



Renewable Energy Investment Show Cases and Prospects (REISCPs) event At 8th International Forum on Energy for Sustainable Development (IFESD)

13-14 June 2017, Astana, Kazakhstan

*From Renewable Energy Pipeline Projects
to Matchmaking*

EU Technical Assistance Facility (TAF) for the “Sustainable Energy for All” Initiative



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Agenda



- 1. Global RE trends**
- 2. RE Opportunities in the UNECE region**
- 3. Matchmaking for Renewable Energy Investment**

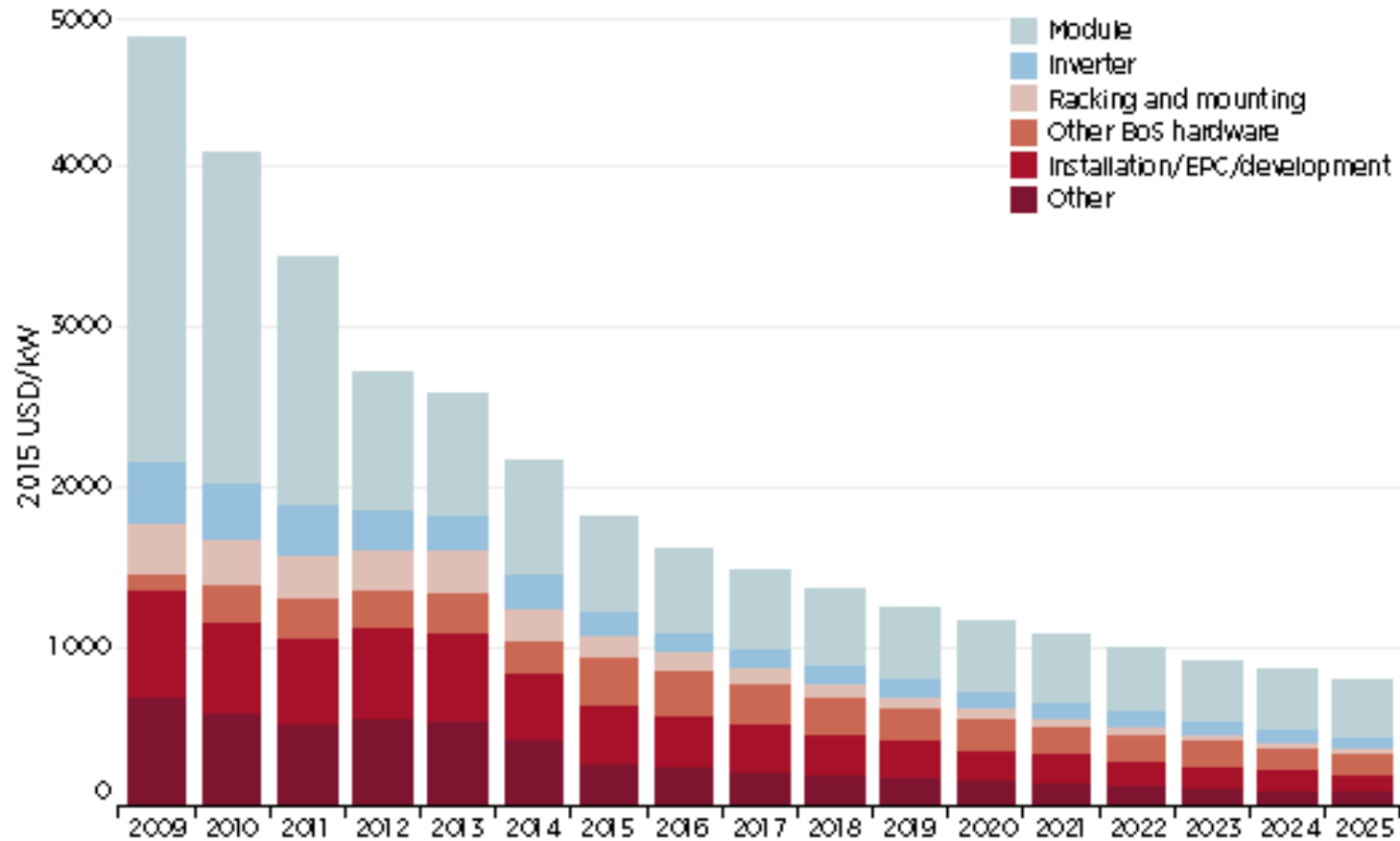


Guiding questions

- *What is the status of renewable energy in Central Asia, the Caucasus and Eastern Europe?*
