

# Lectures to students of higher educational institutions of Turkmenistan

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## Rooftop solar – challenges and solutions

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# RENEWABLE ENERGY IN THE EU



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# Renewable Energy in the European Union (EU)

## Why is the EU increasing the share of renewables in its energy mix?

- Under the European Green Deal, renewable energy is a pillar of the clean energy transition

*The European **Green Deal** is the ambitious EU climate policy that aims for Europe to become the first climate neutral continent by 2050*

- It comes at a low cost and is home-grown
- It reduces Europe's dependency on external suppliers
- It contributes to achievement of EU's objective of climate neutrality by 2050

# Renewable Energy in the EU (2)

- Globally EU leads technology development in renewables
- Since the introduction of the Renewable Energy Directive (2009/28/EC), the share of RES in EU energy consumption has increased from 12.5% in 2010 to 21.8% in 2021 and 23% in 2022
- The increase from in 2023, was largely driven by a strong growth in solar power
- In July 2021, the European Commission proposed a revision of the Directive, raising the 2030 target to 40% (up from 32%)

# Renewable Energy in the EU (3)

- According to the revised Directive EU/2023/2413:
  - The share of energy from RES in the gross final consumption of energy in 2030 should be at least 42.5%
  - Member States shall collectively endeavor to increase the above share to 45%
- EU member states have to ensure that new buildings are fit to host rooftop solar PV or solar thermal installations
- Starting in 2027, existing public and non-residential buildings will be required to install solar systems

# ROOFTOP SOLAR SYSTEMS



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# Rooftop solar Systems

- A rooftop solar system, or rooftop PV system, is a photovoltaic (PV) system with solar panels generating electricity installed on the roof of a residential or commercial building or structure
- There are 3 types of rooftop solar systems
  - On-grid system - the most common type, where the systems are connected to the grid. If net metering is available, the excess electricity produced by the solar panels is used to offset the electricity bill
  - Off-grid system - the energy from the solar panels must be stored in batteries and used as needed
  - Hybrid - combining an on-grid system with a battery



# Rooftop solar Systems (2)

## On-grid system



# Rooftop solar Systems (3)

## Off-grid system



# Rooftop solar Systems (4)

## Hybrid system



# Rooftop solar Systems (5)

- The deployment of rooftop solar PV systems has increased significantly in recent years due to rapidly decreasing costs and supportive policies
- In many markets, self-consumption of electricity from PV installations is already economically more attractive than buying electricity from the grid
- According to the International Energy Agency, the number of households relying on solar energy will grow from 25 million in 2022 to more than 100 million by 2030

# ROOFTOP SOLAR SYSTEMS IN THE EU



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# Rooftop solar systems in the EU

- On 18 May 2022, the European Commission published the **REPowerEU package**, which sets out a roadmap to end dependence on Russian fossil fuel imports. The package includes:
  - A first-of-its-kind EU Solar Strategy, which sets the following targets:
    - ✓ Adding 19 TWh (i.e. capacity addition from business-as-usual 16 GW has been increased to 19 GW) of rooftop solar in the first year of its implementation
    - ✓ 58 TWh by 2025 (i.e. 50.7 to 58GW)
  - Several steps to accelerate solar deployment

# Rooftop solar systems in the EU (2)

The **EU Solar Energy Strategy** includes:

- European Solar Rooftops Initiative
- EU large-scale skills partnership for renewable energy
- EU Solar PV Industry Alliance
- Commission's permitting package (legislative proposal, recommendation and guidance)

# Rooftop solar systems in the EU (3)

The main element to achieve the objectives of **EU Solar Strategy** - the introduction of a **solar mandate**:

- ***On all new public and commercial buildings*** with useful floor area larger than 250 m<sup>2</sup> - by 2026
- ***On all existing public and commercial buildings*** with useful floor area larger than 250 m<sup>2</sup> - by 2027
- ***On all new residential buildings*** - by 2029
- The EU proposes to ensure that at least one renewable energy community is set up in every municipality with a population higher than 10,000 people - by 2025



