

ROLE OF PRIVATE INVESTORS IN CLIMATE FINANCE

Somya Mathur

*Senior Economist, Infinite Sum Modelling Inc.;
Research Associate, Climate Collective Pune,
Pune International Center, India.*

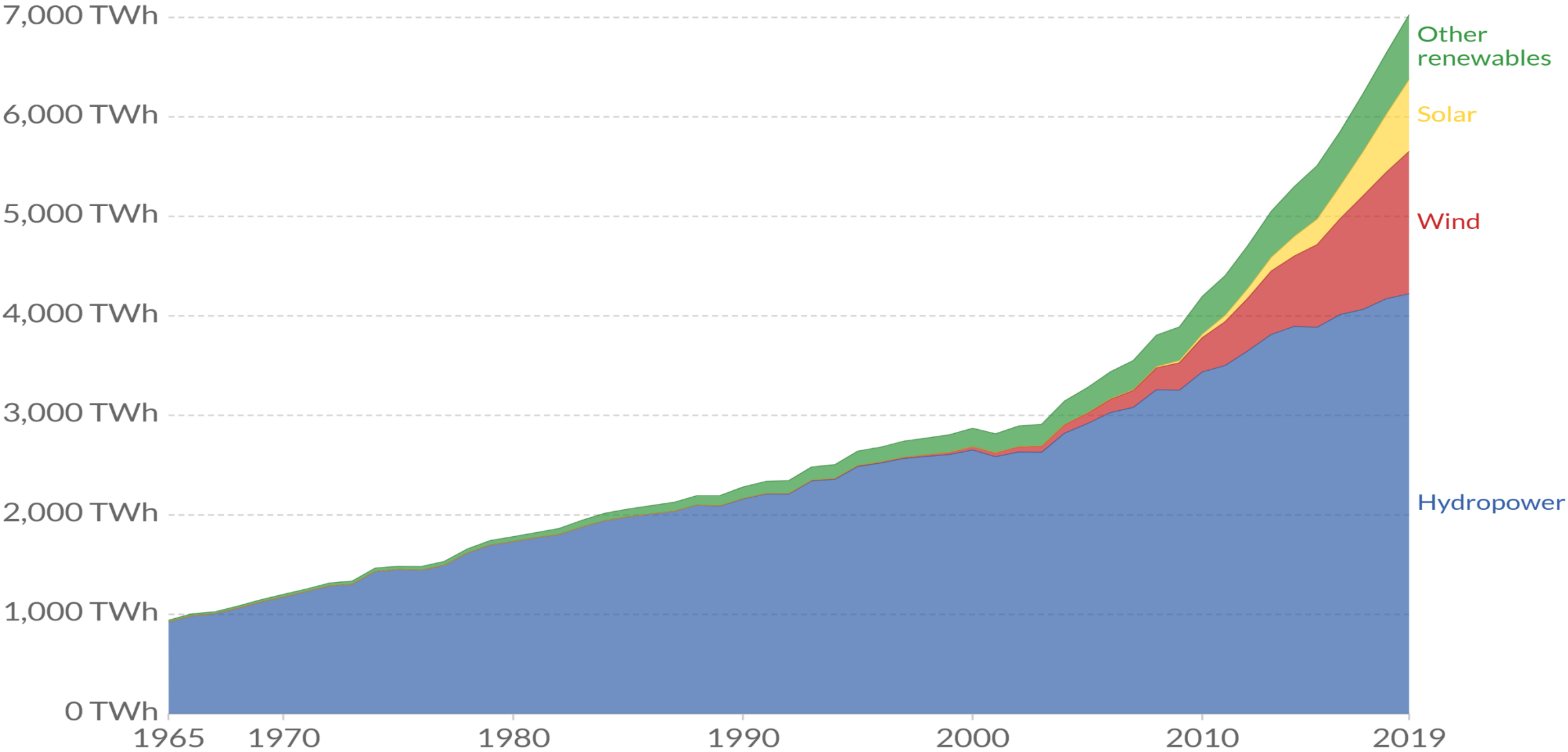
Badri Narayanan

Founder, Infinite Sum Modelling Inc., Seattle, US.

