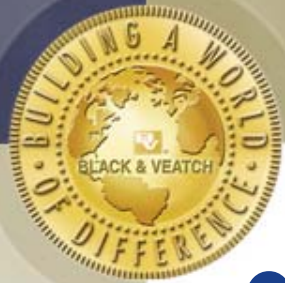




Potential of Renewable Energy in the CEE

**Based on an EBRD Project:
“Renewable energy resources
and priority projects
in the Former Soviet Union
and Eastern Europe”**



Agenda

- Introduction to EBRD
- Project Background and Objectives
- Assessment Methodology
- Assessment Results
- Barriers and Incentives
- Recommendations & Next Steps

European Bank for Reconstruction and Development (EBRD)



- Multilateral Bank Established in 1991
- Operates in 27 Countries from C. Europe to C. Asia
- Owned by 60 Countries & 2 Intergovernmental Institutions
- Largest Lender in the Region
- Every EBRD Investment must:
 - Help move a country closer to market economy
 - Take risk that supports private investors and does not crowd them out
 - Apply sound banking principles

EBRD 2002 Renewable Energy Project: Objectives & Background



- Objective of Stage 1: Strategic Assessment of the potential for Renewable Energy in EBRD countries to help identify projects for possible EBRD investment
- Stage 1 tasks:
 - Develop Renewable Energy Country Profiles
 - Develop and Apply Assessment Methodology
 - Identify Barriers and Institutional Support Mechanisms
- Desk Study – collect and assimilate available information
- Schedule: May to December 2002

Renewable Resources Investigated



- Wind
- Biomass (excluding Municipal Waste)
- Geothermal
- Small to Medium Hydro (<100MW)
- Solar



Renewable Energy Country Profiles



- Prepared for All 27 Countries
- Information for the Five Renewable Resources:
 - Current Status
 - Overall Resource Potential
 - Areas / Projects with High Technical Potential
 - Barriers and Incentives for Development
- Tremendous Amount of Data, Maps, and Information Resources (600+ pages)
- Available as Separate Country Reports

2002 Installed and In-Construction Capacity



Country	Wind, MW _e	Solar, MW _e	Geothermal, MW _{th}	Biomass, MW _{th}	Hydro, MW _e
Data Availability	Very Good	Poor	Good	Poor	Very Good
Albania	0.0	N/A	0.0	N/A	14.0
Armenia	32.7	0.10	1.0	N/A	367.0
Azerbaijan	0.3	N/A	0.0	N/A	42.0
Belarus	0.9	N/A	0.0	N/A	10.8
Bosnia/Herzegov	0.0	N/A	0.0	N/A	31.0
Bulgaria	0.0	N/A	107.2	977.0	63.0
Croatia	0.0	0.01	113.9	7.0	655.2
Czech Republic	23.0	0.01	13.0	775.0	283.0
Estonia	6.2	0.05	0.0	917.0	4.3
Georgia	0.0	N/A	245.0	N/A	710.0
Hungary	2.8	0.01	350.0	573.0	43.8
Kazakhstan	0.0	N/A	0.0	N/A	181.6
Kyrgyzstan	0.0	N/A	0.0	N/A	48.7
Latvia	22.8	N/A	0.0	70.0	64.5
Lithuania	0.0	N/A	21.0	285.0	118.0
FYR Macedonia	0.0	N/A	74.5	N/A	365.8
Moldova	0.0	N/A	0.0	N/A	64.0
Poland	73.0	N/A	68.5	6,425.2	790.0
Romania	1.0	0.06	137.0	4,036.0	2,598.0
Russia	5.0	0.2	503.0	N/A	2,249.8
Slovakia	0.0	N/A	132.2	88.0	684.0
Slovenia	0.0	0.05	42.0	364.0	520.0
Tajikistan	0.0	N/A	0.0	N/A	101.0
Turkmenistan	0.0	N/A	0.0	N/A	1.2
Ukraine	40.0	N/A	13.0	2775.0	114.7
Uzbekistan	0.0	N/A	0.0	N/A	563.0
FR Yugoslavia	0.0	N/A	86.0	N/A	923.0
	207.5	0.49	1,907	17,292.2	11,611.4

Results for the 10 Accession Countries Current Installations (2002) [MWe]

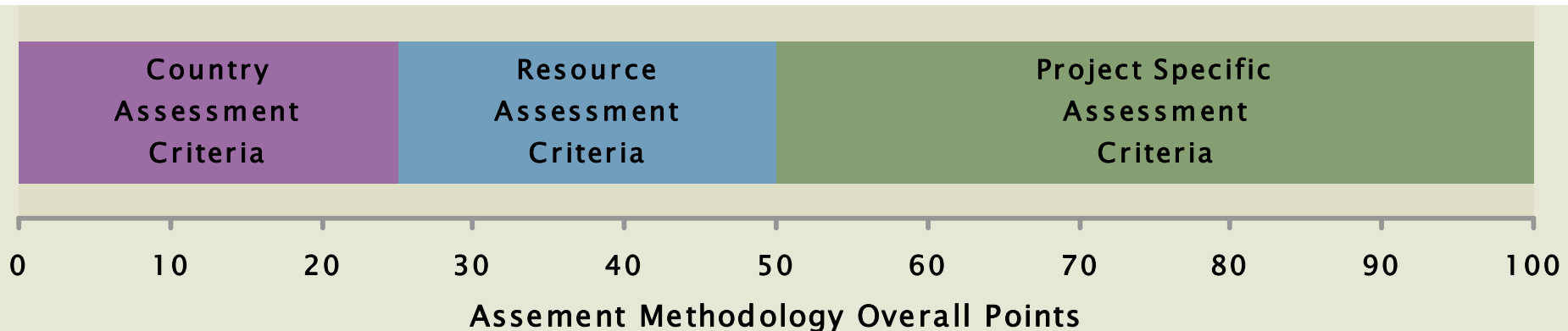


● Wind	130 MW
● Biomass	4,500 MW
● Small & Medium Hydro	5,200 MW
● Geothermal	<u>870 MW</u>
● Total	~10,700 MW
● Current Installed Capacity in Region	110,000 MW



