Energy Economics Group

TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

RES in SEERMAP … some key inputs to the analysis

Authors: Gustav Resch, Lukas Liebmann, Albert Hiesl – all *Energy Economics Group, TU Wien*

Contact … Web: http://eeg.tuwien.ac.at
Email: resch@eeg.tuwien.ac.at

… developed initially in the period 2002 to 2004 within the research project

Green-X (5th framework programme of the European Commission, DG RESEARCH)

www.green-x.at

Content

1. **Background: 27% RES by 2030 at EU level**

   … thesis on the way forward

2. **Key assumptions in our modelling exercise on SEE countries**

   … potentials of renewables

   … financing conditions

Background: ***27% RES by 2030 at EU level***

- The EU Energy Roadmap 2050 gave first signals of renewable energy development pathways beyond the year 2020 and identified renewables as a “no-regrets” option.
- Subsequently, Europe’s way forward towards 2030 has been discussed intensively and at the Council meeting of this October (2014) the next step was taken: A binding EU-wide RES target of achieving at least 27% as RES share in gross final energy demand was adopted.

→ This part of the presentations aims for an outlook to 2030, discussing possible RES developments within the EU in the light of the new Council agreement on **27% RES by 2030**.

→ Furthermore, next steps in defining the framework for RES post 2020 will be identified and possible solutions presented.

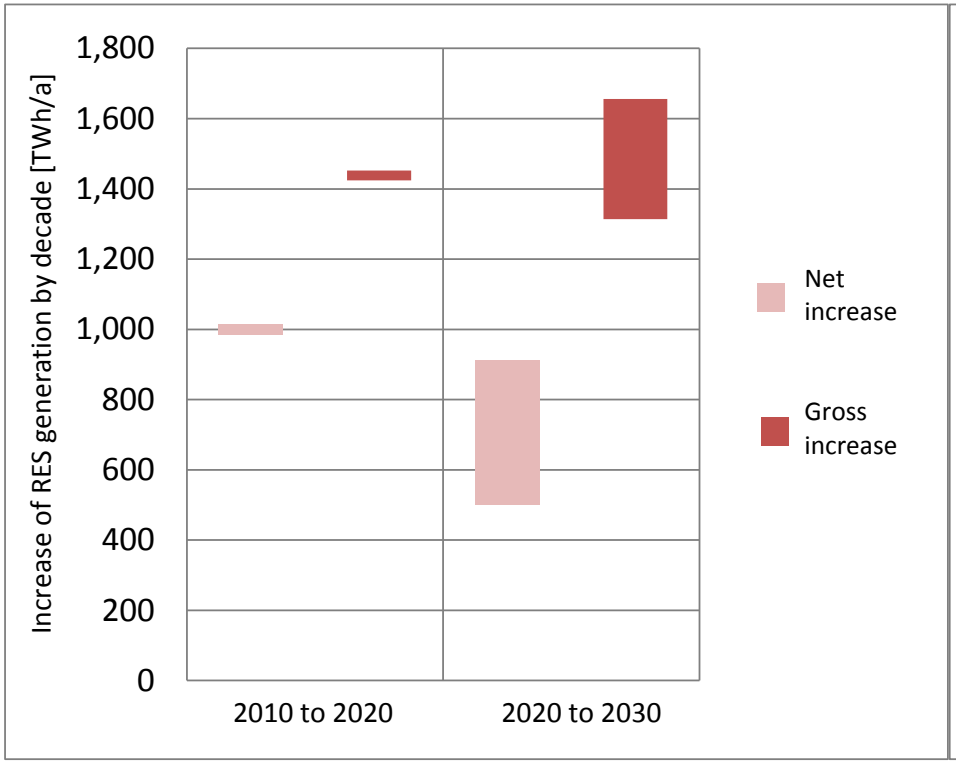
→ **Few theses** will be introduced, aiming for identifying **required next steps to be taken…**

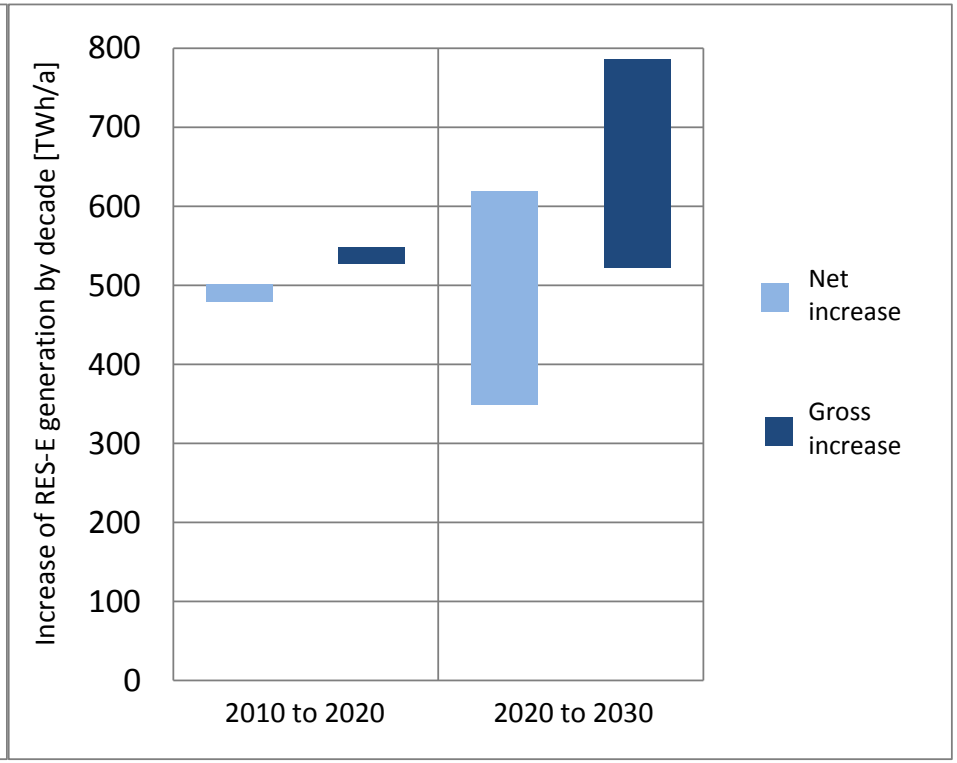
Co-funded by the Intelligent Energy Europe Programme of the European Union