Rahul Sen

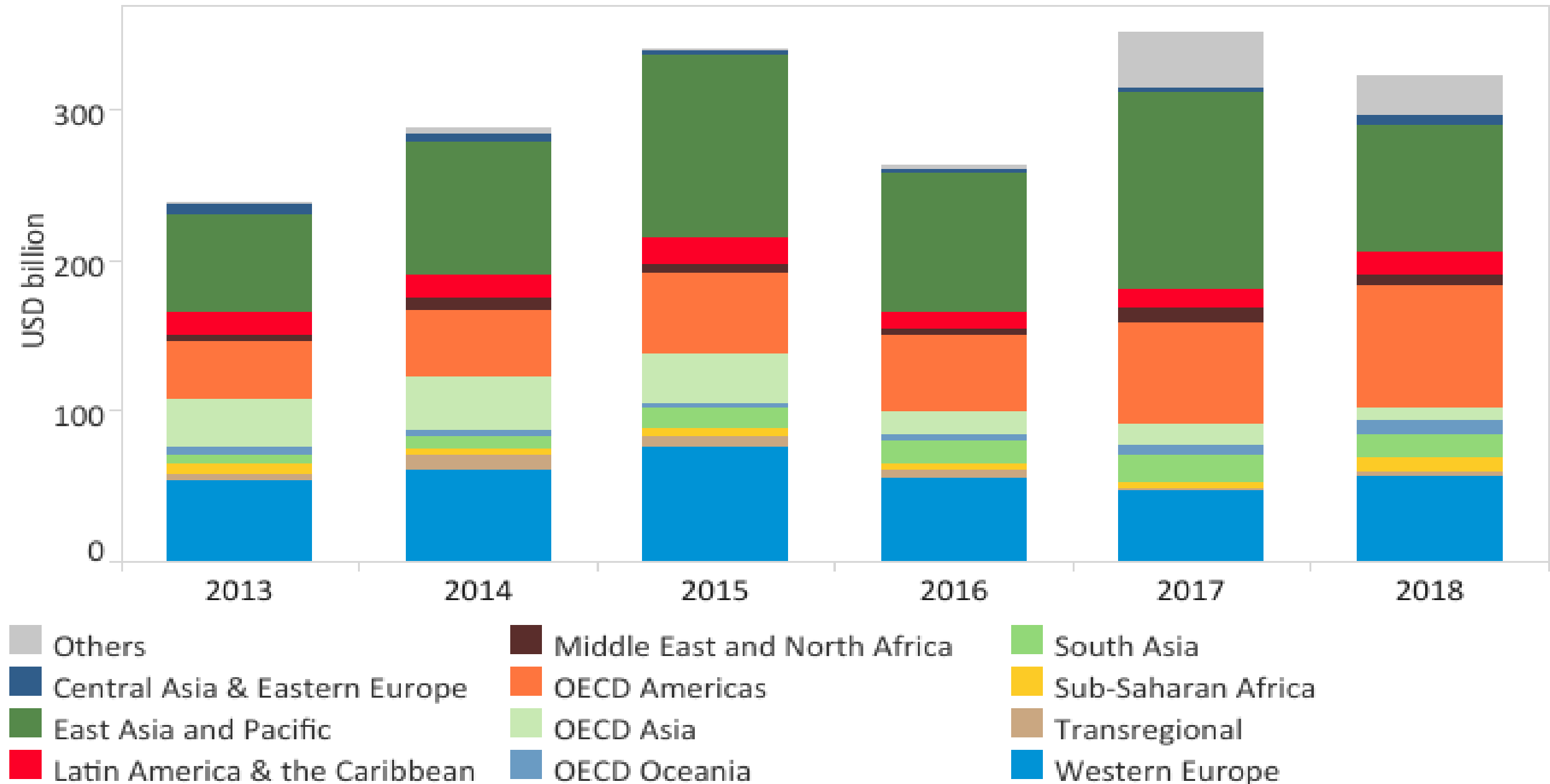
*Senior Lecturer, AUT, Auckland, New Zealand
Advisor, Infinite Sum Modelling Inc.*