Assessment Methodology

- Objective: Rank Countries, Resources, and Projects
- Three Parts:
 - Country Assessment for each of the 27 countries
 - Resource Assessment for each resource (wind, biomass, etc.) for each country
 - Project Assessment for each of the identified projects
- Weighted Criteria
- Mix-and-Match to Perform Numerous Analyses





Assessment Methodology Criteria

- **Country Assessment Criteria**

- Foreign direct investment per capita
- EBRD average transition indicator
- EBRD electric transition indicator
- Electricity tariff
- EU accession status
- Availability of financing
- Renewable barriers and incentives

- **Resource Assessment Criteria**

- Level of information availability
- Installed / under construction capacity
- Estimated technical potential
- Incentives
- Barriers

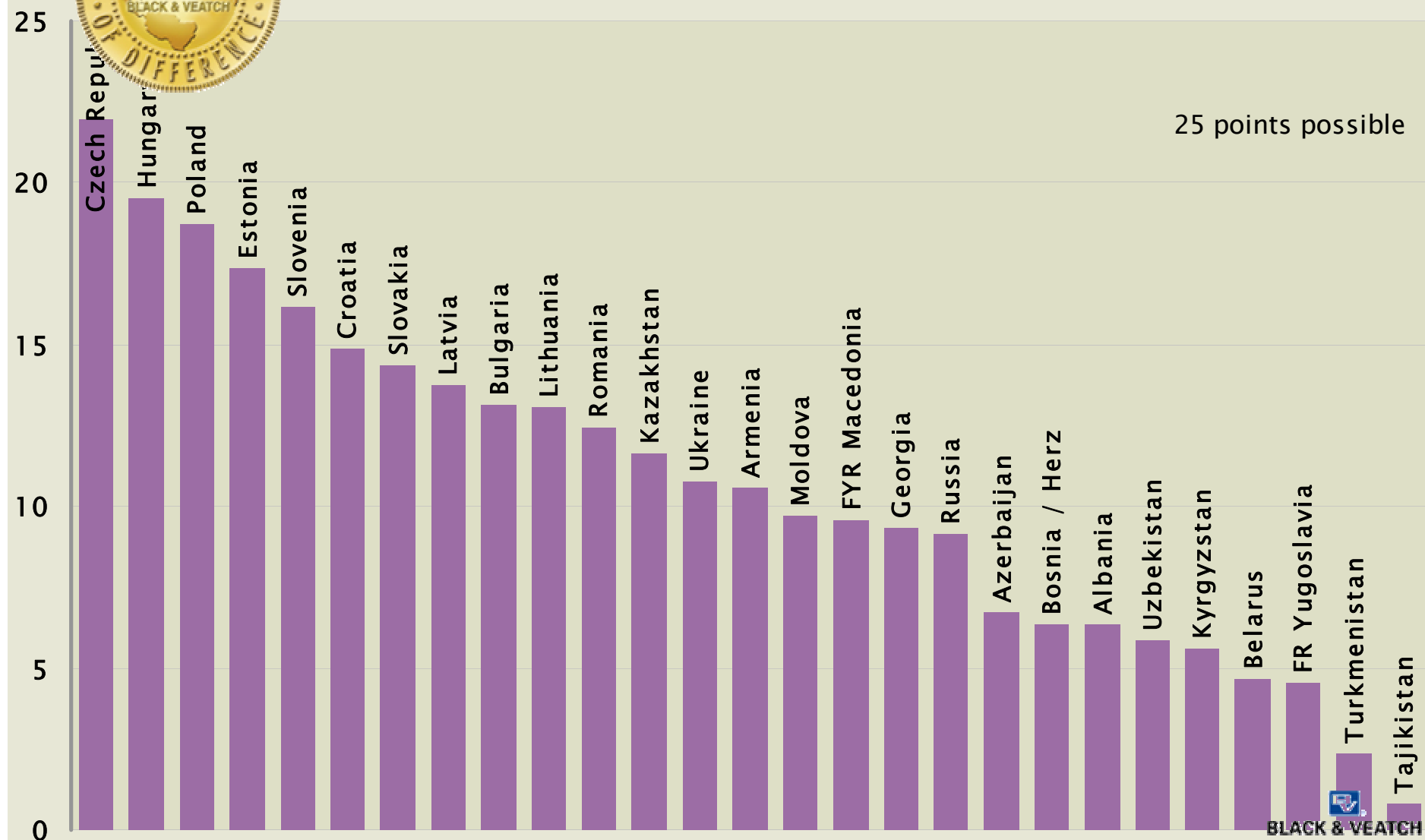
- **Project Assessment Criteria**

- Estimated capital cost of project
- Financial viability (profitability)
- Overall environmental impact
- Overall socioeconomic impact
- Use of commercial technology
- Access to sufficient transmission
- Project status
- Developer capability
- Foreign investment interest
- Timeliness
- Replicability