… *Efforts required for meeting 27% RES by 2030*

- RES developments at EU-level up to 2030: **Net and gross increase of RES generation** at EU level **by decade (2010-2020 vs. 2020-2030)** in accordance with 27% RES by 2030 …

  … across **all energy sectors (left)** and in the **electricity sector (right)**





→ The ambition level of 27% renewables by 2030 should not be underestimated, specifically in the power sector

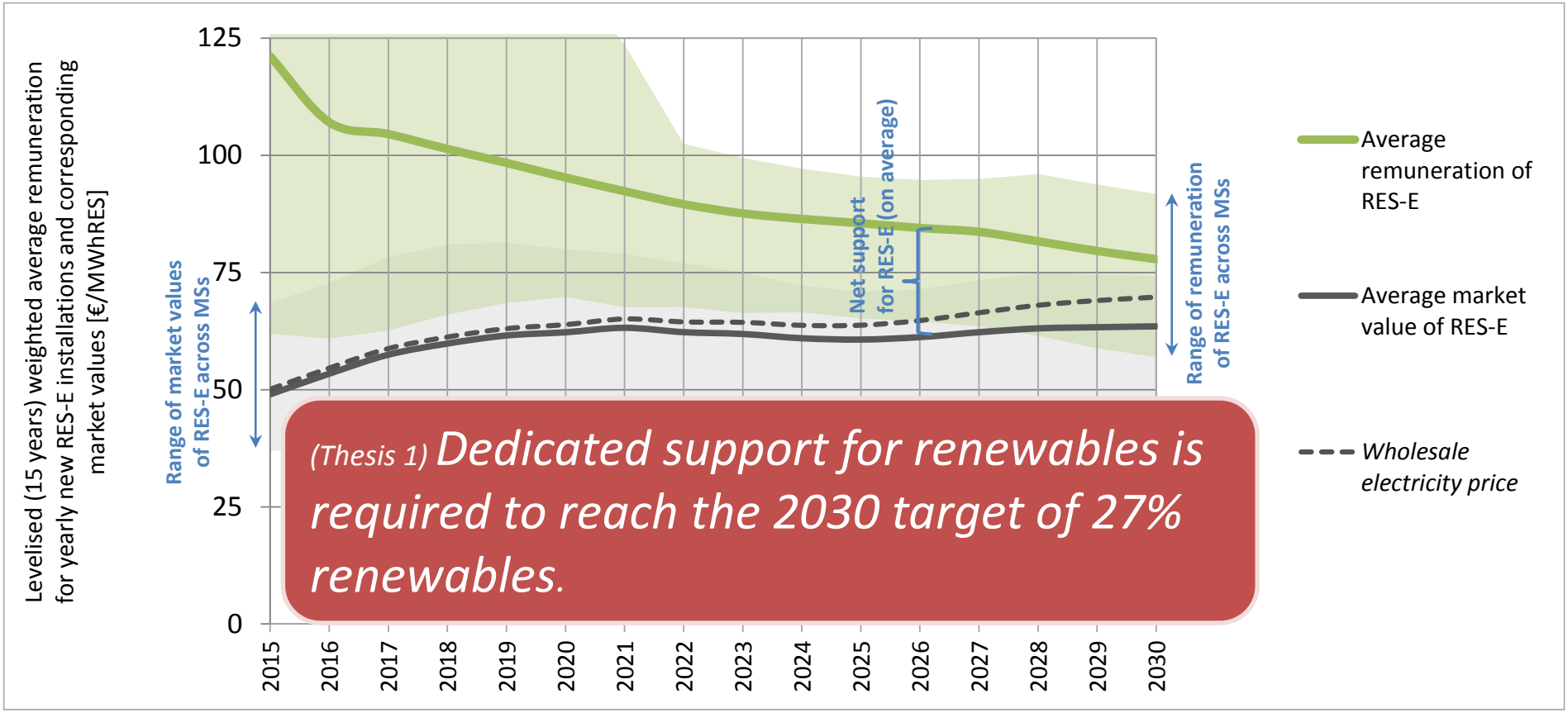
→ Energy efficiency (and related demand developments) is a key determinant

towards2030

Co-funded by the Intelligent Energy Europe Programme of the European Union

… *Efforts required for meeting 27% RES by 2030*

- Future development of remuneration levels and corresponding market values of renewable energy technologies (on average) at EU level according to a Green-X scenario of meeting 27% renewables by 2030 → helps to **identify the required net support** (i.e. remuneration minus market revenues)



towards2030

Co-funded by the Intelligent Energy Europe Programme of the European Union

Sharing the effort: How to break down the EU-wide target?

… top-down vs. bottom-up approaches …

- It is currently not clear how individual EU member states can or should contribute to the EU-wide 2030 target for renewables.
- In principle, the EU-wide target can be allocated to smaller regional entities either via a **top-down** or **bottom-up** approach:
  - In the **top-down** case, the European Commission would follow a predetermined allocation formula and set individual national targets accordingly.
  - In the **bottom-up** case, EU member states would pledge their planned contribution.

Pros & cons:

Whilst in the case of a **top-down** allocation individual targets typically sum up to the overall target of 27% …

- individual (**bottom-up**) pledges may fall short of the overall EU-target.
  → this would require to close the gap accrued:
  - either **by a separate financing mechanism** or
  - **by an iteration of pledges until the gap is closed**.

Co-funded by the Intelligent Energy Europe Programme of the European Union

Sharing the effort: How to break down the EU-wide target?

Benchmarks as a way forward

- To better guide the pledging procedure, **the European Commission should provide a first benchmark** on regional or national targets.
- **EU member states or regions could then put pledges forward** specifying a higher or a lower target than proposed in the benchmark.
- Major benefits of combining national or regional pledges with an initial top-down benchmark include **a first quantitative indication for a potential national or regional target** than can help structuring the pledging process.
- In addition, **extremely low pledges may be avoided** by publicly comparing the pledged target with the benchmarking.