Renewable energy generation, World



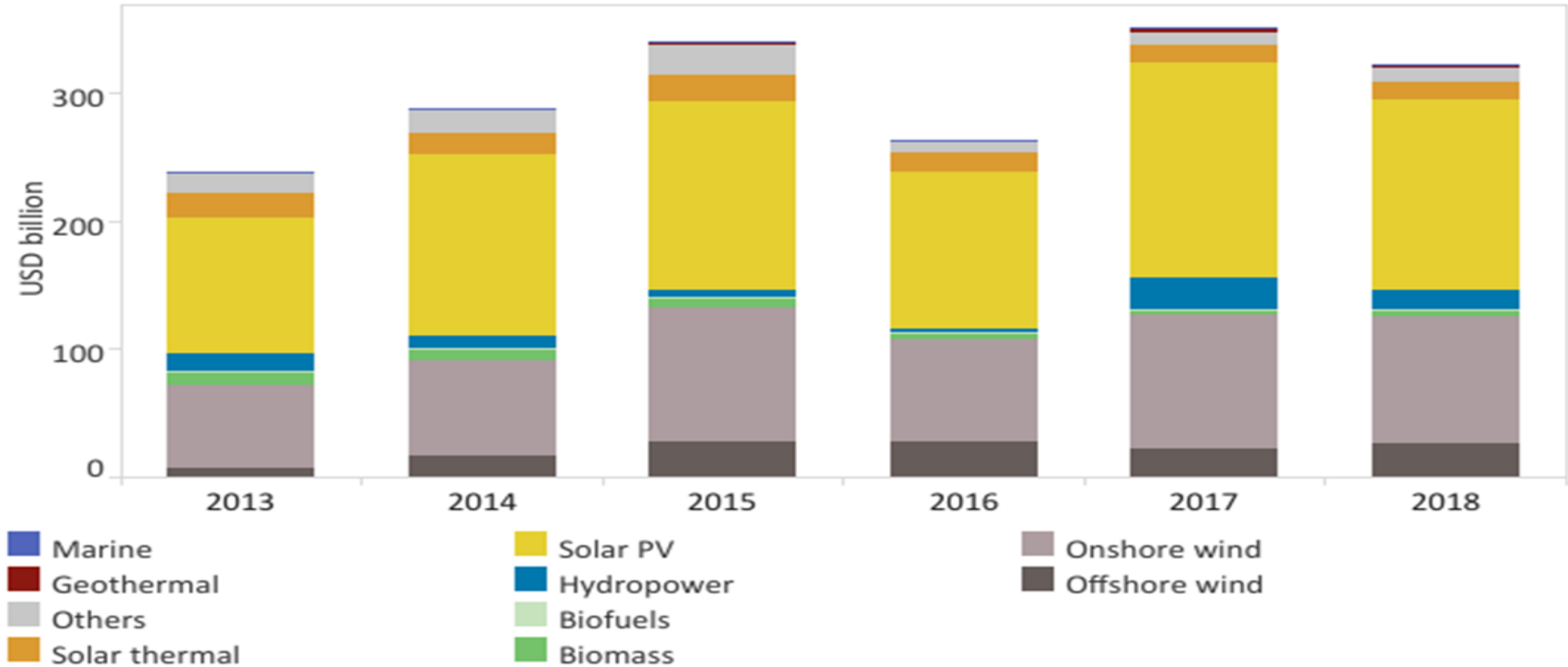
Source: BP Statistical Review of Global Energy
OurWorldInData.org/renewable-energy • CC BY
Note: 'Other renewables' refers to renewable sources including geothermal, biomass, waste, wave and tidal. Traditional biomass is not included.