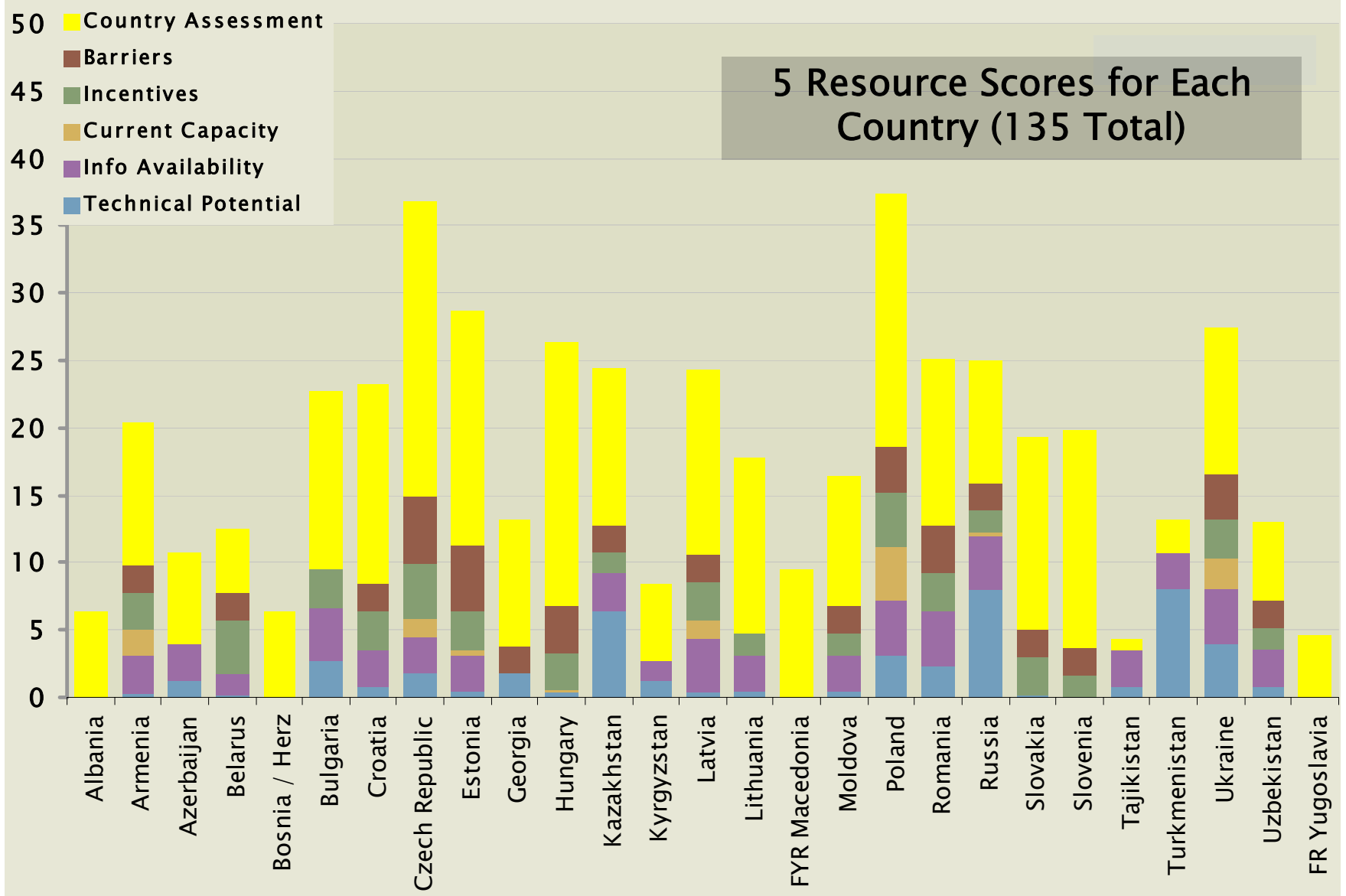
Criteria developed specifically for EBRD. Other organizations and companies have different priorities.