→ *For these reasons, we encourage* ***combining national or regional pledges with a top-down benchmark****.*

towards2030

Co-funded by the Intelligent Energy Europe Programme of the European Union

Sharing the effort: How to break down the EU-wide target?

27% renewables by 2030

as a binding EU-target: *implications*

"Doing nothing" as a way forward?

- If EU member states are reluctant in providing sufficient pledges …
- … the European Commission has to act: **establishing a separate financing mechanism to ensure target achievement**.

Co-funded by the Intelligent Energy Europe Programme of the European Union

Financing is a (the) decisive element

Example: Improving financing conditions for onshore wind across the EU

*"Calculations based on the Green X model show that **if all countries had the same renewable energy policy risk profile** as the best in class, the EU Member States could **reduce the policy costs for wind onshore by more than 15%**."*

Impacts of improvements in risk performance (WACC) at EU level (EU28)	Scenario:	Business-As-Usual (BAU)				Strengthened National Policies (SNP)			
		WACC real	WACC ideal			WACC real	WACC ideal		
	EU28 (average)	8.3%	5.9%			8.3%	5.9%		
				Change to WACC real				Change to WACC real	
	[Unit]				%*				%*
Impact on wind onshore									
Electricity generation from wind onshore									
2020	TWh	319.0	324.9	5.9	1.9%	353.7	362.6	8.9	2.5%
2030	TWh	560.1	576.6	16.5	2.9%	674.5	680.7	6.2	0.9%
Support expenditures for wind onshore, yearly average									
2016 to 2020	billion €	8.8	8.6	-0.2	-2.1%	8.7	8.4	-0.4	-4.2%
2016 to 2030	billion €	7.8	7.5	-0.2	-3.1%	8.4	7.1	-1.3	-15.6%

Note: * ... deviation to default (WACC real), expressed in percentage terms (compared to default)

Source: Green-X modelling, DIA-CORE project

Co-funded by the Intelligent Energy Europe Programme of the European Union

Financing is a (the) decisive element

- **Governments can play an important role in mitigating risks**, for instance by implementing **long-term stable policy schemes that are less liable to regulatory interventions**.

*(Thesis 3) Improving financing conditions: the next step could be to equalise cost of capital in EU member states through a **risk sharing facility**.*

Source: DIA-CORE project

Co-funded by the Intelligent Energy Europe Programme of the European Union

Conclusions / Policy recommendations

(Thesis 1) *Moderate dedicated support for renewables is required to reach the 2030 target of 27% renewables.*

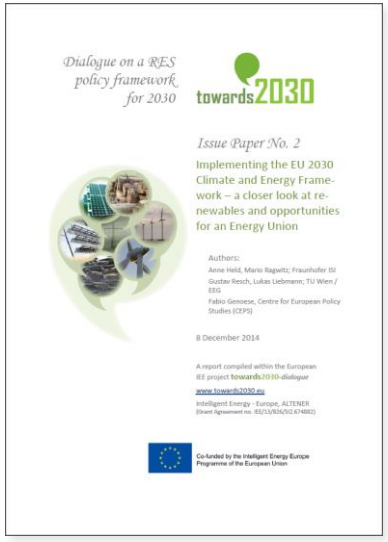
(Thesis 2) *Benchmarks of how to break down the EU-wide target to member states should be provided in order to encourage sufficiently ambitious pledges.*

(Thesis 3) *Improving financing conditions: the next step could be to equalise cost of capital in EU member states through a **risk sharing facility**.*

(Thesis 4) *The concept of an Energy Union can be developed further by supporting regional targets for renewables and grid infrastructure.*

Interested in further background information?

Thanks for your attention!



→ **www.towards2030.eu**

Issue Paper No. 2:* Implementing the EU 2030 Climate and Energy Framework – a closer look at renewables and opportunities for an Energy Union

Issue Paper No. 4 on **benchmarks** to facilitate sharing the renewables effort

Interested in the dialogue process?

→ **http://platform.towards2030.eu**

Co-funded by the Intelligent Energy Europe Programme of the European Union

▸ Key assumptions

To ensure maximum consistency with existing EU scenarios and projections the key input parameters of the Green-X scenarios are (as default) based on **PRIMES modelling** and the (updates of the) **Green-X database**.

*Based on PRIMES**	*Defined for this study*
Energy demand by sector	RES policy framework
Primary energy prices	Reference electricity prices
Conventional supply portfolio and conversion efficiencies	RES cost & learning rates (Green-X database, incl. biomass)
CO_2 intensity of sectors	RES potential (Green-X database)
	Biomass trade specification
	Technology diffusion
	Financing conditions

Main input sources for scenario parameters

**Primes scenario used subsequently: Reference case (as of 2015/2016)*

▸ *Key assumptions*

To ensure maximum consistency with existing EU scenarios and projections the key input parameters of the Green-X scenarios are (as default) based on **PRIMES modelling** and the (updates of the) **Green-X database**.

*Based on PRIMES**	*Defined for this study*
Energy demand by sector	RES policy framework
Primary energy prices	Reference electricity prices
Conventional supply portfolio and conversion efficiencies	RES cost & learning rates (Green-X database, incl. biomass)
CO_2 intensity of sectors	**RES potential** (Green-X database)
	Biomass trade specification
	Technology diffusion
	Financing conditions

