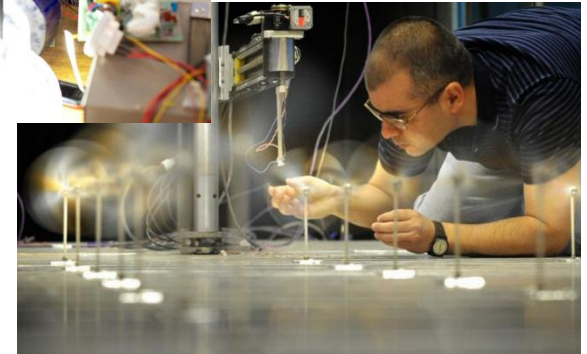
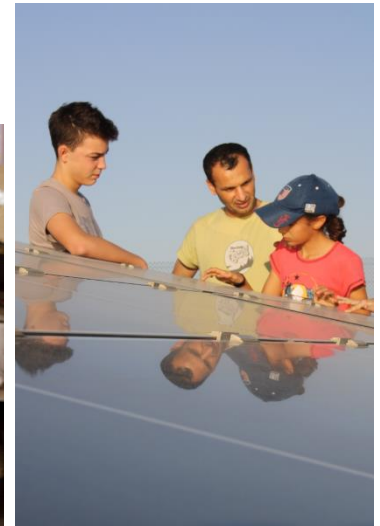


Renewable energy skills, education and training: key enablers of deployment

“Looking ahead: Inspiring and Empowering
Youth through Skills Development”

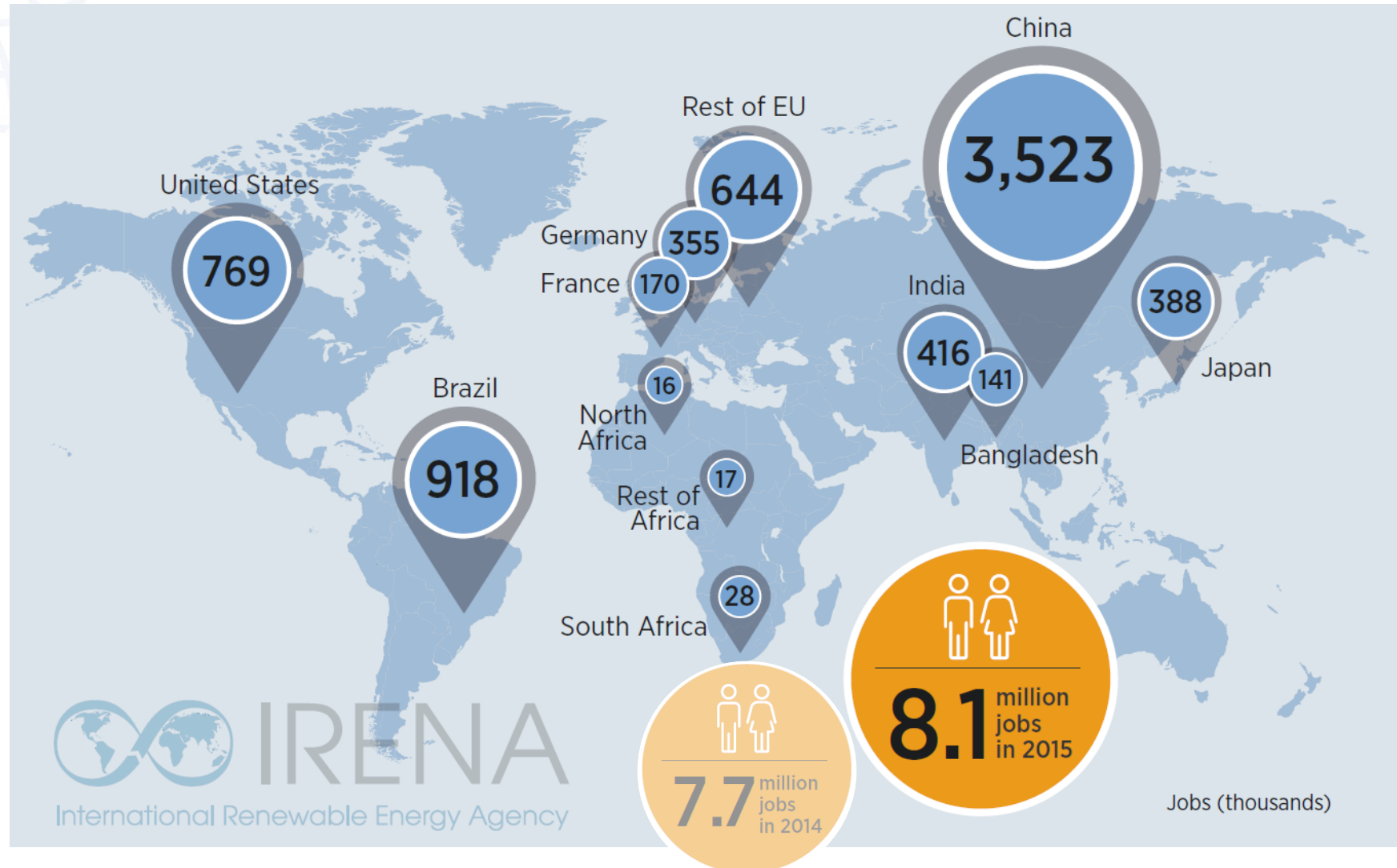
World Youth Skills Day 2016
UNESCO TVET Forum