Country Assessments

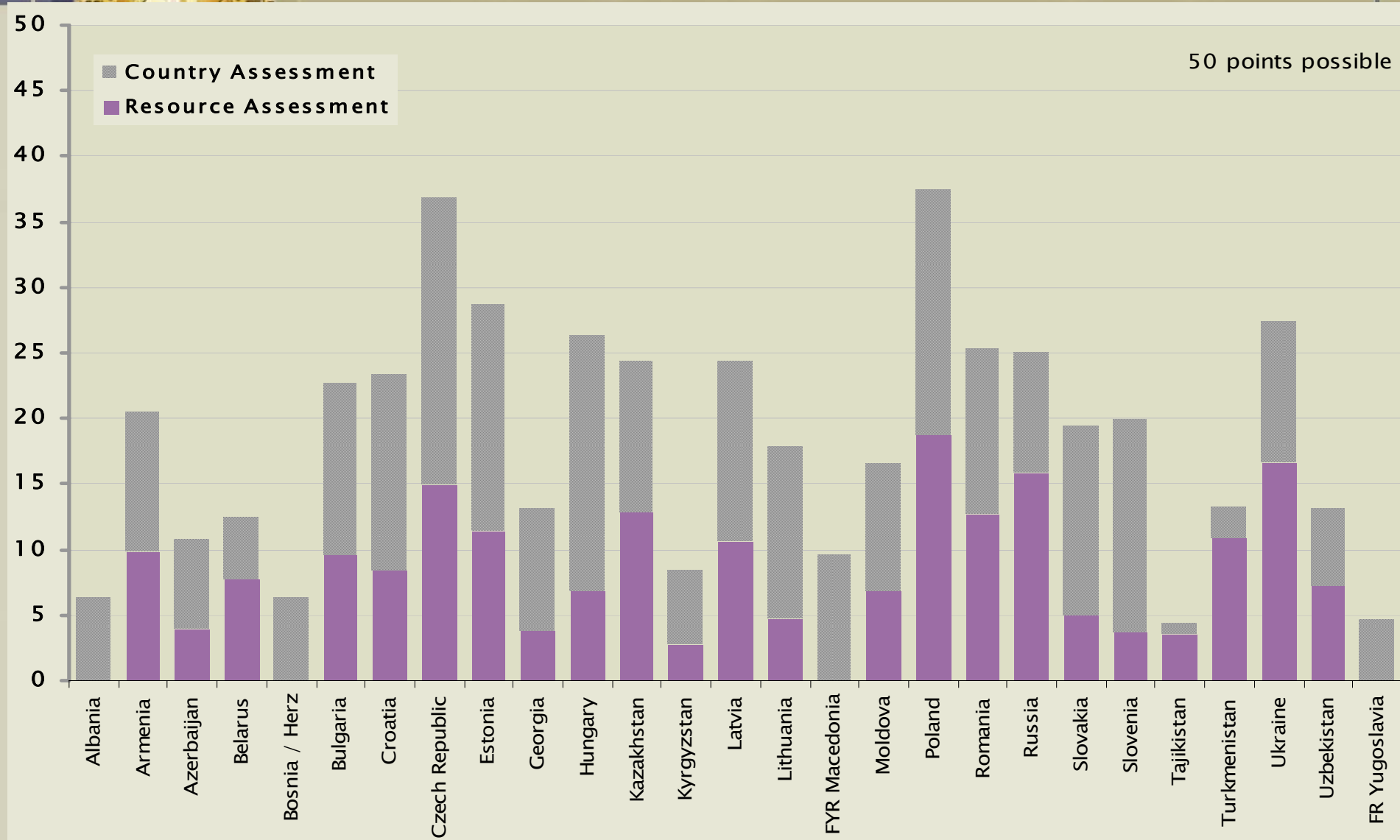


Example Resource Assessment (Wind)

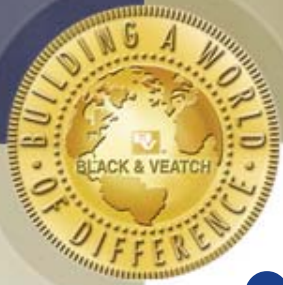




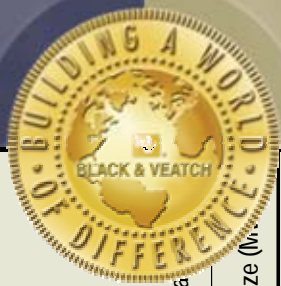
Country & Wind Resource Assessment



Applying the Project Assessment Methodology



- Project Opportunities Identified
 - 422 High Potential Areas
 - 162 Strategic Studies
 - 1,400+ Specific Projects
 - ▲ 138 Projects Excluding Hydro
 - ▲ These 138 Were Scored and Ranked



Project Lists

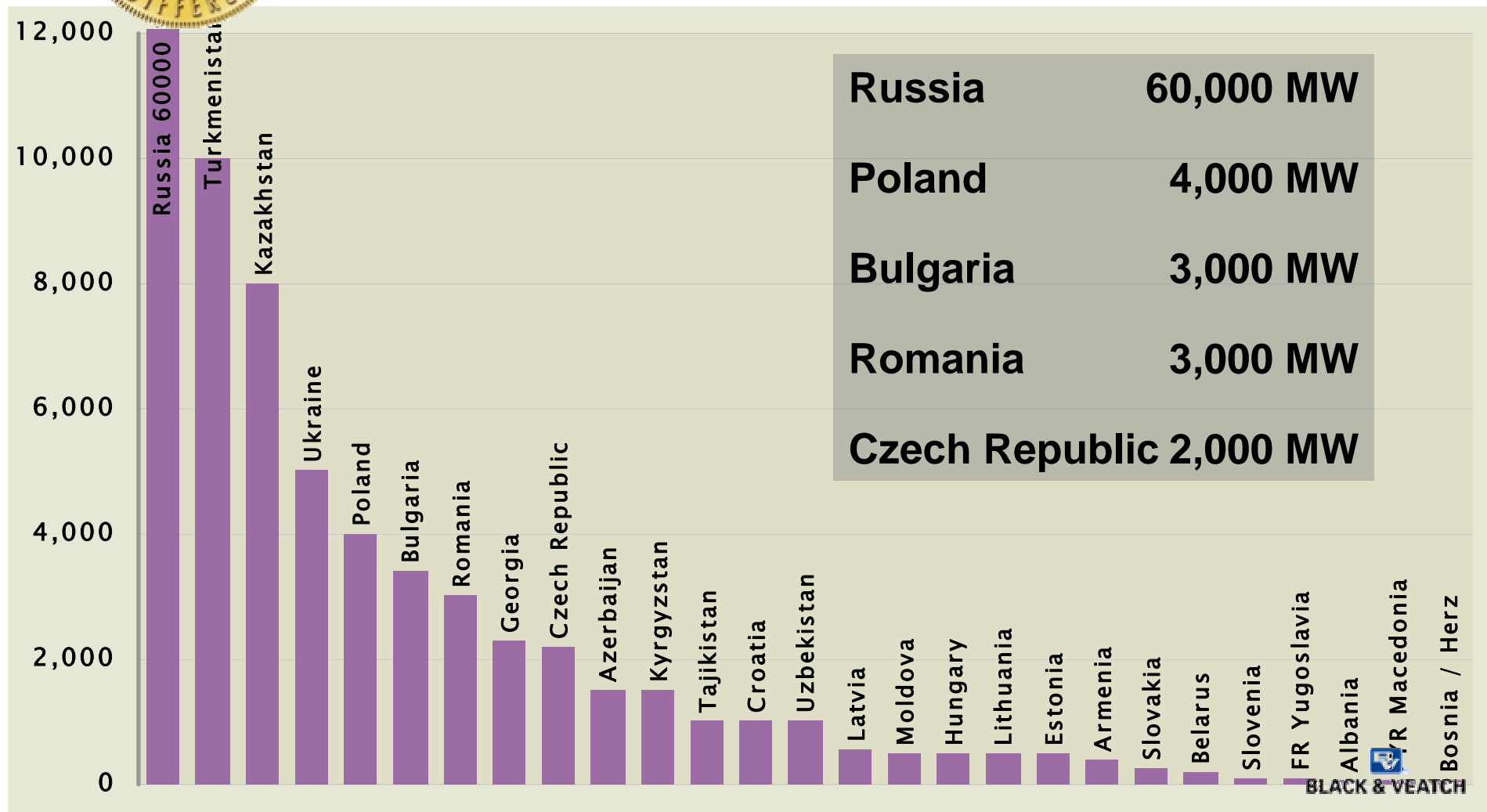
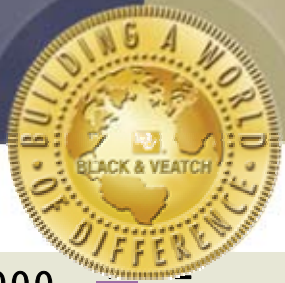
No.	Project Name	Info Availa	Project Size (Mw)	Country Assessment Subtotal		Resource Assessment Subtotal		Estimated capital cost of project			Financial viability (profitability)		Environmental impact		Socio-economic impact		Commercial technology		Sufficient transmission access		Project status		Developer capability		Foreign investment interest		Timeliness		Replicability		Project assessment subtotal		Assessment Total
				County	S (25)	Resource	S (25)	Mill \$	S (10)	W (6)	S (10)	W (10)	S (10)	W (3)	S (10)	W (3)	S (10)	W (5)	S (10)	W (4)	S (10)	W (5)	S (10)	W (2)	S (10)	W (5)	S (10)	W (2)	S (10)	W (5)	S (50)	W (100)	
1	Kaminsk Gora WindPark	Very Good	32	Poland	18.7	Wind	18.7	40.0	7.8	4.7	7	7.0	10	3.0	4	1.2	10	5.0	10	4.0	4	2.0	10	2.0	10	5.0	0	0.0	6	3.0	36.9	74.3	
2	Suwalki Wind Park	Very Good	60	Poland	18.7	Wind	18.7	78.0	10.0	6.0	7	7.0	7	2.1	4	1.2	10	5.0	4	1.6	7	3.5	8	1.6	4	2.0	0	0.0	6	3.0	33.0	70.4	
3	Rapeseed Bio-Refinery	Very Good	NA	Poland	18.7	Bio	18.8	11.5	1.4	0.9	7	7.0	7	2.1	4	1.2	7	3.5	10	4.0	7	3.5	8	1.6	10	5.0	0	0.0	6	3.0	31.8	69.3	
4	Jelenia Gora & Kamienna Gora Wind	Very Good	80	Poland	18.7	Wind	18.7	65.0	10.0	6.0	7	7.0	7	2.1	4	1.2	10	5.0	4	1.6	4	2.0	0	0.0	0	0.0	0	0.0	6	3.0	27.9	65.3	
5	Leborc Straw-Fired CHP	Very Good	12	Poland	18.7	Bio	18.8	10.0	1.1	0.7	4	4.0	7	2.1	4	1.2	7	3.5	10	4.0	4	2.0	10	2.0	10	5.0	0	0.0	6	3.0	27.5	65.0	
6	Slupsk Shoal Offshore Wind	Very Good	250	Poland	18.7	Wind	18.7	400.0	10.0	6.0	4	4.0	7	2.1	4	1.2	7	3.5	4	1.6	4	2.0	10	2.0	4	2.0	0	0.0	6	3.0	27.4	64.8	
7	Phase 2 Mutnovsky Geothermal	Very Good	50	Russia	9.2	Geo	19.6	146.0	10.0	6.0	4	4.0	7	2.1	4	1.2	10	5.0	10	4.0	10	5.0	10	2.0	7	3.5	4	0.8	2	1.0	34.6	63.4	
8	Nuon Wind	Poor	60	Poland	18.7	Wind	18.7	60.0	10.0	6.0	7	7.0	7	2.1	4	1.2	10	5.0	0	0.0	0	0.0	8	1.6	4	2.0	0	0.0	2	1.0	25.9	63.3	
9	Chukotka Russia Wind-Diesel Hybrid	Very Good	17.2	Russia	9.2	Wind	15.9	40.0	7.8	4.7	7	7.0	10	3.0	10	3.0	7	3.5	10	4.0	7	3.5	4	0.8	4	2.0	8	1.6	6	3.0	36.1	61.1	