# Rooftop solar systems in the EU (4)

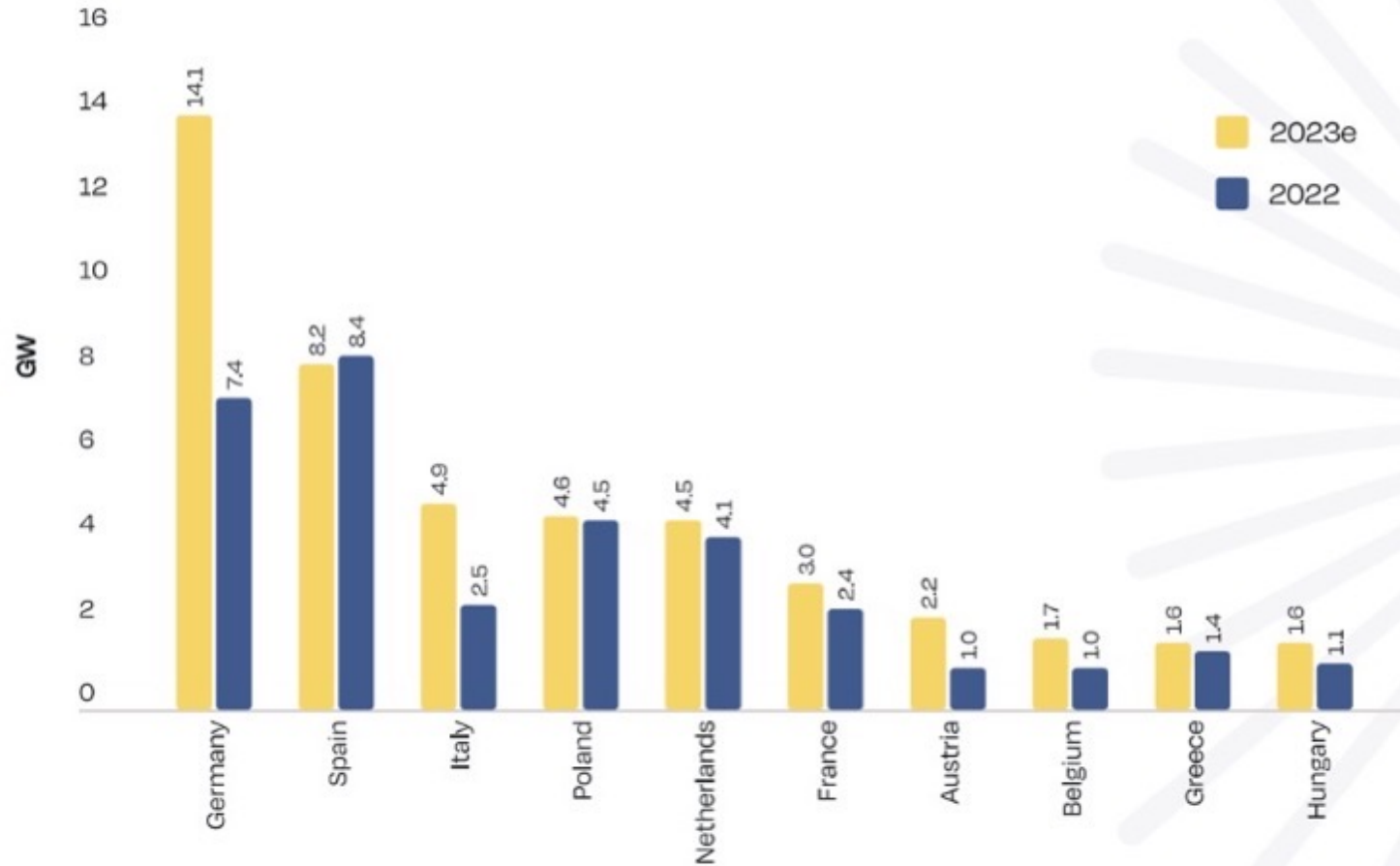
- **Steps to accelerate solar deployment**
  - In December 2022, a new **EU Solar PV Industry Alliance** was launched. The alliance will promote investment in large-scale factories, aiming for 30 GW of manufacturing of each key solar component, annually, by 2025 – more than six times the current average capacity of around 4.5 GW
- Both the rooftop and the utility-scale segments grew significantly with the increase of the total annual market in 2022
- But as in previous years, rooftop has remained the largest source of solar installations in the EU