- *Which EU programmes and financing facilities exist to support renewable energy project development in this region?*
- *What are country's experiences and lessons learnt of renewable energy project development?*
- *Which support mechanisms, investment incentives exist to upscale renewable energy uptake?*
- *What are the risks, potentials and opportunities in selected countries for renewable energy upscaling?*
- *Do the pipelines developed mirror the risk appetite of potential investors?*

1. Global RE trends

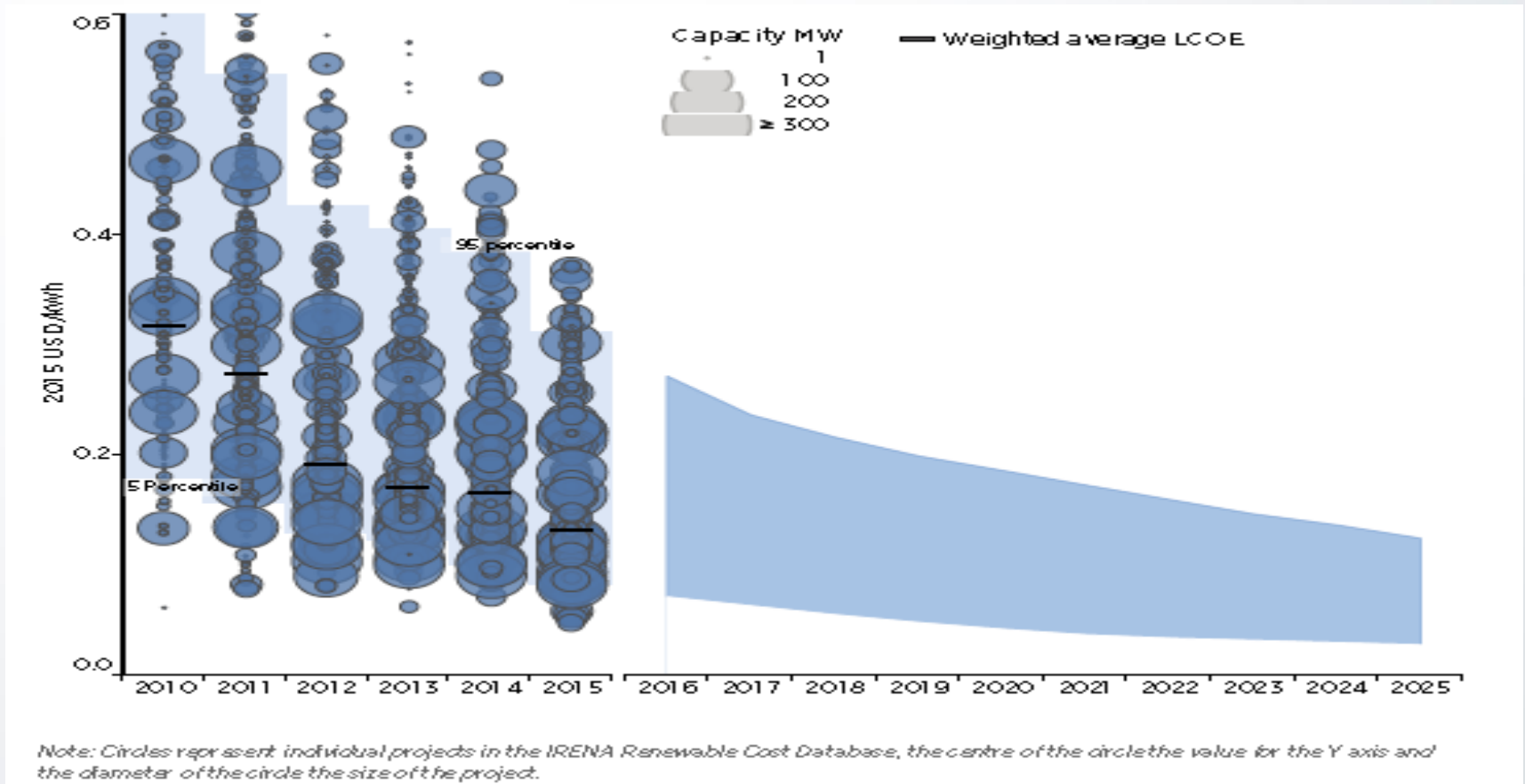
Global weighted average utility-scale Solar PV total installed costs 2009 – 2025