Results for the 10 Accession Countries New Technical Potential (2020) [MWe]



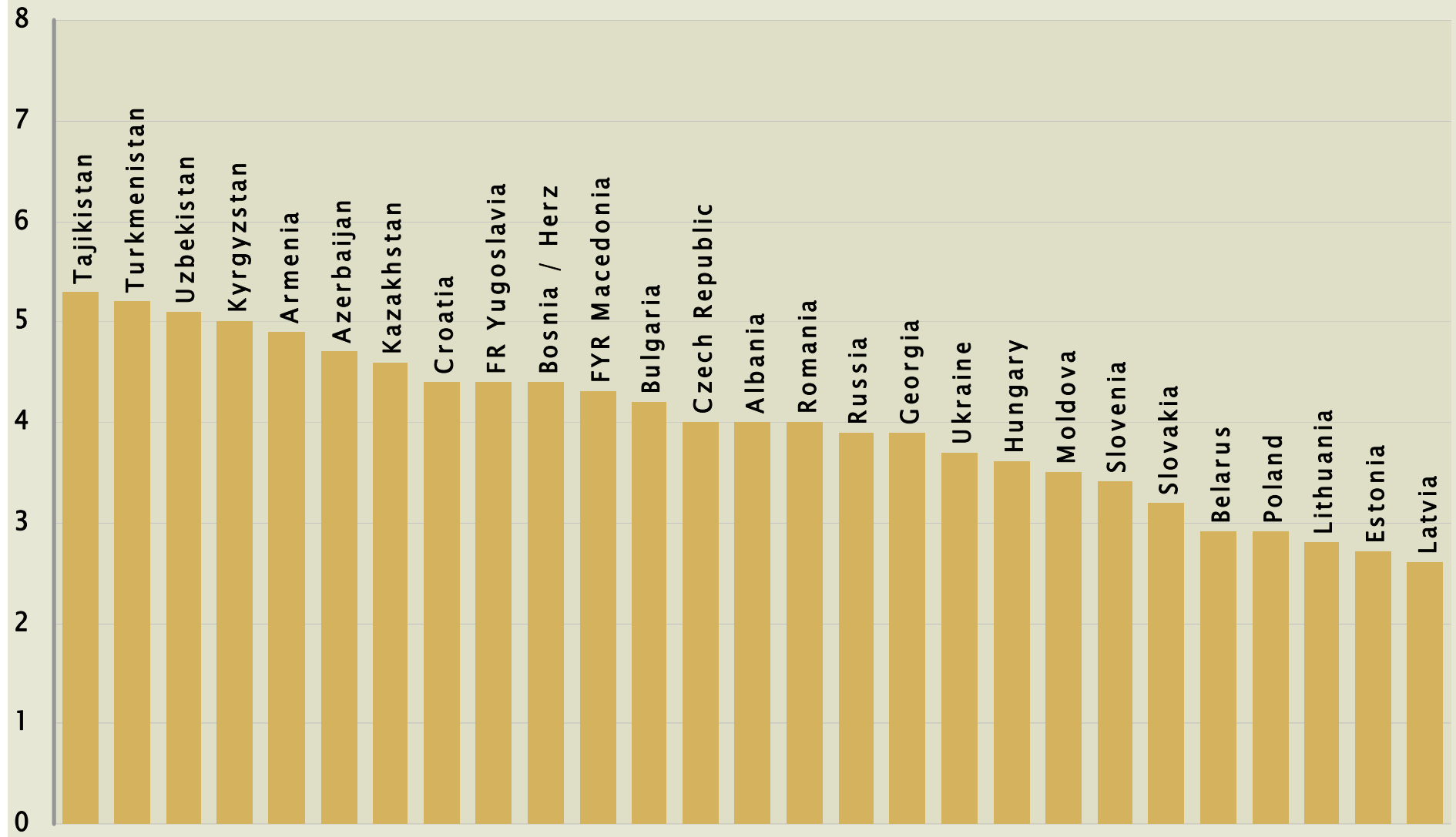
● Wind	15,000 MW
● Biomass	12,500 MW
● Small & Medium Hydro	7,000 MW
● Geothermal	<u>225 MW</u>
● Total	~35,000 MW
● Current Installed Capacity in Region	110,000 MW