Share of Renewable Energy Investments



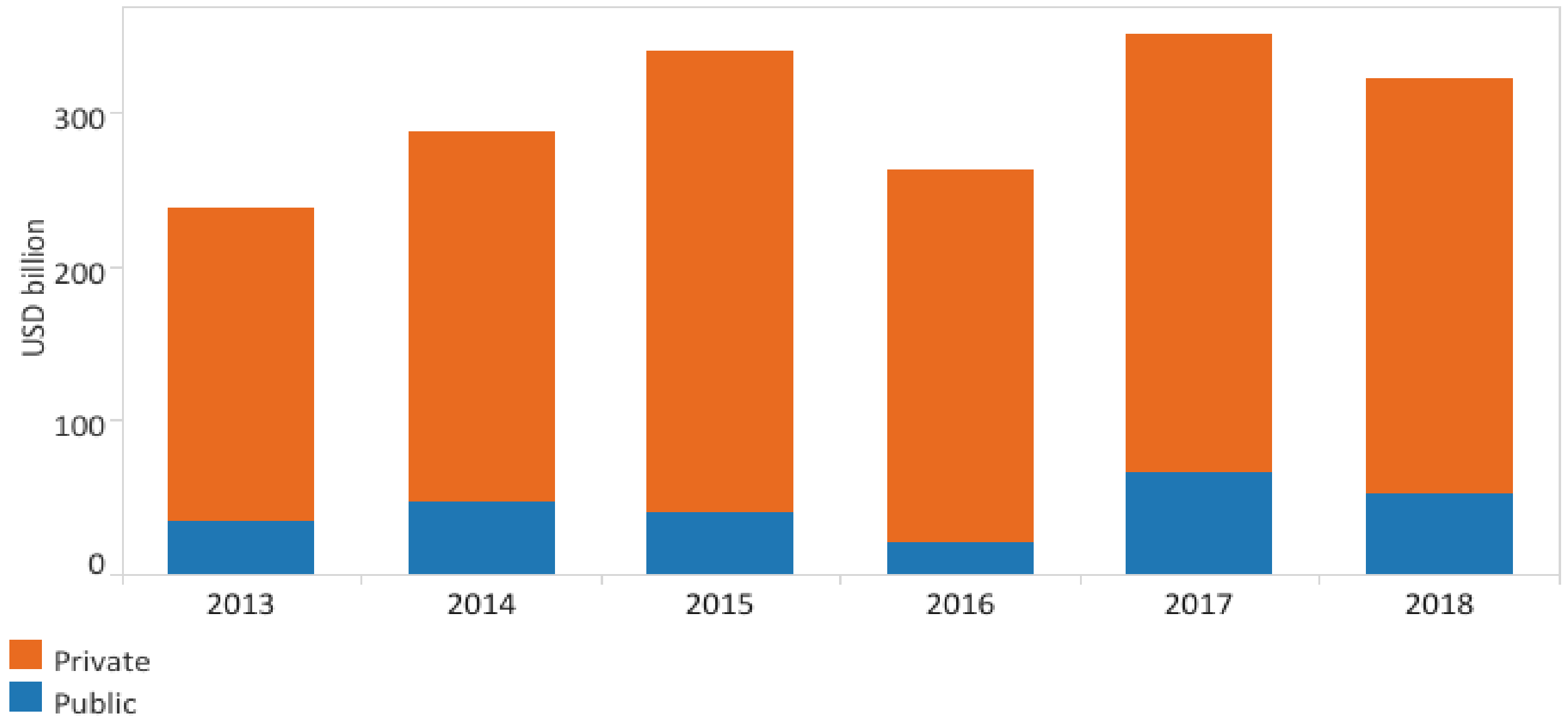
Source: IRENA

ANNUAL FINANCIAL COMMITMENTS IN RENEWABLE ENERGY



Source: IRENA, 2020

INVESTMENTS IN RENEWABLE ENERGY



Private Investments

```
graph TD; A[Private Investments] --> B[Corporations (electric utilities, oil and gas, consumer-facing industries).]; A --> C[Retail Investors (individuals, family offices).]; A --> D[Investment partnerships (hedge funds, private equity firms).]; A --> E[Financial intermediaries (banks, insurance companies, pension funds).]; A --> F[Endowment funds (foundations, universities).];
```

Corporations (electric utilities, oil and gas, consumer-facing industries).