# Rooftop solar systems in the EU (5)

- In 2023, 55.9 GW solar PV has been installed in EU, out of which:
  - 19 GW rooftop PV (16 GW in 2022)
  - 37 GW new utility-scale PV (24 GW in 2022)
  - By countries:
    - ✓ Germany 14.1 GW
    - ✓ Spain 8.2 GW
    - ✓ Italy 4.8 GW
    - ✓ Poland 4.6 GW
    - ✓ The Netherlands 4.1 GW

# Rooftop solar systems in the EU (6)

FIGURE 6 TOP 10 MARKETS 2022-2023



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# CAPEX AND RESCO MODELS FOR ROOFTOP SOLAR INSTALLATIONS



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# CAPEX and RESCO models for rooftop solar installations

Two main types of business models for rooftop solar installations:

- CAPEX (capital expenditure) model - the consumer hires a company that provides turnkey installation of the entire solar energy system and transfers the assets to the consumer (EPC - Engineering, Procurement and Construction)
- RESCO model - involves a Renewable Energy Service Company (RESCO)

# CAPEX and RESCO models for rooftop solar installations (2)

## CAPEX Model

- Allows residential, industrial and commercial customers to own a solar PV system
- Customer installs a solar project with the intention of either owning the power source or reducing their own energy costs
- The customer bears all capital costs of the solar project
- The customer may benefit by selling surplus energy generated to the grid operator

# CAPEX and RESCO models for rooftop solar installations (3)

## RESCO model



# CAPEX and RESCO models for rooftop solar installations (4)

## RESCO model

- The solar power plant is owned by RESCO or an energy company
- Customer must sign a power purchase agreement (PPA)
- Customer pays only for the electricity consumed
- The developer RESCO is responsible for annual operation and maintenance (O&M) costs
- RESCO can get additional benefit by selling surplus generated electricity to the grid operator



# ROOFTOP SOLAR IN TAJIKISTAN



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# Rooftop solar in Tajikistan

At the request of the Ministry of Energy and Water Resources of the Republic of Tajikistan, SECCA is assisting in the development of rooftop solar. The assistance includes:

- Study of technical, environmental and financial aspects of rooftop solar in Tajikistan
- Analysis of legal & regulatory (L&R) framework and elaborated recommendations for its improvement
- Estimation of technically and economically feasible potential of rooftop solar in Dushanbe city
- Development of a financing scheme for rooftop solar in Tajikistan

# Rooftop solar in Tajikistan (2)

- Roof area and potential for electricity generation by building type in Dushanbe

Type of building	Number	Area, km <sup>2</sup>	Usable area, km <sup>2</sup>	Optimal capacity, MW	Estimated annual electricity generation, GWh
Residential (old)	1047	1,294	1,04	103,5	149,1
Residential (new)	1442	1,752	1,40	140,1	201,8
Social	200	0,589	0,47	47,1	67,8
Commercial	14	0,050	0,04	4,04	5,8

# Rooftop solar in Tajikistan (3)

- Preliminary results of Cost-benefit analysis of rooftop solar systems in Dushanbe

Type of building	Electricity tariff (w/out VAT)		Without Net Metering		With Net Metering	
	TJS/kWh	USD/kWh	IRR, %	Payback, year	IRR, %	Payback, year
Residential	0,3075	0.0281	-	-	-	-
Social	0,5279	0.0482	5,0%	12,48	9,4%	9,32
Commercial	0,7035	0.0642	12,0%	7,50	15,0%	6,50

IRR – Internal Rate of Return

**THANK YOU  
FOR YOUR  
ATTENTION!**