Bonn, 15th July, 2016



Renewable Energy Jobs

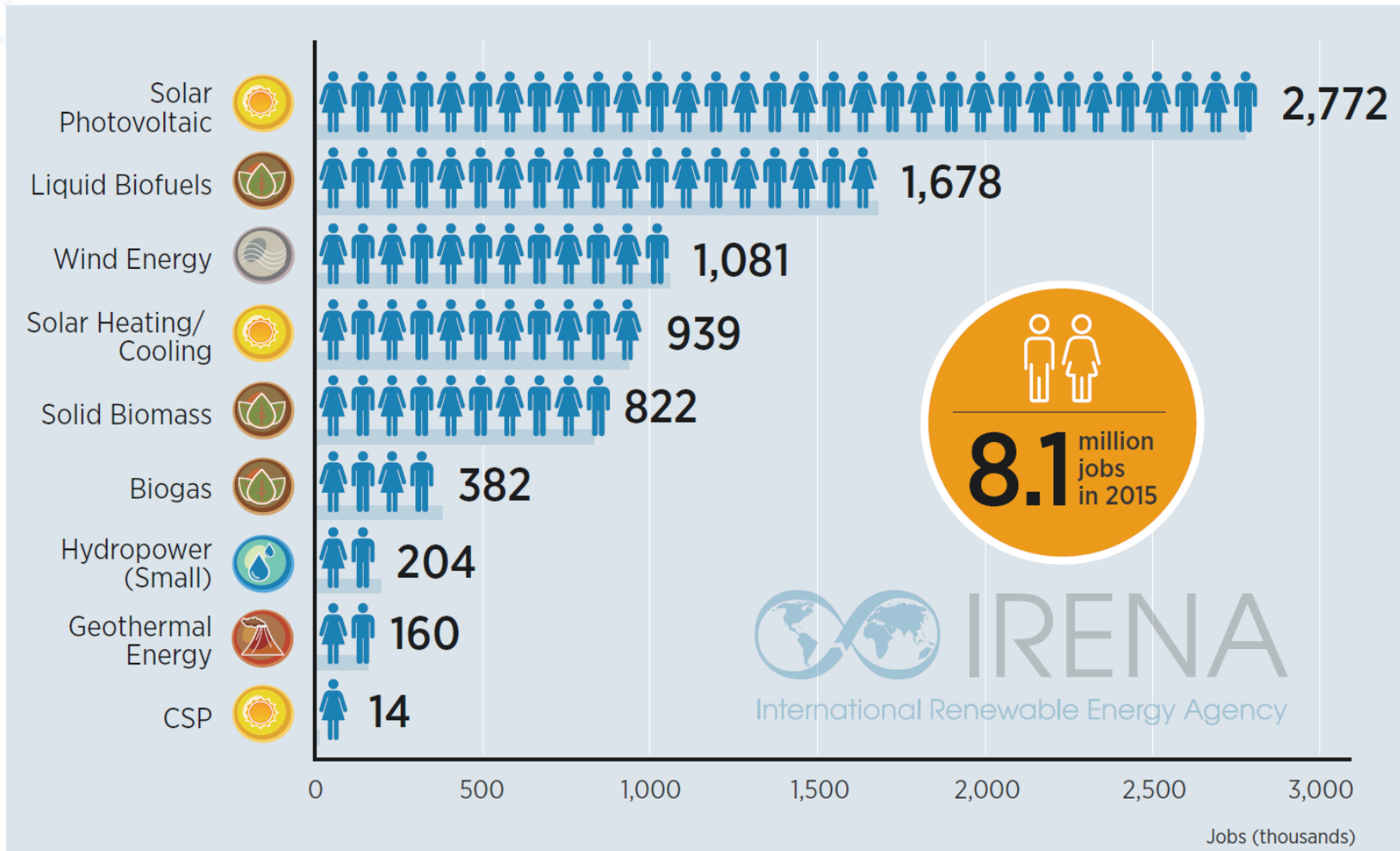
Employment in Selected Countries



Source: IRENA (2016), *Renewable Energy and Jobs - Annual Review 2016*

Renewable Energy Jobs

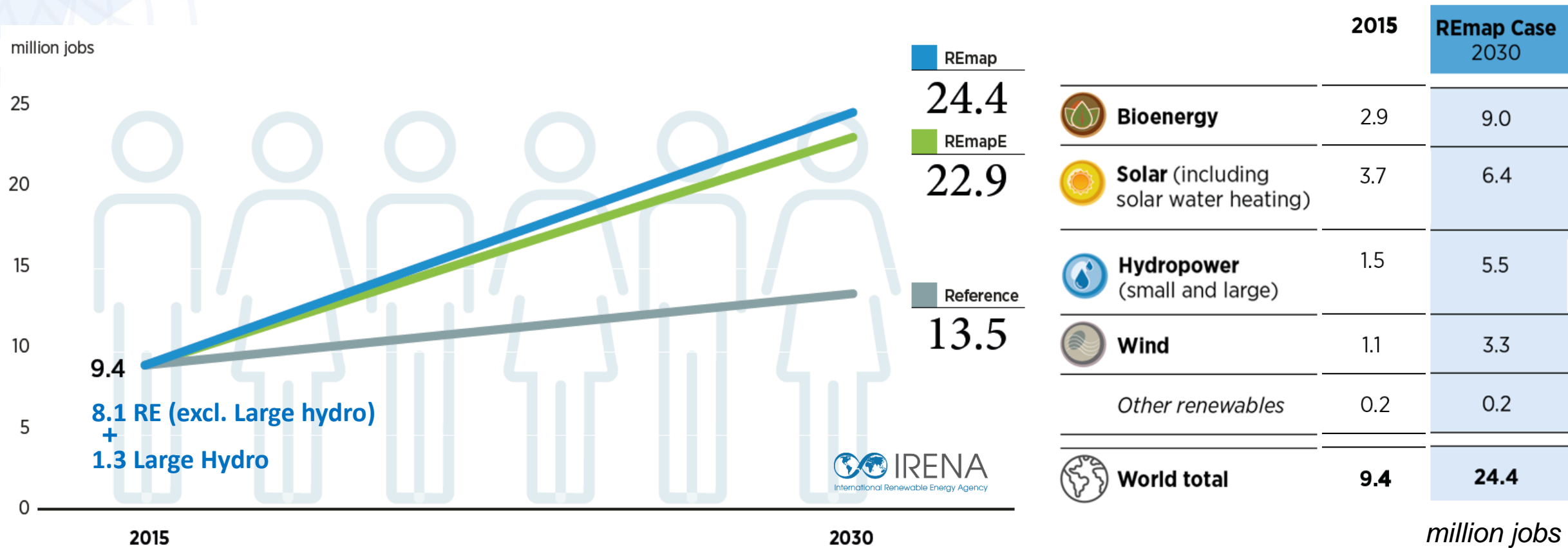
Employment by technology



Source: IRENA (2016), *Renewable Energy and Jobs - Annual Review 2016*






Renewable energy will create more jobs

The renewable energy sector could support up to 24 million jobs in 2030








Source: IRENA (2016), Renewable Energy Benefits: Measuring The Economics.