Source IRENA 2016

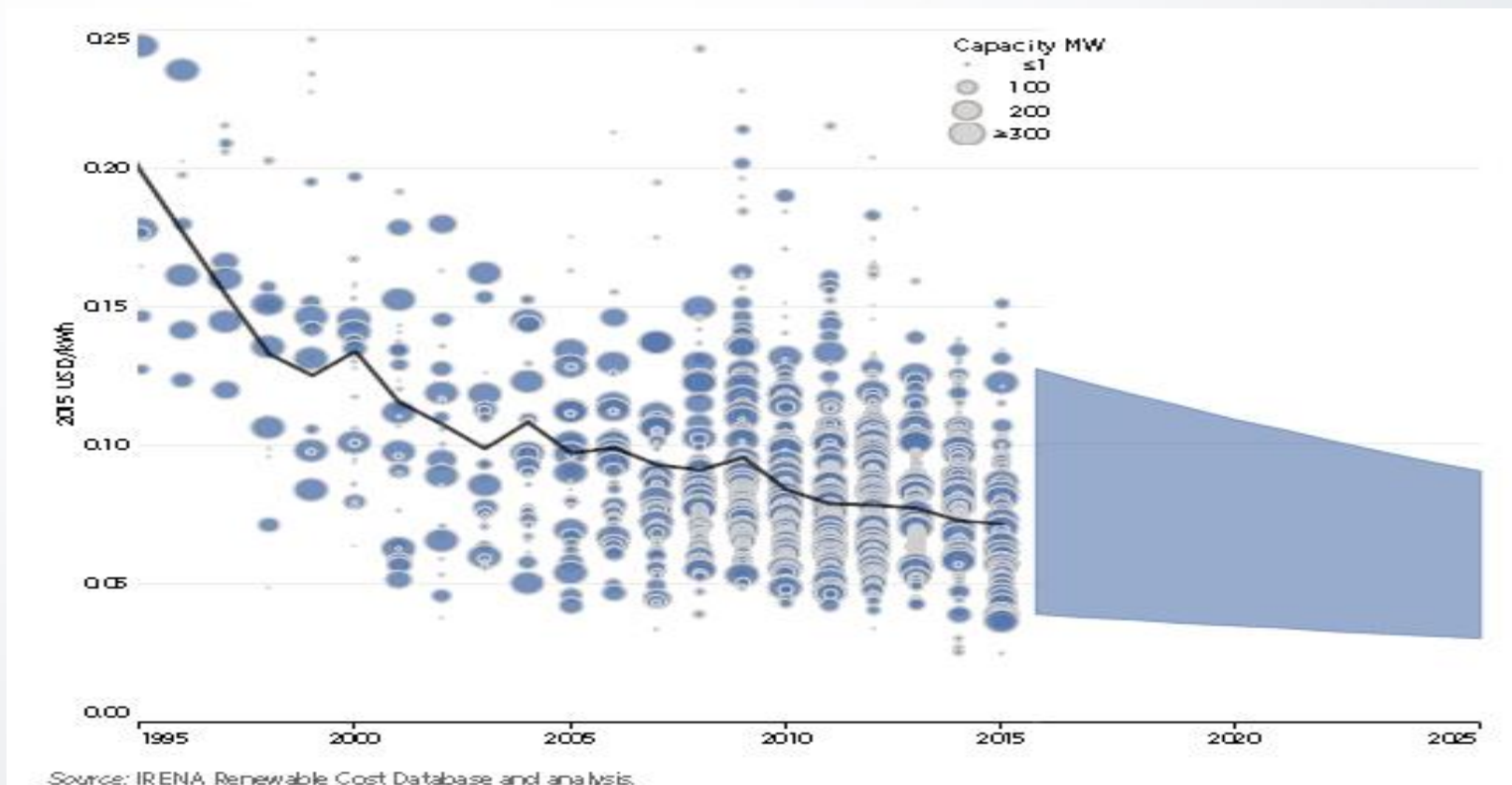
Global RE trends

Global utility-scale Solar PV LCOE ranges by project 2010 – 2025



Global RE trends

Levelised Cost of Electricity of onshore wind 1995 - 2025



2. RE Opportunities in the UNECE region

Potential and Existing Renewable projects in the UNECE region (2010 – 2020)

Size (MW) (est)	Price (USD/kWh)	Energy cost (USD/kWh)	CAPEX (USD/m (est))
20,500	1720	0.20 - 0.52	19,800
14,600*	1750	0.20 - 0.54	14,000*

Source: Revelle 2017

* excluding large hydropower, like Rogun, etc.





Selected analysed UNECE Investment proposals *

	Name	Size MW	Cost Euro m	IRR	IRR equit y	DSCR min	Tariff E/M Wh	LCOE E/M Wh
1	Armenia PV	1.00	0.60	77%	154%	12.63	n/a	n/a
2	Armenia, production of more efficient PV modules							
3	Georgia biomass amaranth	3.00	3.54	14%	89%	1.71	50.00	42.66
4	Georgia wood pellets, schools	0.30	0.12	48%	142%	4.14	n/a	n/a
5	Ukraine Bio Gaz Zorg	4.50	18.00	20%			135	
6	Uzbekistan biomass amaranth	1.00	6.0	39%			60	
7	Uzbekistan solar	0.50	1.00	-7%	9%	1.54	n/a	n/a
8	Uzbekistan biomass	20.00	1.00	165%	276%	16.25	60.00	88.39

*under "Promoting Renewable Energy Investments for Climate Change Mitigation and Sustainable Development" project by UNESCWA and UNECE