Main input sources for scenario parameters

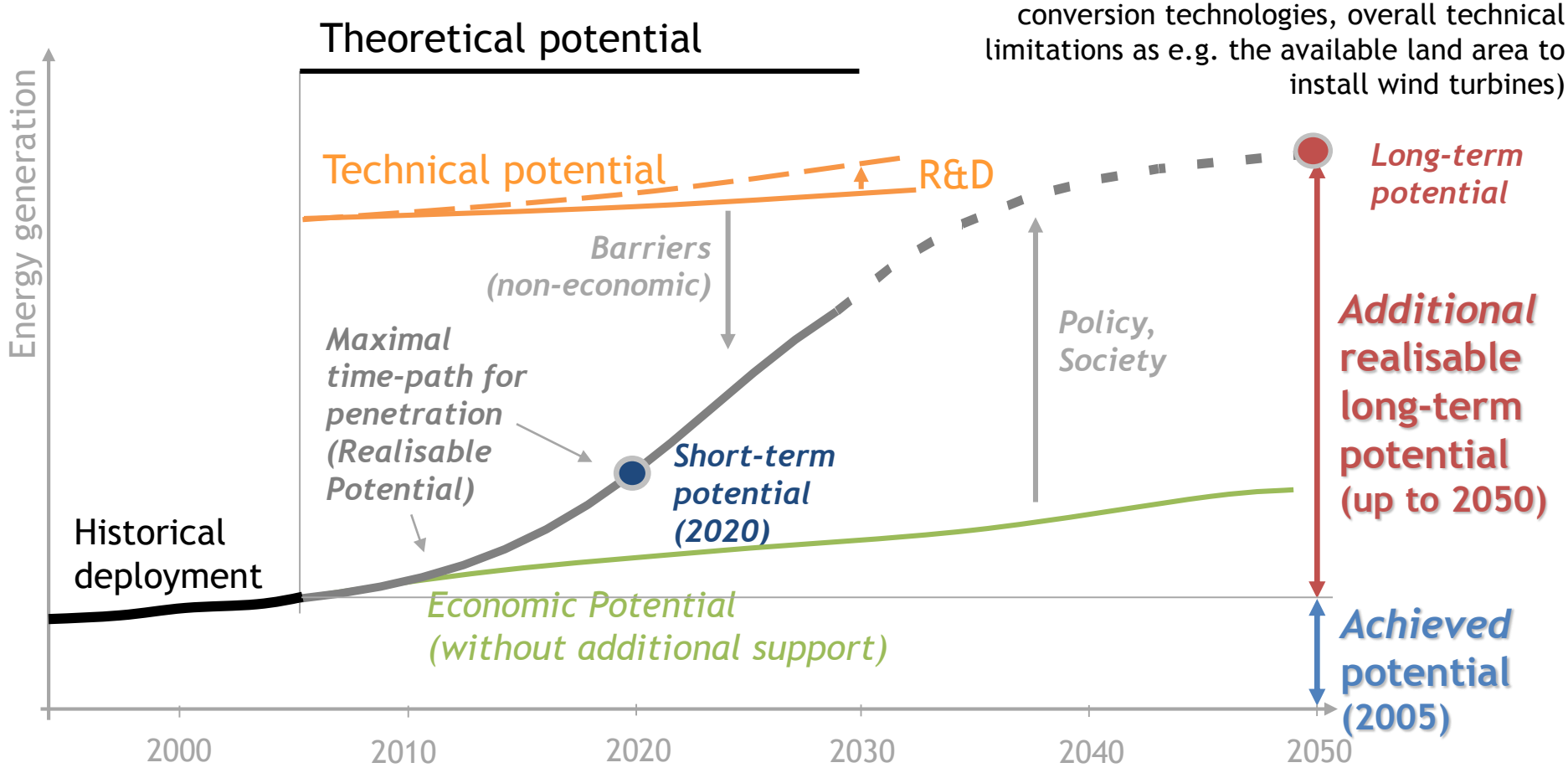
**Primes scenario used subsequently: Reference case (as of 2015/2016)*

Definition of the (additional) realisable mid-term potential (up to 2020/2030/2050)

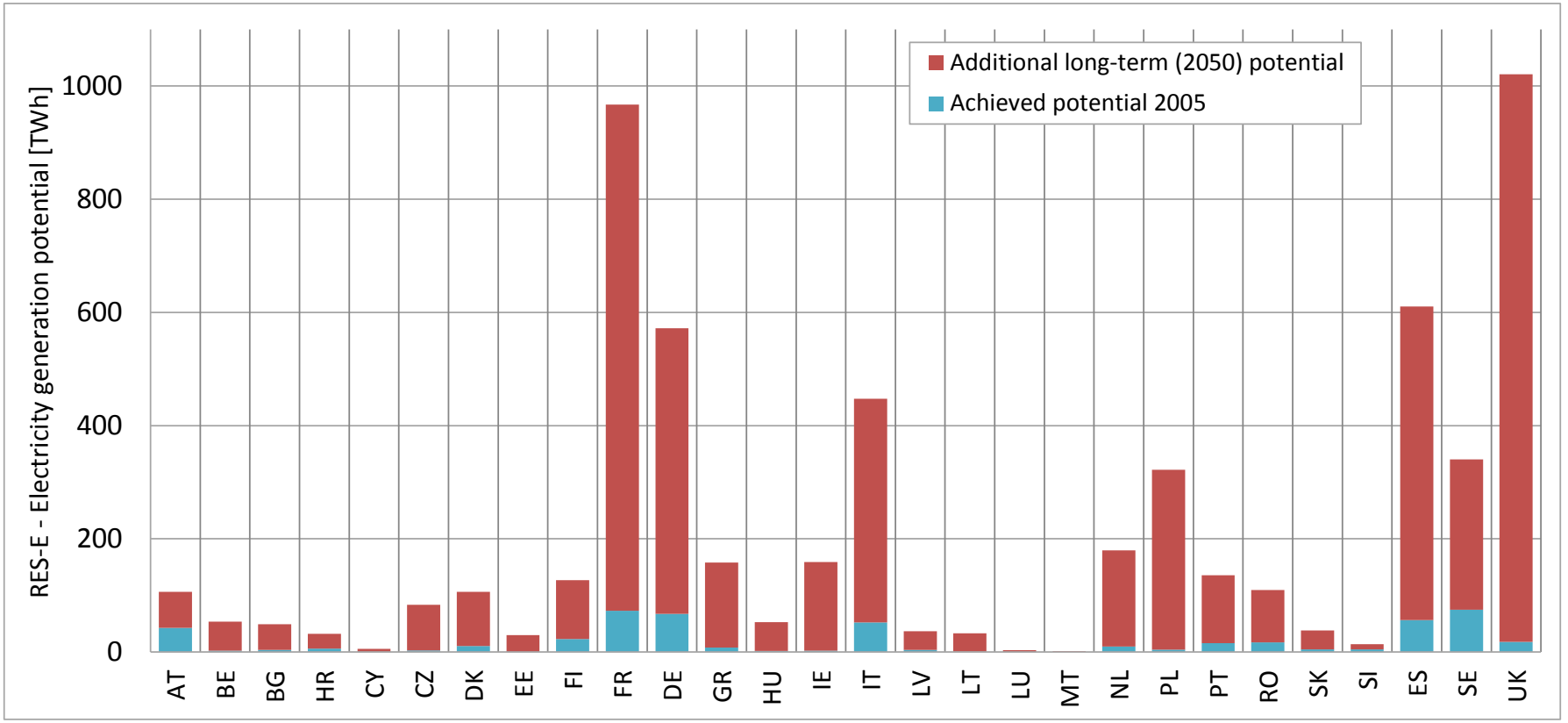
Definition of potential terms

Theoretical potential ... based on the determination of the energy flow.