Renewable energy Occupations

	 SOLAR	 WIND	 HYDRO	 GEOTHERMAL	 BIOENERGY			
Equipment Manufacture and Distribution								
Common occupation	<ul style="list-style-type: none"> › R&D engineers (computer, electrical, environmental, mechanical, material) (H) › Software developers and engineers (H,M) 		<ul style="list-style-type: none"> › Modellers (prototype testing) (H,M) › Industrial mechanics (M) › Manufacturing engineers (H) › Manufacturing technicians (M) 		<ul style="list-style-type: none"> › Logistics professionals and operators (H,M) › Manufacturing operators (L) › Manufacturing quality assurance experts (H,M) › Certifiers (M) 		<ul style="list-style-type: none"> › Equipment transporters (L) › Procurement professionals (H,M) › Marketing specialists (H,M) › Sales personnel (H,M) 	
Occupations for each technology	<ul style="list-style-type: none"> › Researchers (chemists, physicists, engineers with specialisation in electrical, mechanical, chemical, materials, system design or process engineering) (H) › Chemical laboratory technicians and assistants (M) 	<ul style="list-style-type: none"> › R&D engineers (computer, electrical, environmental, mechanical, wind power design) (H) 	<ul style="list-style-type: none"> › Design engineers (civil, mechanical, electrical, hydropower) (H) 	<ul style="list-style-type: none"> › Machinists (M) › Welders (M) 	<ul style="list-style-type: none"> › Biochemists and microbiologists (H) › Agricultural, biological, chemical and physical scientists (H) › Chemical, biological, mechanical and electrical engineers (H) 			
Project Development								
Common occupation	<ul style="list-style-type: none"> › Project designers (engineers) (H) › Market analysts (H) › Environmental impact assessment engineers, consultants (H,M) › Economic/financial/risk specialists (H) › Atmospheric scientists and meteorologists (H) › Geographers (H) and social impact specialists (H) 		<ul style="list-style-type: none"> › Lawyers (commercial, feed-in contract, grid connection and financing contract, construction permit, power purchase agreement, government programmes) (H) › Sustainability specialists (natural resource/environmental planners, social scientists, cultural consultants) (H) 		<ul style="list-style-type: none"> › Planners (permit monitoring, amendment, application) (H) › Resource assessment specialists and site evaluators (H) › Archaeologists (H) › Land development advisors (H) › Land use negotiators (H) › Lobbyists (H) 		<ul style="list-style-type: none"> › Mediators (H) › Environmental and social NGO representatives (H,M) › Public relations officers (H) › Procurement professionals (H,M) › Debt financier representatives (H) › Developers/facilitators (H,M) › Communications specialists (H) 	
Occupations for each technology	<ul style="list-style-type: none"> › Architects (H) (small projects) 		<ul style="list-style-type: none"> › Physical and environmental scientists (hydrologists, geologists, ecologists) (H) › Natural resource/environmental lawyers (H) 	<ul style="list-style-type: none"> › Hydrologists, hydrogeologists (H) › Geologists (H) › Geophysicists (H) › Geothermal engineers (H) 				
Construction and Installation								
Common occupation	<ul style="list-style-type: none"> › Project designers and managers (H) › Engineers (civil, mechanical, electrical, environment.) (H) › Technicians (civil, mechanical, electrical) (M) › Construction electricians (M) 		<ul style="list-style-type: none"> › Project and installation evaluators (H,M) › Power line technicians (M) › Construction workers (M,L) › Quality control inspectors (M) 		<ul style="list-style-type: none"> › Measurement and control engineers (H) › Business developers (H) › Commissioning engineers (electrical) (H) › Instrumentation and control technicians (M) 		<ul style="list-style-type: none"> › Transportation workers (L) › Construction professionals (H) › Software engineers (H,M) › Construction equipment operators (M) 	