Cost of RE technologies

Investment cost of power generation technologies in the UNECE region

Technology	Range (\$/kW)	Weighted average (\$/kW)	Capacity factor range	Capacity factor range weighted
Biomass	1344 to 7106	1756	0.713 to 0.958	0.831
Hydro	519 to 5416	2945	0.169 to 0.854	0.421
Solar	1545 to 3697	2775	0.117 to 0.127	0.119
Onshore Wind	1550 to 2651	1751	0.272 to 0.350	0.344

Source REN21 2017



Cost of generated energy

Levelised cost of Energy of power generation technologies in the UNECE region (in \$/kWh)

Technology	Range	Weighted average
Biomass	0.05 to 0.12	0.05
Hydro	0.03 to 0.27	0.05
Solar	0.17 to 0.25	0.21
Onshore Wind	0.07 to 0.14	0.075

Source: REN21 2017



RE investments and opportunities

Renewable projects implemented and in pipeline in the UNECE region 2010-2020

Country	Size (MW)	Price (USD/kWh)	Energy cost (USD/kWh)	CAPEX in USD m (estimated)
Armenia	1,268	1,185	0.37	480
Azerbaijan	623	2,140	NA	1,040
Georgia	2,185	1,850	NA	4,136
Kazakhstan	2,426	1,710	1.00	4,416
Kyrgyzstan	2,475	2,330	0.45	3,427
Tajikistan	7,808	1,872	0.29	4,101
Ukraine	1307	2,800	NA	2,848
Uzbekistan	2,397	1,607	0.80	700
TOTAL	20,489	1,937	0.58	19,748