Technical potential ... based on technical boundary conditions (i.e. efficiencies of conversion technologies, overall technical limitations as e.g. the available land area to install wind turbines)

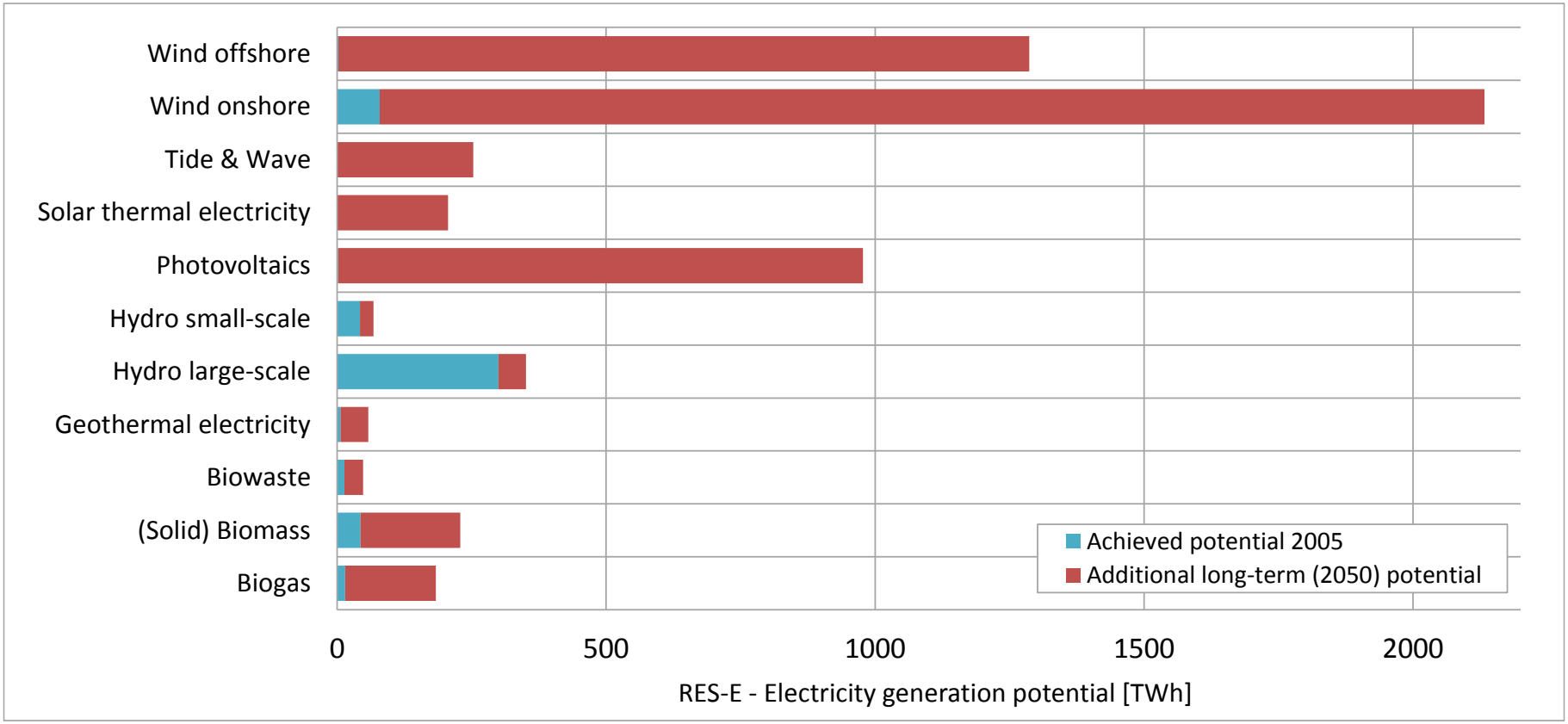


Green-X database on RES potentials



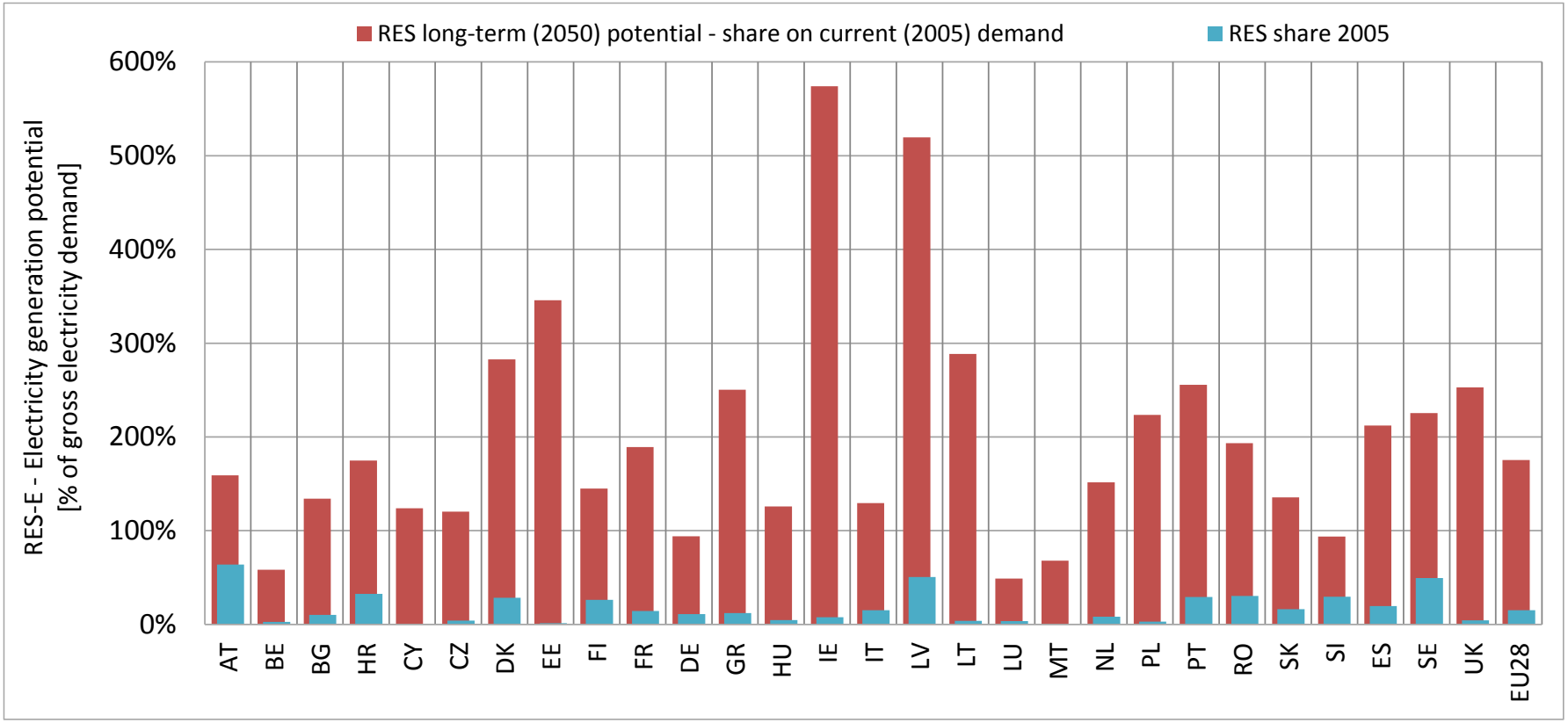
Long-term (2050) potentials for RES-electricity in EU28 countries