Renewable energy Occupations

	 SOLAR	 WIND	 HYDRO	 GEOTHERMAL	 BIOENERGY
Occupations for each technology	<ul style="list-style-type: none"> Solar Thermal (ST) <ul style="list-style-type: none"> System designers (H,M) Plumbers specialising in solar (M) Small Photovoltaic (Small PV) <ul style="list-style-type: none"> System designers (electrical engineers or technologists) (H,M) Electricians specialising in solar (M) Small PV, ST <ul style="list-style-type: none"> Roofers specialising in solar (M) Large PV <ul style="list-style-type: none"> System designers (electrical/mechanical/structural engineers) (H) Installers (M) Concentrated Solar (CSP) <ul style="list-style-type: none"> Welders (M) Pipe fitters (M) Small PV, Large PV, ST, CSP <ul style="list-style-type: none"> Electrician solar specialists (M) Installers (M) Project and installation evaluators (H,M) 	<ul style="list-style-type: none"> Marine engineers (H) 	<ul style="list-style-type: none"> Skilled construction workers (heavy machinery operators, welders, pipe fitters etc.) (M) 	<ul style="list-style-type: none"> Hydrologists, hydrogeologists (H) Geologists (H) Geophysicists (H) Geothermal engineers (H) Geochemists (H) Chemical laboratory technicians and assistants (M) Drilling engineers (H) Architects (H) Structural engineers (H) Surveyors (H) HVAC technicians (H) Drilling technicians and operatives (roughnecks) (M) Welders (M) Pipe fitters (M) Plumbers (M) Drilling equipment operators (M) Excavators (L) 	<ul style="list-style-type: none"> Biochemists and microbiologists (H) Laboratory technicians and assistants (M) Chemical, biological, mechanical and electrical engineers (H) General electricians, plumbers, roofers (M)
Operations and Maintenance					
Common occupations	<ul style="list-style-type: none"> Operations and maintenance specialists (M) Power line technicians (M) 	<ul style="list-style-type: none"> Field electricians (M) Inspectors (M,L) 	<ul style="list-style-type: none"> Recycling specialists (H) 	<ul style="list-style-type: none"> Measurement and control engineers (H) 	
Occupations for each technology	<ul style="list-style-type: none"> Photovoltaic maintenance specialists (electricians specialising in solar) (M) ST maintenance specialists (plumbers specialising in solar) (M) CSP maintenance specialists (M) 	<ul style="list-style-type: none"> Windsmith/millwright/ mechanical technicians or fitter/wind service Mechatronics technicians (M, some H) Operations and maintenance specialists (M) Power line technicians (M) Wind service mechatronics (M) 	<ul style="list-style-type: none"> Engineers (civil, mechanical, electrical) (H) Physical and environmental scientists (hydrologists, ecologists) (H) Tradespersons (M) 	<ul style="list-style-type: none"> Plant managers (H) Welders (M) Pipe fitters (M) Plumbers (M) Machinists (M) Construction equipment operators (M) HVAC technicians (M) 	<ul style="list-style-type: none"> Biochemists and microbiologists (H) Laboratory technicians and assistants (M) Agricultural scientists (H) Biomass production managers (H,M) Plant breeders and foresters (H,M) Agricultural/forestry workers (L) Transportation workers (L)
Cross-cutting/ Enabling Activities (Apply to all technologies and segments of the supply chain)					
Common occupations	<ul style="list-style-type: none"> Sales and marketing specialists (H,M) Educators and trainers (H) Management (H,M) Publishers and science clients (H,M,L) 	<ul style="list-style-type: none"> Trade association professional society staff (H,M,L) Writers (H,M) Insurer representatives (H,M) 	<ul style="list-style-type: none"> IT professionals (H,M) Administration (H,M,L) Human resources professionals (H) 	<ul style="list-style-type: none"> Other financial professionals (accountants, auditors, financiers) (H) Health and safety consultants (H,M) 	

Skills demand – solar PV utility scale

Low skilled technical jobs dominate the workforce

Job Types	Jobs	Jobs (FTE*)/ 100MW		% of total workforce
Technical jobs – low and medium skill level (e.g. technicians, workers, drivers)	Construction workers	178	393	80%
	Technicians	144		
	Factory workers	41		
	Truck drivers and operators	30		
Technical jobs – high skill level (e.g. Electrical, civil & mechanical engineers)	Engineers	40	55	11%
	Experts in safety	11		
	Experts in quality control	4		
Non-technical expertise (e.g. regulation, finance, marketing)	Lawyer, real estate, risk and regulation experts	10	42	9%
	Experts in logistics	7		
	Administration	6		
	Logistic workers	6		
	Marketing and commercial professionals	5		
	Economists	4		
	Environmentalists	3		
Total		490	490	



Around 1,735 GW of solar (PV and CSP) will result in **6.4 million jobs in 2030**.