*Source Revelle 2017

3. RE Investments and Opportunities

Matchmaking for Renewable Energy Investment





Guiding questions

- *Why is it profitable to invest in renewable energy in Central Asia, the Caucasus and Eastern Europe?*
- *What can be done to boost renewable energy investments in these countries?*
- *How to transform project showcases, project ideas and support mechanisms in opportunities?*
- *Do the pipelines developed mirror the risk appetite of the potential investors?*
- *What are the remaining risks and barriers to financing of renewable energy?*
- *What instruments are needed to tackle these risks and barriers?*
- *Are the project developers prepared to deal with financial partners and financing institutions?*

Selected analysed REIPs/ Investment proposals

Submitted and analysed Renewable projects in the UNECE region (1/10)

	Name	Size MW	Cost € m	IRR	IRR equity	DSCR min	Tariff €/MWh	LCOE €/MWh
1	Armenia PV	1.00	0.60	77%	154%	12.63	n/a	n/a
2	Armenia, production of more efficient PV modules							
3	Georgia biomass amaranth	3.00	3.54	14%	89%	1.71	50.00	42.66
4	Georgia wood pellets, schools	0.30	0.12	48%	142%	4.14	n/a	n/a
5	Kyrgyzstan hydro power	2.40	2.50	13%	31%	1.31	67.00	38.21
6	Kyrgyzstan Solar hot water hospital		0.06					
7	Kazakhstan wind	41.00	51.25	5%	17%	1.25	75.62	31.31

Selected analysed REIPs/ Investment proposals

Submitted and analysed Renewable projects in the UNECE region - AZ (2/10)

	Name	Size MW	Cost Euro m	IRR	IRR equit y	DSCR min	Tariff E/M Wh	LCOE E/M Wh
8	Absheron Xizi WPP Azalternativenerji LLC	38.50	77					
9	Absheron Garadagh WPP Azalternativenerji LLC	46.50	93					
10	Shurabad (Xizi) WPP Azalternativenerji LLC	29.50	59					
11	Lokbatan WPP Azalternativenerji LLC	15.50	31					
12	Xizi WPP Azalternativenerji LLC	92.50	185					
13	Siyezen SPP Azalternativenerji LLC	25.66	41.05					
14	Absheron Xizi SPP Azalternativenerji LLC	7.38	11.8					

Selected analysed REIPs/ Investment proposals

Submitted and analysed Renewable projects in the UNECE region - AZ (3/10)

	Name	Size MW	Cost Euro m	IRR	IRR equit y	DSCR min	Tariff E/M Wh	LCOE E/M Wh
15	Absheron Garadag SPP Azalternativenerji LLC	7.38	11.8					
16	Samukh Biogas Cogeneration PP Azalternativenerji LLC	4.42	5.74					
17	Samukh Biomass Cogeneration PP Azalternativenerji LLC	18.00	19.75					
18	Aghjabedi Biomass PP Azalternativenerji LLC	18.00	17.39					
19	Siyazan Biomass Cogeneration PP Azalternativenerji LLC	22.00	26.44					
20	Oguz Biomass PP Azalternativenerji LLC	18.00	18.14					
21	Imishli Biomass PP Azalternativenerji LLC	10.00	4.54					
22	Bilesuvar Biomass PP Azalternativenerji LLC	13.00	6.24					



Selected analysed REIPs/ Investment proposals

Submitted and analysed Renewable projects in the UNECE region - KZ (4/10)