(in absolute terms [TWh])

Green-X database on RES potentials



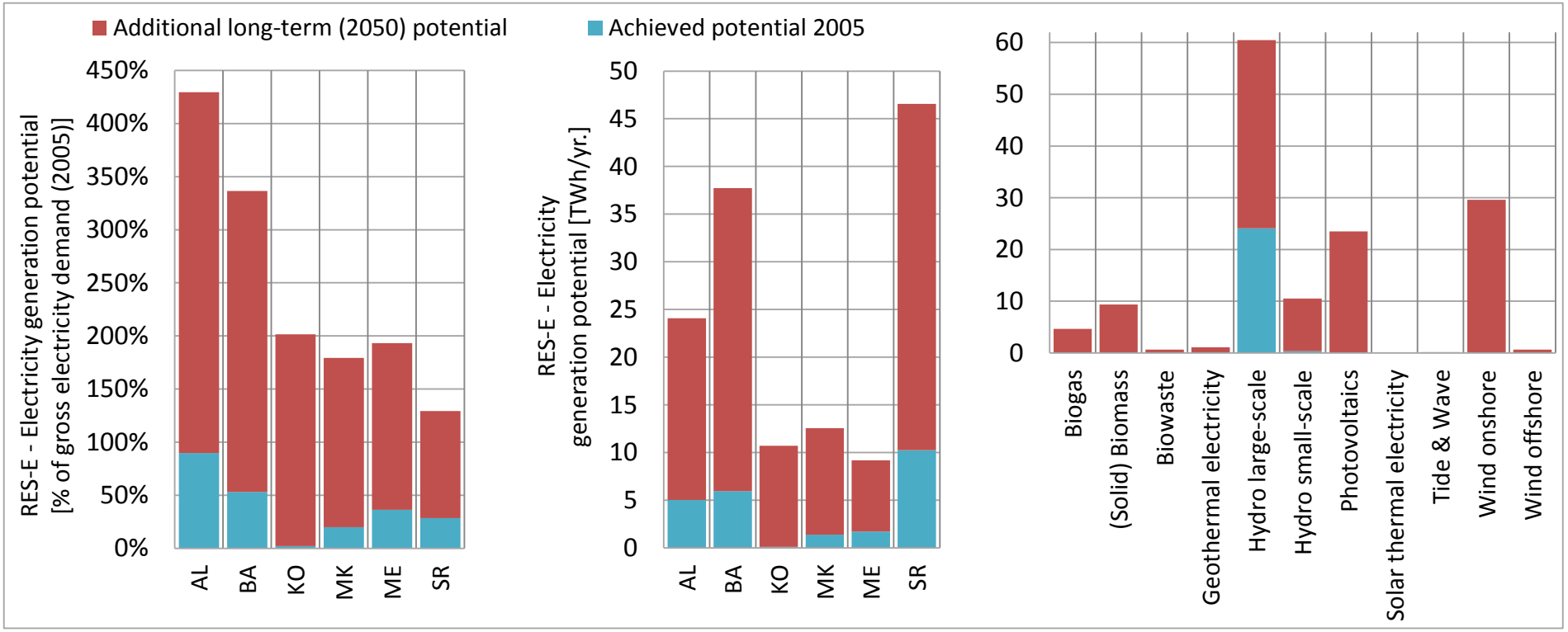
Long-term (2050) potentials for RES-electricity in EU28 countries
(in absolute terms [TWh] by technology)

Green-X database on RES potentials



Long-term (2050) potentials for RES-electricity in EU28 countries
(in relative terms [% - share of gross electricity demand])