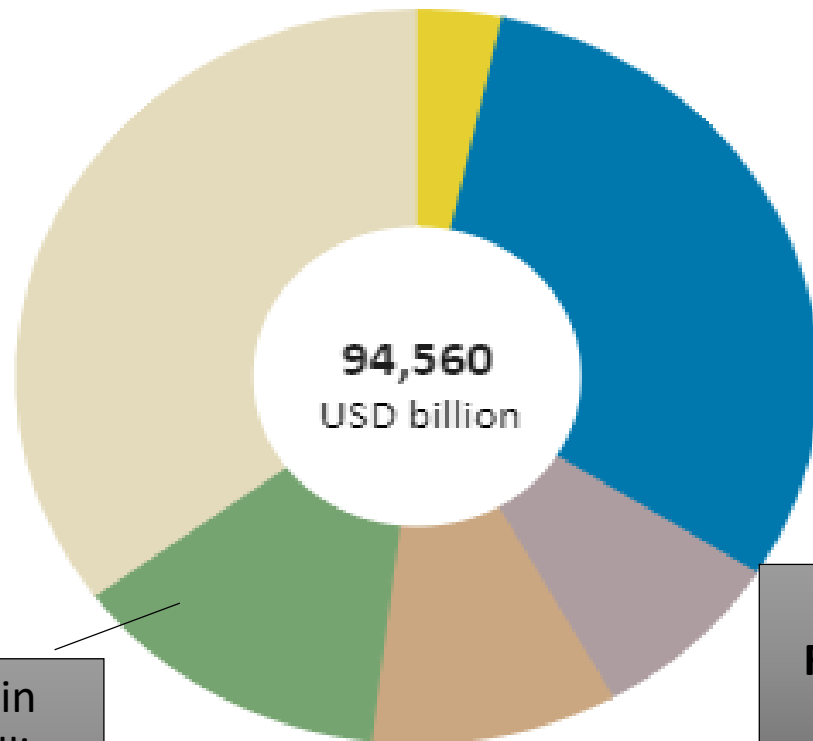
Retail Investors (individuals, family offices).

Investment partnerships (hedge funds, private equity firms).

Financial intermediaries (banks, insurance companies, pension funds).

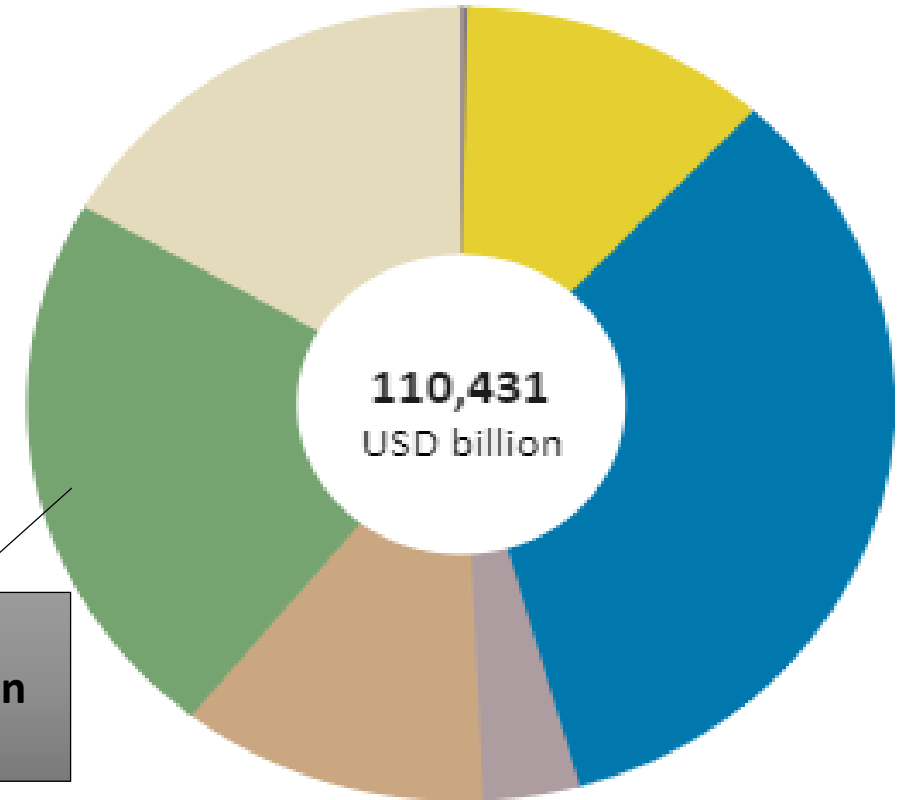
Endowment funds (foundations, universities).