Most of these jobs will be for low and medium skilled workforce (**80%**).

*FTE = Full time equivalent

Source: IRENA (2016 forthcoming), *Opportunities for local value creation from the deployment of wind energy technologies*

Skills demand – wind energy

Low skilled technical jobs dominate the workforce

Job Types	Jobs	Jobs (FTE*)/ 100MW		% of total workforce
Technical jobs – low skill level (e.g. technicians, workers, drivers)	Construction workers and technical personnel	250	409	78%
	Factory workers (manufacturing)	96		
	Professionals managing cranes, trucks, etc.	50		
	Logistic experts	14		
Technical jobs – high skills (e.g. Electrical, civil & mechanical engineers)	Engineers	37	70	13%
	Safety experts	24		
	Experts in quality control	9		
	Geotechnical experts	0.4		
Non-technical expertise (e.g. regulation, finance, marketing)	Management and Administration	12	44	8%
	Environmentalists	9		
	Lawyers, experts in energy regulation	9		
	Marketing and commercial professionals	8		
	Financial analysts	6		
Total		523	523	100%



Around 1,700 GW of wind energy will result in **3.3 million jobs in 2030**.

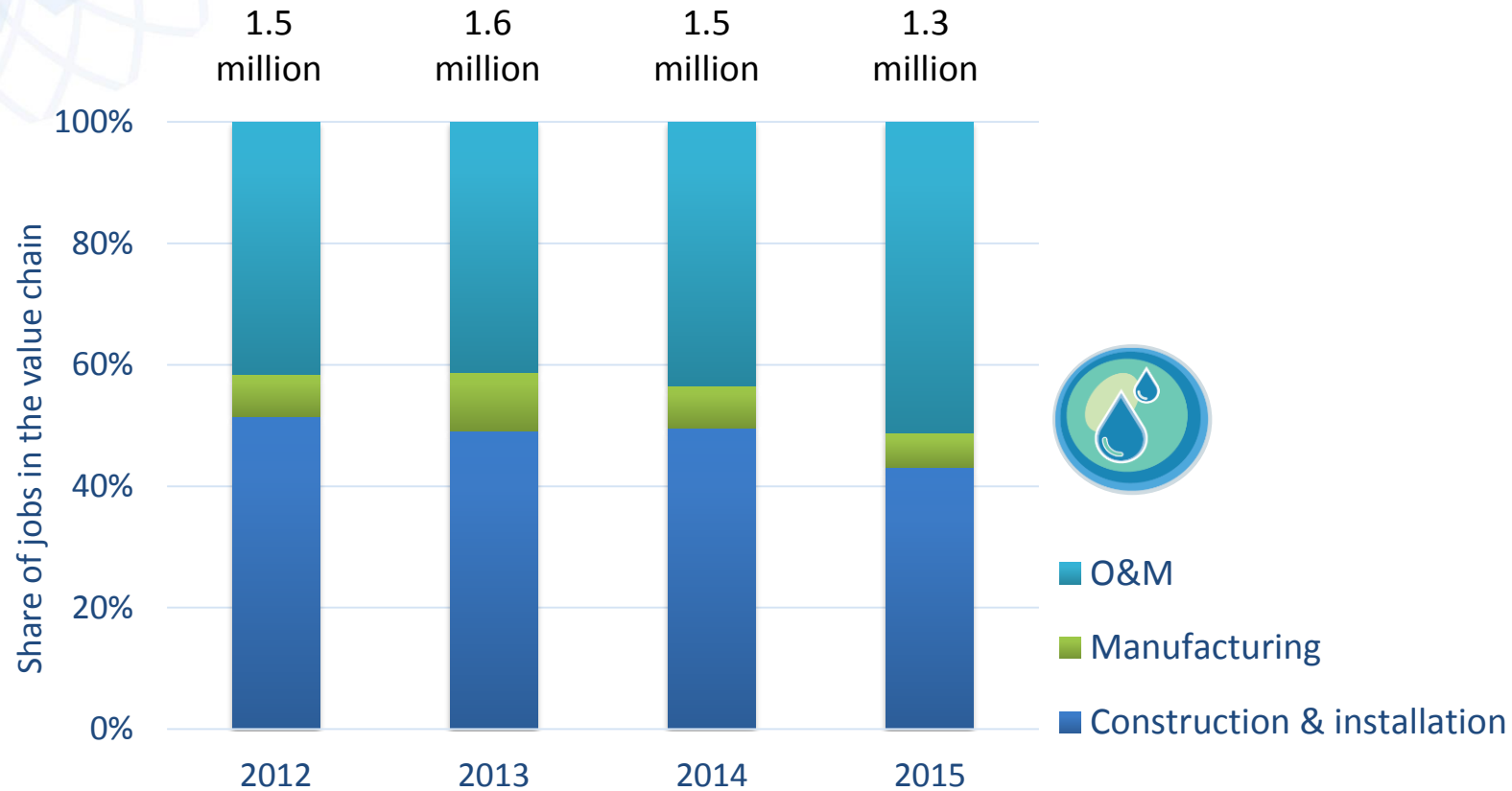
Most of these jobs will be for low and medium skilled workforce (**78%**).