	Name	Size MW	Cost Euro m	IRR	IRR equit y	DSCR min	Tariff E/M Wh	LCOE E/M Wh
23	Construction of Wind Power Plant in Sheleks corridor/Almaty LLP "Samruk Energo"	60	74					
24	Construction of Wind Power Plant in Jambyl/Korday region LLP «Vetroinvest»	53.75	408					
25	Construction of Wind Power Plant in Isatay/Atirau region LLP «VetroEnergoTechnologii»	52.8	105.6					
26	Construction of Wind Power Plant in Shokpar district / Jambyl region LLP «Windhan»	109	550					
27	Construction of Wind Power Plant in Baydibeck/South Kazakhstan Region LLP «Windfarm Juzimdyk»	40	180					
28	Construction of Wind Power Plant in Jarmin district / South Kazakhstan region (Shar city)LLP «Weu Shar»	37.5	112.5					
29	Construction of Wind Power Plant in Fort-Shevchenko-Mangistau region LLP «SouthWindPower»	42	48					
30	Construction of Wind Power Plant in Enbekshikazakh" region/Almaty area LLP "Jeruyik Energo "	50						

Selected analysed REIPs/ Investment proposals

Submitted and analysed Renewable projects in the UNECE region - KZ (5/10)

	Name	Size MW	Cost Euro m	IRR	IRR equity	DSCR min	Tariff E/MW h	LCOE E/MW h
31	Construction of Janatas Wind Power Plant in Sarisus district /Jambyl region LLP “Janatas Wind Power Plant”	100	91					
32	Construction of “Astana Expo-2017” Wind Power Plant LLP «ҚАТАЭК Green Energy»	100	300					
33	Construction of Solar Power Plant (HPP) in Koksaray village/South Kazaxstan region LLP “Promondis Kazaxstan”	35	120					
34	Construction of “Akadyr” Solar Power Plant in Shet district/Karaganda region LLP “KazSolar 50”	50	100					
35	Construction of Solar Power Plant in BatyrMunaylin area/Mangistau region LLP «GroupIndependent»	2	4					
36	Construction of Solar Power Plant in Gulshat/Karaganda region LLP «KPM-Delta»	40	80					
37	Construction of Solar Power Plant in SholakkorganSozak /South Kazaxstan region LLP «YUKSES 50»	50	100					
38	Construction of Solar Power Plant in Jarmin district/South Kazaxstan region LLP «JANGIZ SOLAR»	30	60					



Selected analysed REIPs/ Investment proposals

Submitted and analysed Renewable projects in the UNECE region - KZ (6/10)

	Name	Size MW	Cost Euro m	IRR	IRR equity	DSCR min	Tariff E/MW h	LCOE E/MW h
39	Construction of Solar Power Plant in Saran Karaganda region LLP «SES Saran» (СЭССарань)	100	200					
40	Construction of Kapshagay Solar Power Plant in Almata region LLP “Nadejnie visokie technologii”	50	100					
41	Construction of Solar Power Plant in Tselinograd district/Akmola region LLP «KB ENTERPRISES»	100	200					
42	Construction of Solar Power Plant in Tselinograd district/Akmola region LLP «M-KAT GREEN»	100	200					
43	Construction of Solar Power Plant-2 in Jualyn district/Jambyl LLP «Burnoye Solar-2» (Бурное-Солар-2)	50	100					
44	Construction of Baykonur-2 Solar Power Plant -2 in Kyzylorda region LLP «BaikonyrSolar» (БайқоңырСолар)	50	100					
45	Construction of Hydro Power Plant on Kora River/Almata region LLP «Korinskaya GES»	28.5	99.75					
46	Construction of Shelek Hydro Power Plant-29 on Shelek river/Enbekshikazax district/Almata region LLP «Kazgidrotechenergo»	34.8	121.8					

Selected analysed REIPs/ Investment proposals

Submitted and analysed Renewable projects in the UNECE region - UA (7/10)