Wind Technical Potential (MWe) by 2020

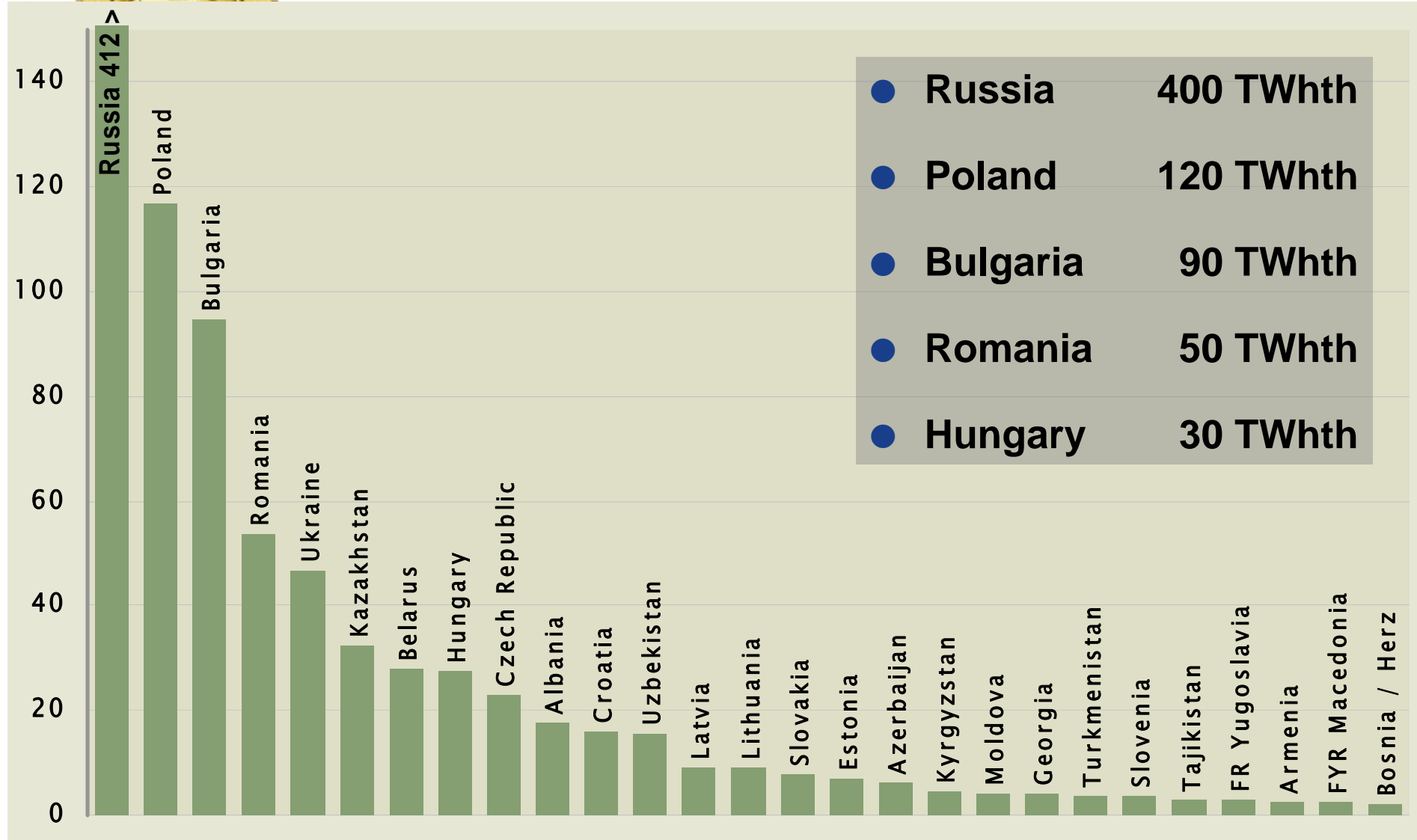


Russia	60,000 MW
Poland	4,000 MW
Bulgaria	3,000 MW
Romania	3,000 MW
Czech Republic	2,000 MW