Green-X database on RES potentials



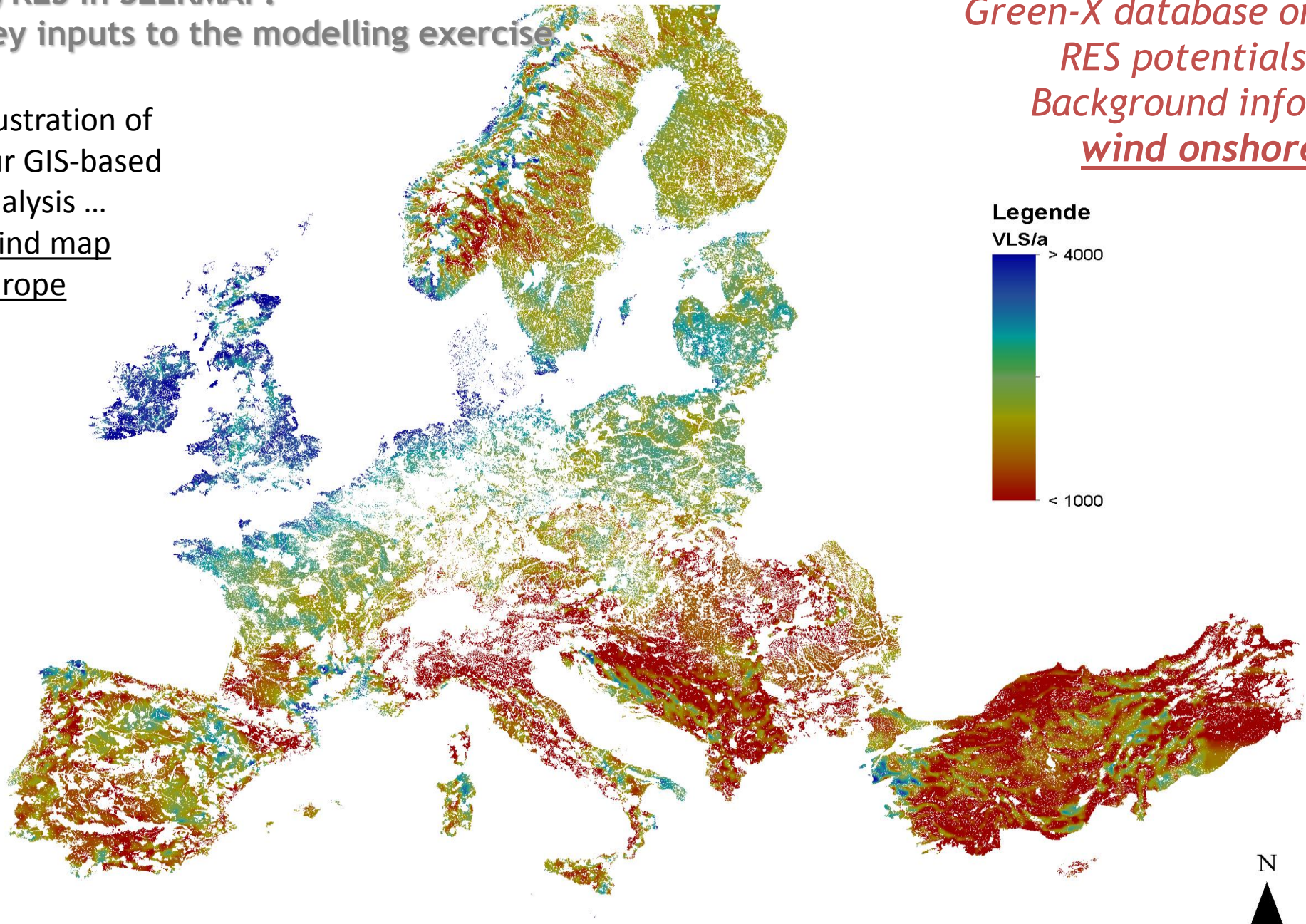
Long-term (2050) potentials for RES-electricity in Western Balkan countries
(in absolute & relative terms)

(2) RES in SEERMAP: Key inputs to the modelling exercise

Green-X database on RES potentials: Background info, ***wind onshore***

Illustration of our GIS-based analysis …

Wind map Europe



Artifical surfaces	0%
Arable land	25.0%
Permanent crops	15.0%
Pastures	20.0%
Heterogeneous agricultural areas 1	10.0%
Heterogeneous agricultural areas 2	10.0%
Heterogeneous agricultural areas 3 (agro-forestry)	5.0%
Forests	5.0%
Natural grasslands, moors	22.5%
Sclerophyllous vegetation & Transitional woodland-shrub	22.5%
Beaches, dunes, sands	10.0%
Bare rocks	0.0%
Sparsely vegetated areas	30.0%
Burnt areas & glaciers	0.0%
Inland wetlands	5.0%
Maritime wetlands	5.0%
Inland waters	0%
Marine waters	0%

Applied Land use constraints: Suitability for wind power plants

*Green-X database on RES potentials: Background info, **wind onshore***

	GR	BG	RO	AL	BA	KO	ME	MK	SR
	Greece	Bulgaria	Romania	Albania	Bosnia H.	Kosovo*	Montenegro	FYR of Macedonia	Serbia
TOTAL POTENTIAL **with land use restrictions**, without power system constraints (Capacity potential) [MW]	54,754	16,412	57,427	9,707	15,983	2,114	6,242	5,386	31,593
RESTRICTED POTENTIAL **with land use restrictions, with default power system constraints** (Capacity potential) [MW]	36,976	10,110	17,922	2,423	4,243	2,023	1,064	1,587	7,293

Long-term (2050) potentials for **Wind Onshore** in SEE countries

▸ Key assumptions

To ensure maximum consistency with existing EU scenarios and projections the key input parameters of the Green-X scenarios are (as default) based on **PRIMES modelling** and the (updates of the) **Green-X database**.

