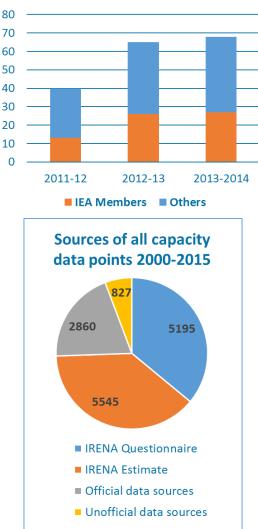
Gross electricity production in MWh															
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
ELECTRICITY PLANTS: TOTAL	448,000	509,000	553,190	637,885	744,231	880,374	1,089,104	1,351,316	1,486,112	1,236,594	971,364	1,021,540	1,426,100	1,772,960	3,061,380
ELECTRICITY PLANTS: NON-RENEWABLE	447,000	508,000	523,045	596,376	714,809	835,710	1,034,815	1,294,356	1,433,296	1,180,683	930,811	955,111	893,983	747,740	1,189,990
Coal and peat									23,359	28,033	32,081	46,500	37,420	168,750	863,020
Oil	447,000	508,000	523,045	596,376	714,809	835,710	1,034,815	1,294,356	1,409,937	1,152,650	898,730	908,611	856,563	578,990	326,970
Natural gas															
Nuclear															
Other (non-renewable)															
ELECTRICITY PLANTS: RENEWABLE	1,000	1,000	30,145	41,509	29,422	44,664	54,289	56,960	52,816	55,911	40,553	66,429	532,117	1,025,220	1,871,390
Hydropower		10 m	29,145	40,509	28,422	43,542	50,609	49,707	46,284	47,425	31,734	51,522	517,370	1,015,540	1,851,600
Small hydropower (<1 MW)															
Medium hydropower (1-10 MW)															
Large hydropower (>10 MW)	0	0	29,145	40,509	28,422	43,542	50,609	49,707	46,284	47,425	31,734	51,522	517,370	1,015,540	1,851,600
Pumped storage															
Geothermal															
Solar Photovoltaic	1,000	1,000	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000	3,000	3,000	3,000	3,000	3,000
Concentrated solar power	1,625.5			110000	1105570								1.000	CORROT	
Marine energy (tide, wave and ocean)															
Wind energy								10							
Onshore wind energy															
Offshore wind energy															
Renewable Municipal Waste															
Solid biofuels						122	1,680	5,253	4,532	6,486	5,819	11,907	11,747	6,680	16,790
Woodfuel	0	0	0	0	0	122	1,680	5,253	4,532	6,486	5,819	11,907	11,747	6,680	16,790
Energy crops															
Wood waste															
Black liquor															
Straw															

# **IRENA** data collection



- Pre-fill with historical data
- Data collection cycle
  - Y+10: Send questionnaires
  - Y+12: Validate replies
  - Y+15: Publish capacities
  - Y+18: Publish yearbook
- Response rate is increasing
- Coordinate with APEC, IEA and others on timing and training

#### Number of countries returning IRENA questionnaire





- Seven main groups: hydro; solar; wind; marine; geothermal; bioenergy; other
- Definitions are mostly similar to other organisations, broadly in-line with International Recommendations for Energy Statistics (IRES), but with greater detail for bioenergy



#### Bioenergy

- Solid biofuels: 12 product categories
  - Woodfuel; Energy crops;
  - Wood waste; Black liquor; Straw; Bagasse; Rice husks; Other vegetal and agricultural waste; other primary solid biofuels (animal waste); renewable municipal waste;
  - Biomass pellets and briquettes; and charcoal.



### Bioenergy

- **Biogas:** 4 product categories
  - Landfill gas;
  - Sewage sludge gas;
  - Other biogases from anaerobic fermentation; and
  - Biogases from thermal processes.



### Bioenergy

- Liquid biofuels: 6 product categories
  - Conventional biogasoline; Advanced biogasoline;
  - Conventional biodiesel; Advanced biodiesel;
  - Bio jet kerosene; and
  - Other liquid biofuels.