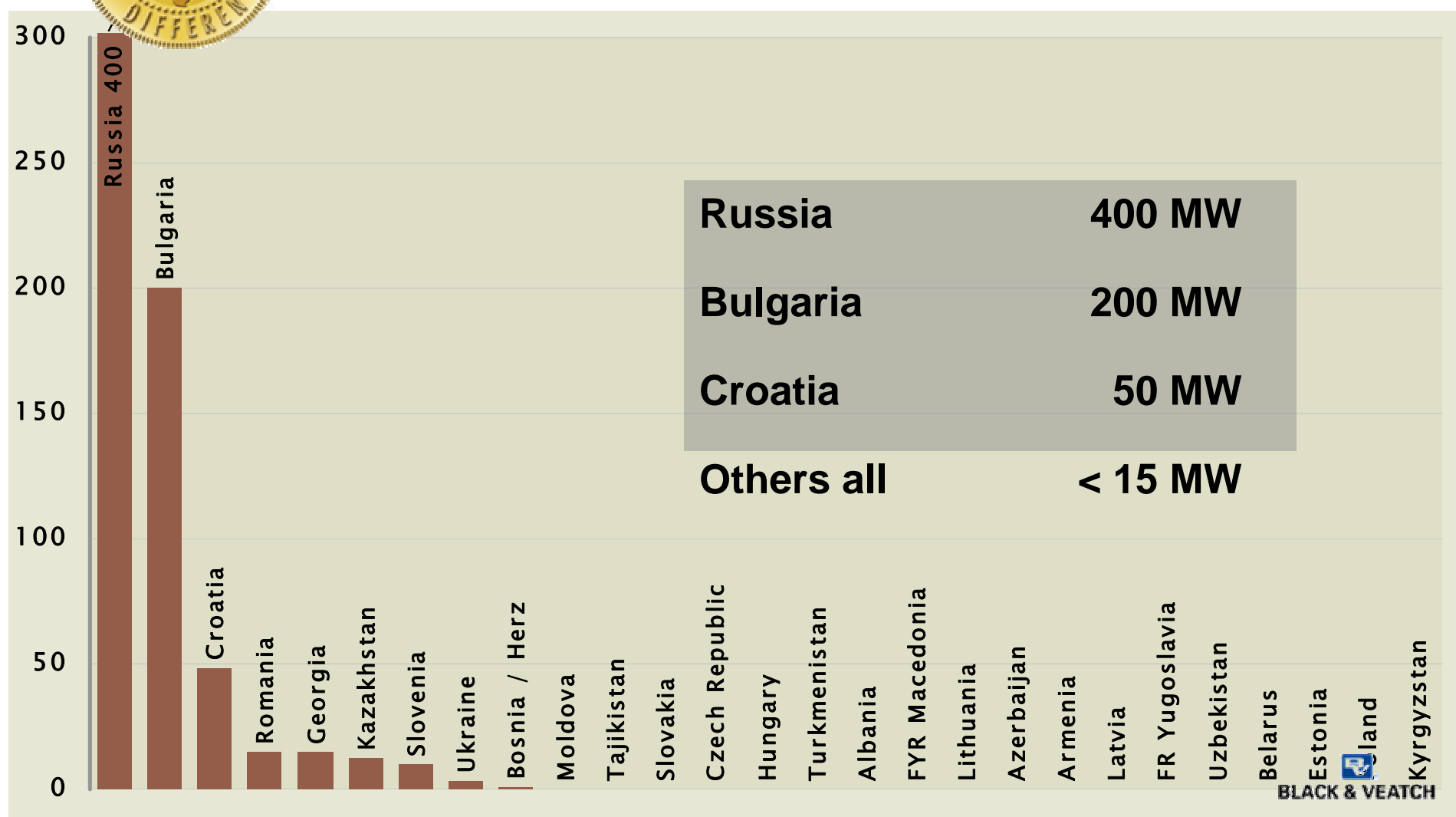
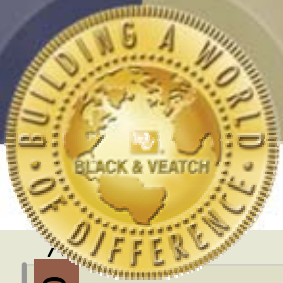
Annual Average Global Horizontal Solar Insolation (kWh/m²/day)