*Based on PRIMES**	*Defined for this study*
Energy demand by sector	RES policy framework
Primary energy prices	Reference electricity prices
Conventional supply portfolio and conversion efficiencies	RES cost & learning rates (Green-X database, incl. biomass)
CO_2 intensity of sectors	RES potential (Green-X database)
	Biomass trade specification
	Technology diffusion
	Financing conditions

Main input sources for scenario parameters

**Primes scenario used subsequently: Reference case (as of 2015/2016)*

WACC – risk elements

WACC assumptions and the impact of risk (policy, technology, country)

$$WACC_{c,t,p} = WACC_{default} * f_c * f_t * f_p$$

Default assumptions concerning energy technologies in Austria

WACC (in Austria)	default (real)	ideal
posttax (nominal)	6.5%	4.9%
pretax (nominal)	8.7%	6.5%
pretax (real)	**7.4%**	**5.3%**

Note: Through complementary measures the investor risk can be reduced, from „real“ to „ideal“ (according to an assessment conducted in the DIA-CORE project)

Source: Dia-Core project (www.diacore.eu)

Technology-specific risk factor (i.e. multiplier of default WACC)

RES-electricity	
Biogas	1.00-1.05
Solid biomass	1.05
Biowaste	1.05
Geothermal electricity	1.1
Hydro large-scale	0.95
Hydro small-scale	0.95
Photovoltaics	0.85-0.90
Solar thermal electricity	1.1 (1.0)
Tide & wave	1.4 (1.2)
Wind onshore	0.95
Wind offshore	1.4 (1.15)

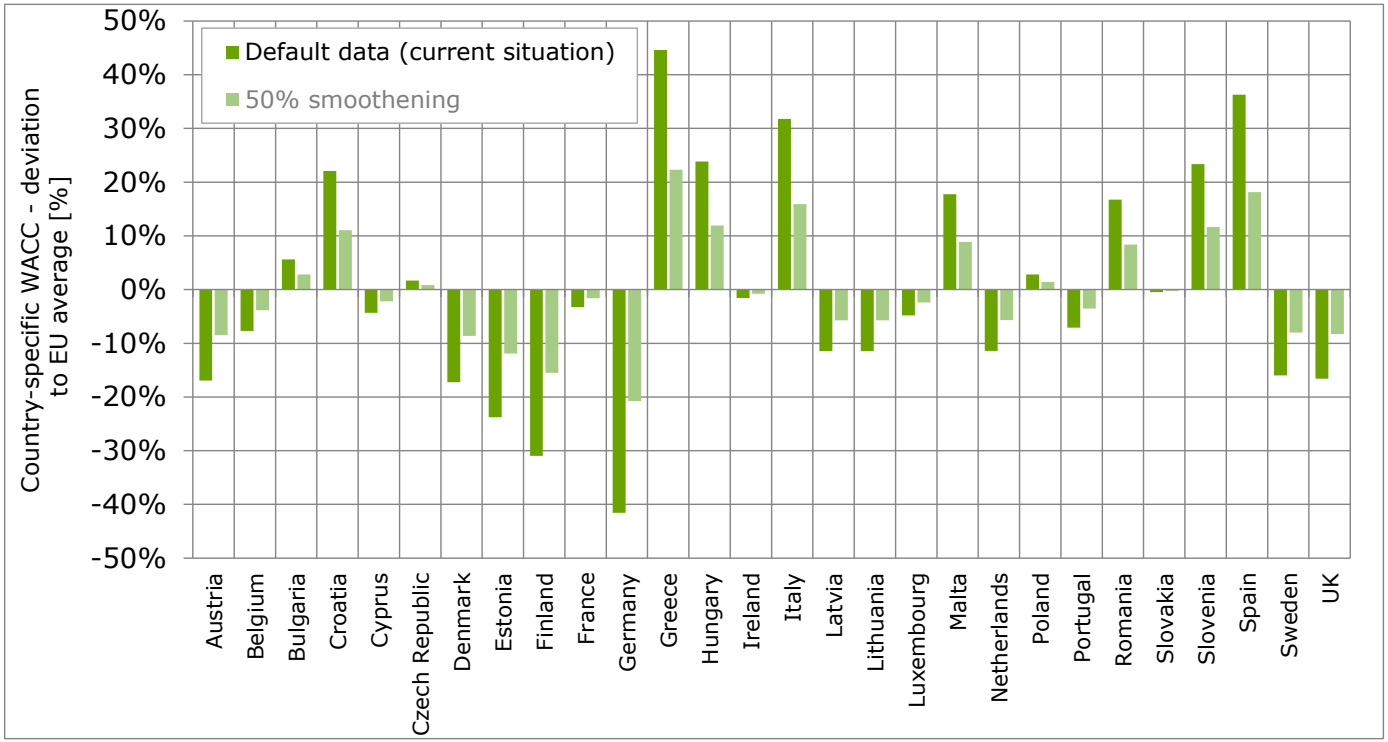
Note: Numbers in brackets refer to the period post 2020.

Policy risk: Instrument-specific risk factor (i.e. multiplier of default WACC)

FIT (feed-in tariff)	1.00
FIP (feed-in premium)	1.10
QUO (quota system with uniform tradable green certificates (TGC))	1.20
ETS only (Emission Trading Scheme only - no dedicated RES support)	1.30
TEN (tenders for selected RES-E technologies)	1.15

WACC – risk elements

The impact of country specific risk



MS	WACC pretax (real)	WACC pretax (real)
	Interview	Triple A policies
	Real case	Ideal situation
Austria	7.4%	5.3%
Belgium	7.1%	5.8%
Bulgaria	9.9%	6.7%
Croatia	13.8%	7.7%
Cyprus	10.2%	6.0%
Czech Republic	8.6%	6.4%
Denmark	6.4%	5.2%
Estonia	11.0%	4.8%
Finland	6.9%	4.4%
France	7.3%	6.1%
Germany	4.4%	3.7%
Greece	15.0%	9.1%
Hungary	12.7%	7.8%
Ireland	9.0%	6.2%
Italy	10.4%	8.3%
Latvia	8.8%	5.6%
Lithuania	9.7%	5.6%
Luxembourg	7.2%	6.0%
Malta	9.6%	7.4%
Netherlands	7.2%	5.6%
Poland	10.3%	6.5%
Portugal	9.1%	5.9%
Romania	12.0%	7.4%
Slovakia	9.1%	6.3%
Slovenia	12.0%	7.8%
Spain	10.5%	8.6%
Sweden	11.6%	5.3%
UK	7.0%	5.3%
	9.4%	6.3%

- Represents the status quo
- For future trends: link to GDP per capita trends?