*FTE = Full time equivalent

Source: IRENA (2016 forthcoming), *Opportunities for local value creation from the deployment of wind energy technologies*

Skills demand – large hydro power

Share of jobs in O&M increases as construction slows down



Operation & Maintenance

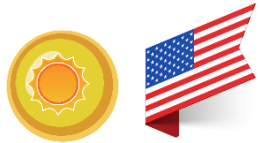
- Engineers (electrical, control, mechanical, etc.)
- Technicians
- Environmental experts
- Inspectors

Construction & Installation

- Engineers (civil, electrical, mechanical etc.)
- Technicians
- Environmental experts
- Construction workers
- Business developers

Skill shortages remain a key barrier to growth

Current skill shortages



As the solar industry grew rapidly in 2015, it became more difficult to hire qualified employees.



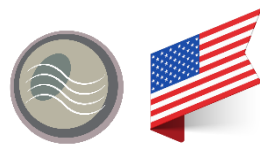
In 2013, more than 75% of wind companies found it *difficult* or *very difficult* to find suitably trained staff.



Unavailability of appropriately skilled manpower is a prominent challenge in hiring, especially for positions with low skill requirement.



Projected skill gaps



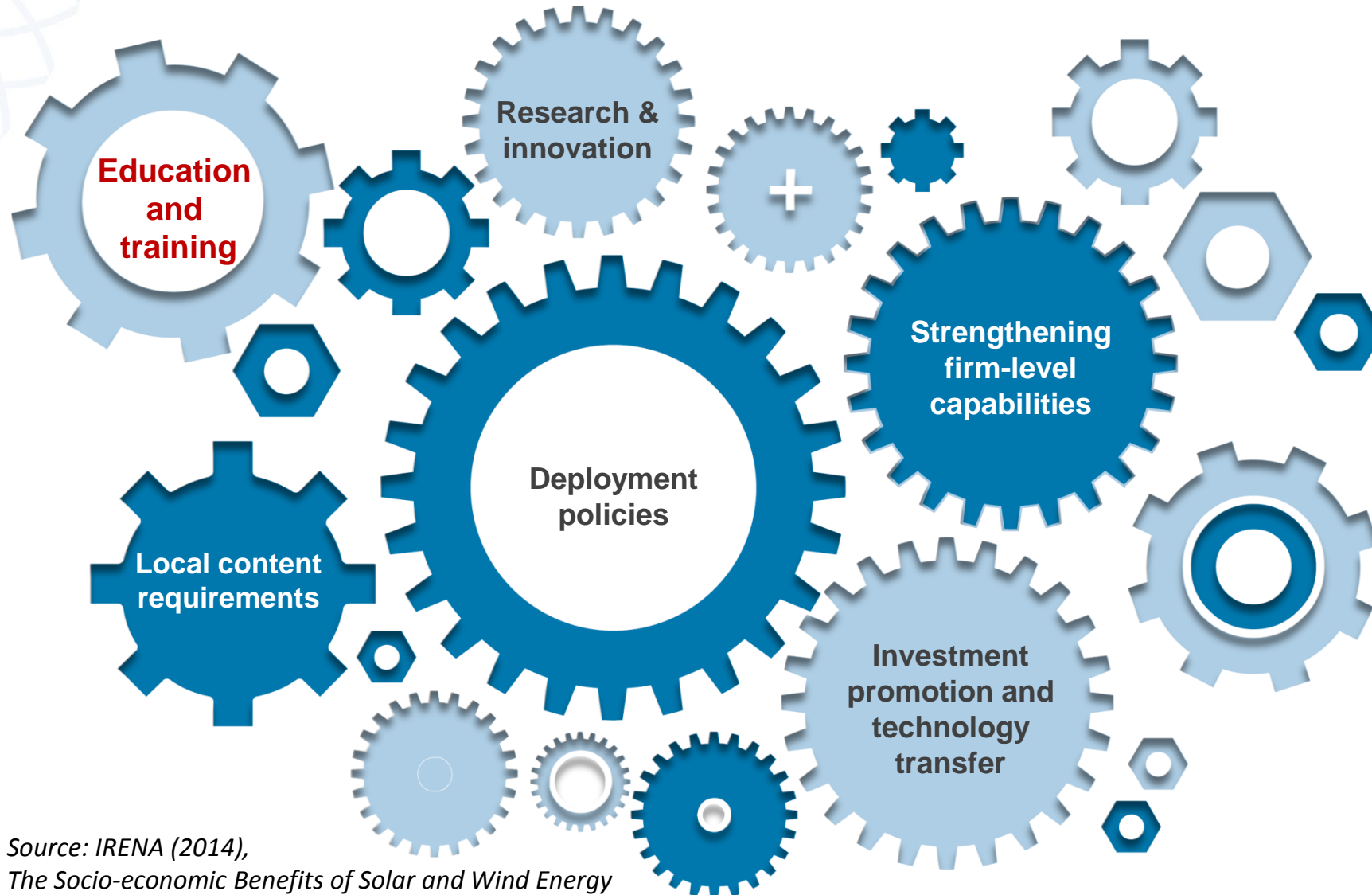
The number of bachelor- and master-level programmes for wind energy needs to be multiplied by 5-10 to reach the 2030 wind targets



India's solar target (100GW of by 2022) requires 1.1 million jobs. More than 70% of the these will require medium and low level skills.

Promoting renewable energy education and training

A vital part of a conducive policy landscape



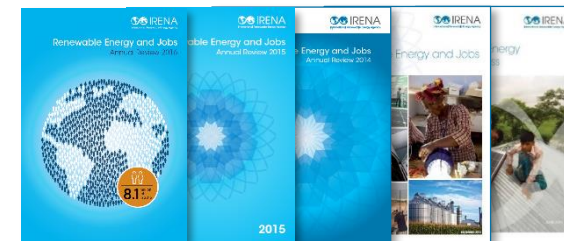