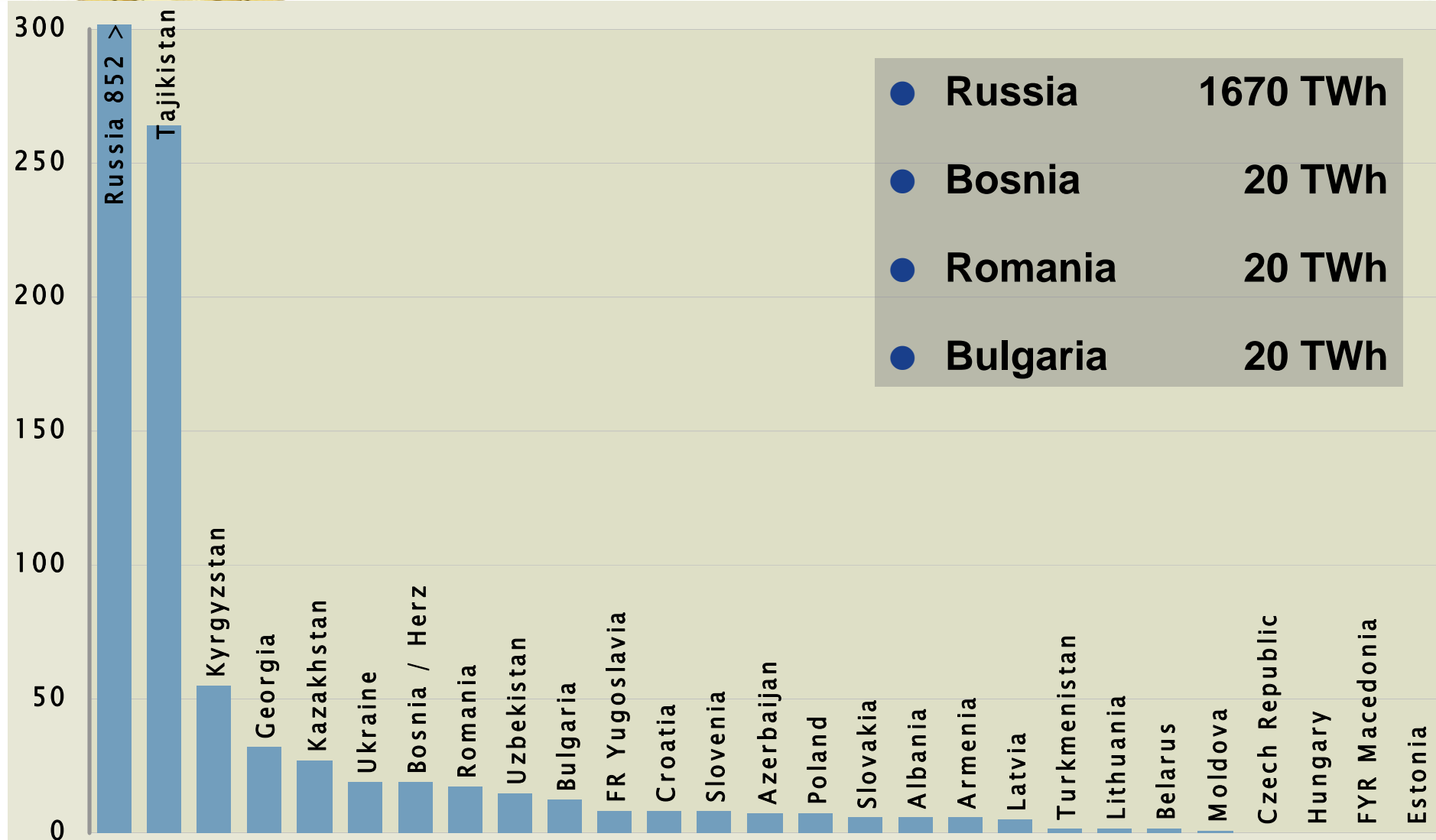
Biomass Technical Potential (TWh[th]) by 2020



Geothermal Technical Potential (MWe) by 2020



Hydro Technical Potential (TWhe) by 2020



Regulatory Environment Key to Project Success



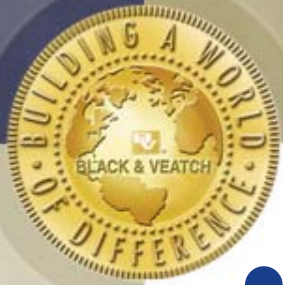
- Renewable Energy Regulations on Many Levels
 - International Agreements
 - National Policies
 - Local Policies
- Various Types of Market Assists for Renewables:
 - Feed-In Tariffs
 - Renewable Portfolio Mandates
 - Public Benefits Fund
 - Tax Credits, Net Metering, Green Pricing, Disclosure, Carbon Trading, etc.

Common Barriers For All Renewable Energy Sources in the EBRD Countries



- Lack of knowledge among decision makers and general public
- High up-front capital cost
- Smaller projects, higher relative development cost
- Low power and electricity tariffs
- Poor collections rate for current tariffs
- Externalities are not accounted for
- Lack of reliable, quality resource data for project developers

Common Barriers For All Renewable Energy Sources in the EBRD Countries



- Lack of local “success stories” / demonstration projects
- Absent, inconsistent, and changing government policies
- Lack of local equipment and O&M suppliers
- Abundant fossil fuel reserves
- Subsidized fossil fuel prices
- Overcapacity in the electric system

Common Barriers For All Renewable Energy Sources in the EBRD Countries



- “Larger units are better” syndrome
- Weak renewable industry lobby
- Lack of long-term finance needed for renewables
- Lack of creditworthiness, collateral, equity among interested project promoters
- Insufficient private sector participation in the energy sector
- Perceived risk of new technologies
- Risk of common EU green credit trading market



Key Recommendations

Sectoral Support

- Sectoral Support
 - Disseminate Project Results to Decision Makers
 - Continue and Enhance Project Website
 - Establish Renewable Energy Manager at EBRD
 - Assist with Targeted Barrier Removal
 - Support Additional Resource Assessment and Strategic Studies

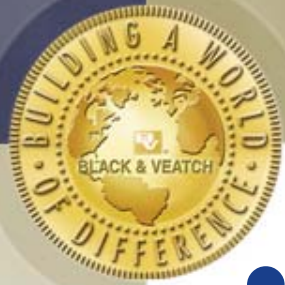
Key Recommendations

Project Support



Project Support

- Assist Development of Specific Promising Projects in High Potential Markets
- Consider Off-grid Electrification Projects
- Investigate Prospects for Hydro Rehabilitation (Safety + Power)
- Advocate Renewable Energy Integration in Industries (forest products, waste water treatment, district heating, etc.)



Next Steps

- Stage 2 of the EBRD Project
 - Identification of Leading Projects from Stage 1
 - Feasibility Studies of Projects
 - Financing of Top Projects
 - Implementation of Projects
 - Funding
- Maintain Project Website as Renewable Energy Portal to the Region


See Project Website For Latest Updates <http://projects.bv.com/ebrd>



Strategic Renewable Energy Assessment
Central & Eastern Europe
Former Soviet Union

Project Overview
News / Announcements
Project Publications
Renewable Energy Country Profiles
Sponsors & Developers
Partners
Project Contacts

Strategic Assessment of the Potential for Renewable Energy in the EBRD Countries of Operation, Stage 1



Sponsored by European Bank for Reconstruction and Development
Performed by Black & Veatch

Funded by US Trade and Development Agency Evergreen Fund
and UK EBRD Technical Co-operation Fund

Project sponsored by
European Bank for
Reconstruction and
Development