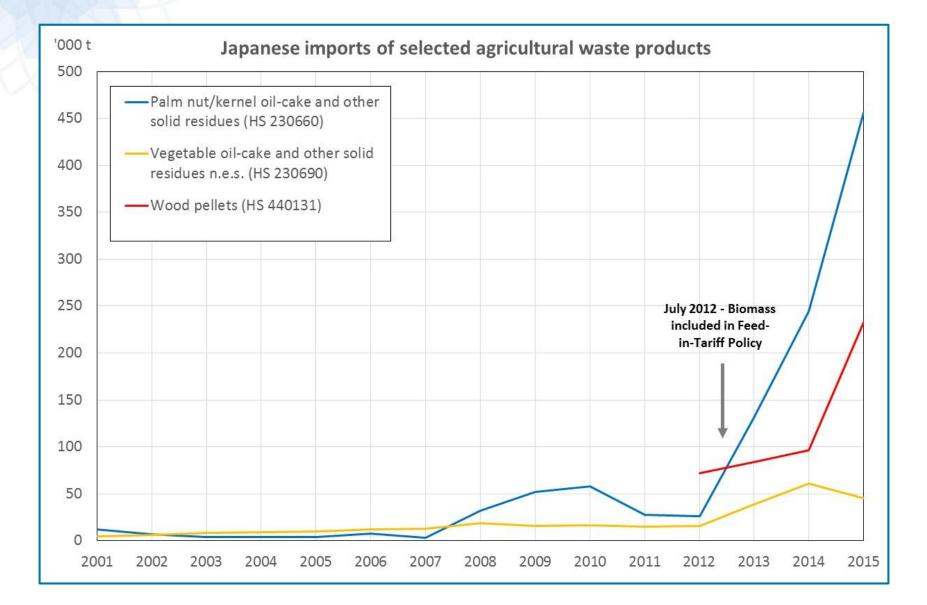
### Why so many products?



- **Sustainability:** Natural resource or waste?
- Energy content: Vastly different
- **Global scope:** Biofuels vary by region, usually only 6-8 types per country (12 in Austria)
- Useful to monitor market developments
- Building data framework for the future

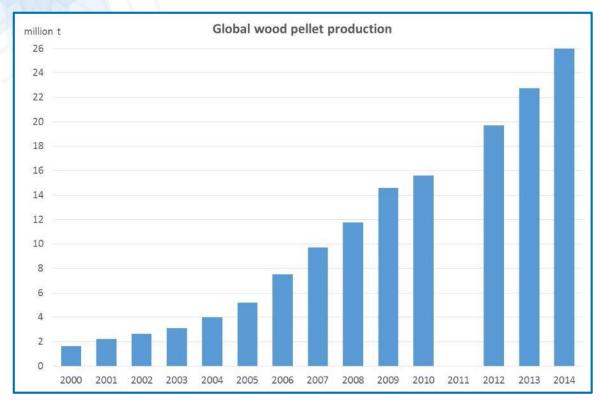
### **Market developments**





# **Biomass pellet development**





Pellets are a rapidly growing part of the biofuel market

Advanced liquid biofuels are also being developed



Wood

Palm (EFB)

Rice husk

Straw

V

Waste (SRF)

Torrefied

#### **IRENA RE energy balance**



- Heat (solar, geo), bioenergy, other
- Transformation: pellets; solids to liquids

Supply and consumption		Geothermal Energy	Solar thermal energy	Renewable municipal waste	Woodfuel	Energy crops	Wood waste	Black liquor	Straw	Begesse	Rice husks	Other vegetal and agricultural waste		pellets and	Charcoal	
2014			τı	LT	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Production	(+)															
Imports	(+)									1						
Exports	(-)															
Stock changes	(+)			Ŭ.							1					
International Bunkers	(-)		c.	0											5	
Domestic supply	(=)															
Transfers		1												Ĩ		
Statistical Differences					2									ŝ		
Power plants			ĵ	1	1			1		11						
CHP plants														1		
Communical Investigation																
Charcoal production				1				1								
Biomass pellet and briquette product	ion							£								
Other transformation										11						
Energy sector and own use	-															
Distribution losses																