Source: IRENA (2014),
The Socio-economic Benefits of Solar and Wind Energy

Promoting renewable energy education and training

IRENA's initiatives

Renewable energy and jobs

- Study of the latest status and trends
- Analysis of key aspects such as skills, policy making, off grid and gender



IRELP

- Education centre: Repository of courses, webinar and other educational resources
- Career centre: Internships and career guidance

Capacity Building

- Trainings, workshops and publications to build capacity on topics including policy making, finance, technical issues and entrepreneurship etc.



Thank you!



Background slides

1. The figures are based on the following facilities:

- Wind: 50 MW
- Solar PV: more than 50 MW

2. During the phase of construction the figures are as follows:

		Wind	Solar PV (large scale)
Site preparation	Effort (number of days per 50 MW)	2,280	2,900
	Difference (%) with wind energy	27%	
Civil works	Effort (number of days per 50 MW)	14,320	19,250
	Difference (%) with wind energy	34%	
Assembling	Effort (number of days per 50 MW)	10,200	9,550
	Difference (%) with wind energy	-6%	

The site preparation and the civil works requires around 30% more effort in the case of solar PV, the difference is relevant: the works are less complex for the solar PV, but the surface is much (much) bigger.

On the other hand, the assembling tasks are more complex in the wind energy: it is necessary to install wind turbine at the top of the tower and it takes more time to install the same power capacity.