	Name	Size MW	Cost Euro m	IRR	IRR equi ty	DSCR min	Tariff E/M Wh	LCOE E/M Wh
47	Ukraine biomass Chernobil	5.00	14.40	13%	26%	1.45	123.9 0	90.16
48	Ukraine Thermal Power 5 x 2 MW with Own Biofuel Production	10.00	1.3	25%			135	
49	Ukraine thermal power stations of 9.4 MW own biofuel production	9.40	17	27%			135	
50	Ukraine Landfill Gas/ Electricity 0.72MWt	0.70	1.3	30%			135	
51	Ukraine solar photovoltaic power Ivanovo Frankivsk	10.00	8.5	20%			150	



Submitted and analysed Renewable projects in the UNECE region - UA (8/10)

	Name	Size MW	Cost € m	IRR	IRR equity	DSCR min	Tariff €/MWh	LCOE €/MWh
52	Ukraine Wind power	12.00	18	17%			105	
53	Ukraine Solar PV Kirovograd	8.00	6.65	22%			150	
54	Ukraine Wind power	234.0	327	19%			105	
55	Ukraine Lviv Wind	112.2	165	19%			112.7	
56	Ukraine solar PV Korolyvka	3.00	2.5	19%			150	
57	Ukraine biomass Vinitsa	10.00	3.8					
58	Ukraine Biogas Vimeksim	4.5	18	26%			124/5 2Gc	



Submitted and analysed Renewable projects in the UNECE region - UA (9/10)

	Name	Size MW	Cost Euro m	IRR	IRR equity	DSCR min	Tariff €/MWh	LCOE €/MWh
59	Ukraine Wind projects by SAE	532						
60	Ukraine Solar PV projects by SAE	43						
61	Ukraine biomass projects by SAE	67						
62	Uzbekistan biomass amaranth	1.00	6.0	39%			60	
63	Uzbekistan solar	0.50	1.00	-7%	9%	1.54	n/a	n/a
64	Uzbekistan biomass	20.00	1.00	165%	276%	16.25	60.00	88.39

Submitted and analysed Renewable projects in the UNECE region - UA (10/10)

	Name	Size MW	Cost Euro m	IRR	IRR equity	DSCR min	Tariff €/MWh	LCOE €/MW h
65	Armenia PV	1.00	0.60	77%	154%	12.63	n/a	n/a
66	Armenia, production of more efficient PV modules							
67	Georgia biomass amaranth	3.00	3.54	14%	89%	1.71	50.00	42.66
68	Georgia wood pellets, schools	0.30	0.12	48%	142%	4.14	n/a	n/a
69	Ukraine Bio Gaz Zorg	4.50	18.00	20%			135	
70	Uzbekistan biomass amaranth	1.00	6.0	39%			60	
71	Uzbekistan solar	0.50	1.00	-7%	9%	1.54	n/a	n/a
72	Uzbekistan biomass	20.00	1.00	165%	276%	16.25	60.00	88.39



Selected REIPs by country and technology (1/3)

Azerbaijan	MW	Cost \$m
Wind	223	445
Solar	40	65
Hydro		
Biomass	103	98

Kazakhstan	MW	Cost \$m
Wind	501	2,269
Solar	657	1,836
Hydro	107	
Biomass		



Selected REIPs by country and technology (2/3)

Kyrgyzstan	MW	Cost \$m
Wind		
Solar		
Hydro	225.9	102.95
Biomass		

Ukraine	MW	Cost \$m
Wind	890	,110
Solar	64	68
Hydro		
Biomass	107	56



Selected REIPs by country and technology (/3)

Georgia Construction	MW	Cost \$m
Wind		
Solar		
Hydro	7,989	1,659
Biomass		

Georgia Feasibility	MW	Cost \$m
Wind		
Solar		
Hydro	8,875	1,075
Biomass		

Georgia Feasibility	MW	Cost \$m
Wind	787	132
Solar	197	505
Hydro	646	985
Biomass		



Let the Developers talk B2B session/bilateral meetings

Thank you for your attention





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Thank you for your kind attention