#### **Electricity and heat sheets**



A	В	C	D	E	F	G	н	1	J	K	L	М	N	0	Р	Q
1	Gross electricity production in MWh															
2		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
3	ELECTRICITY PLANTS: TOTAL	95,977,000	102,420,000	109,013,000	116,983,000	125,727,000	132,195,000	138,732,000	143,364,000	147,387,000	148,306,000	159,304,000	155,684,000	170,563,650	167,619,565	7,531,000
4	ELECTRICITY PLANTS: NON-RENEWABLE	89,440,000	95,623,000	100,854,000	108,531,000	118,405,000	124,867,000	129,145,000	133,465,000	137,699,000	138,159,000	150,573,000	143,437,000	157,499,117	155,713,633	0
5	Coal and peat	17,773,000	19,868,000	18,837,000	19,369,000	20,605,000	20,522,000	25,309,000	30,768,000	31,772,000	30,034,000	30,047,000	34,809,000	35,090,028	35,256,787	
6	Oil	10,028,000	2,928,000	2,825,000	3,162,000	7,751,000	8,724,000	8,526,000	3,853,000	1,667,000	720,000	1,177,000	2,062,000	2,448,033	1,585,640	
7	Natural gas	61,639,000	72,827,000	79,192,000	86,000,000	90,049,000	95,621,000	95,310,000	98,844,000	104,260,000	107,405,000	119,349,000	106,566,000	119,961,056	118,871,206	
8	Nuclear	0	0													
9	Other (non-renewable)	0	0													
10	ELECTRICITY PLANTS: RENEWABLE	6,537,000	6,797,000	8,159,000	8,452,000	7,322,000	7,328,000	9,587,000	9,899,000	9,688,000	10,147,000	8,731,000	12,247,000	13,064,533	11,905,932	7,531,000
11	Hydropower	6,026,000	6,303,000	7,471,000	7,299,000	6,040,000	5,798,000	8,125,000	8,114,000	7,113,000	7,148,000	5,537,000	8,163,000	8,640,742	5,611,054	5,523,000
12	Small hydropower (<1 MW)	8,580	8,926	13,798	13,214	8,625	8,279	11,602	11,587	10,136	10,156	9,024	16,631	17,544	11,318	22,390
13	Medium hydropower (1-10 MW)	126,677	131,783	203,718	195,106	152,205	146,107	204,746	204,469	178,868	179,223	138,830	208,063	249,548	173,231	133,223
14	Large hydropower (>10 MW)	5,890,743	6,162,292	7,253,485	7,090,679	5,879,170	5,643,614	7,908,652	7,897,945	6,923,996	6,958,621	5,389,146	7,938,305	8,373,650	5,426,506	5,367,387
15	Pumped storage															
16	Geothermal	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	1,000	1,000	2,000	1,000	869	1,251	1,200
17	Solar Photovoltaic	0	0	0	0	0	0	1,000	1,000	3,000	9,000	20,000	95,000	447,013	932,309	1,384,800
18	Concentrated solar power															
19	Marine energy (tide, wave and ocean)															
20	Wind energy										1,000		5,000	17,179	351,304	305,100
21	Onshore wind energy	0	0	0	0	0	0	0	0	0	1,000	0	5,000	17,179	351,304	305,100
22	Offshore wind energy															
23	Renewable Municipal Waste													222,900	293,400	316,900
24	Solid biofuels															
25	Woodfuel	509,000	492,000	686,000	1,151,000	1,280,000	1,528,000	1,459,000	1,782,000	2,571,000	2,988,000	3,172,000	3,983,000	3,735,830	4,716,614	13,356,000
26	Energy crops															
27	Wood waste															
28	Blackliquor													406559/45030	496705/45770	516,400
29	Straw															
30	Bagasse													6,313,800	6,806,700	7,064,900
31	Rice husks													2,311,900	2,757,900	2,241,500
32	Other vegetal and agricultural waste													2,088,900	2,171,100	3,532,400
33	Other primary solid biofuels (animal was	te)														
34	Biomass pellets and briquettes															
35	Biogas															
36	Landfill gas	0	0	0	0	0	2,000	10,000	14,000	39,000	83,000	214,000	302,000	290,190	382,515	1,478,700
37	Sewage sludge gas															
38	Other biogases from anaerobic fermenta	tion														
39	Biogases from thermal processes															
40	Liquid biofuels															
41	Conventional biodiesel															
42	Advanced biodiesel															
43	Other liquid biofuels															



- Trade data: Solar panels; solar lanterns; solar water heaters; biomass pellets – refinement of Harmonized System (HS) codes
- Estimation techniques: Using census and household surveys to examine energy data
- Energy content: More work can always be done to understand calorific values





- Are there any issues you have encountered related to the completion of the templates?
- Where does IRENA get the data?
  - Handout: Overview



International Renewable Energy Agency

Questions? Thank you!