CUMULATIVE INVESTMENT NEEDS 2017-2050



Planned Energy Scenario

Investment in
Renewables Billion
US\$ 12,282



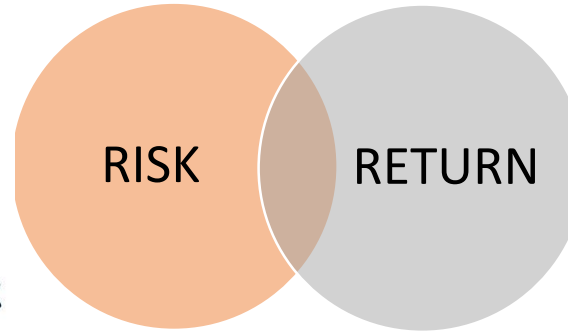
Transforming Energy Scenario

Investment in
Renewables Billion
US\$ 24,985

- Carbon capture, storage and other
- Electrification of heat and transport
- Energy efficiency
- Power generation - fossil fuel and nuclear

- Power grids, adequacy and storage
- Renewables
- Supply side

HOW CAN WE MOBILIZE PRIVATE SECTOR INVESTMENTS IN RENEWABLE ENERGY?



INVESTMENT RISK

Decreasing
associated Risks

Increasing
Returns by
reducing costs



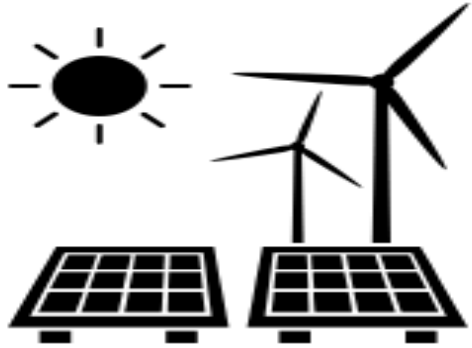
GTAP E Power Model by Jeffery Peters, 2016

	REGIONS					
Disaggregated Annex 1 Countries :	Canada, United States of America, Austria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Poland, Portugal, Romania, Slovenia, Belgium, Australia, New Zealand, Japan, Spain, Sweden, Switzerland, Norway, United Kingdom, Russian Federation.					
Disaggregated Emerging Economies:	China, Indonesia, Singapore, Vietnam, India, Bangladesh, Brazil.					
Disaggregated Middle East:	Bahrain, Iran Islamic Republic of, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates.					
Rest of North America	Rest of European Union	Rest of Oceania	Rest of Asia	Latin America	Africa	Rest of the World

SECTORS

Renewable Sectors	Nuclear base load, Wind base load, Hydro base load, Other base load Hydro peak load, Solar peak load
Fossil Fuel Sectors	Coal base load, Gas base load, Oil base load, Gas peak load, Oil peak load, Electricity: Transmission and distribution, Gas manufacture and distribution
Other Sectors	agriculture and food processing, Coal, Oil, Gas, Forestry, Fishing, Minerals , Petroleum, coal products, Paper products, publishing, Wood products, Leather products, Wearing apparel, Textiles, Chemical products, Basic pharmaceutical products, Rubber and plastic products, Mineral products Ferrous metals, Metals , Metal products, Computer, electronic and optic, Electrical equipment, Machinery and equipment , Motor vehicles and parts, Transport equipment, manufacturing.

I. REDUCTION OF COSTS



Costs of equipment (e.g., photovoltaic solar modules, wind turbines)

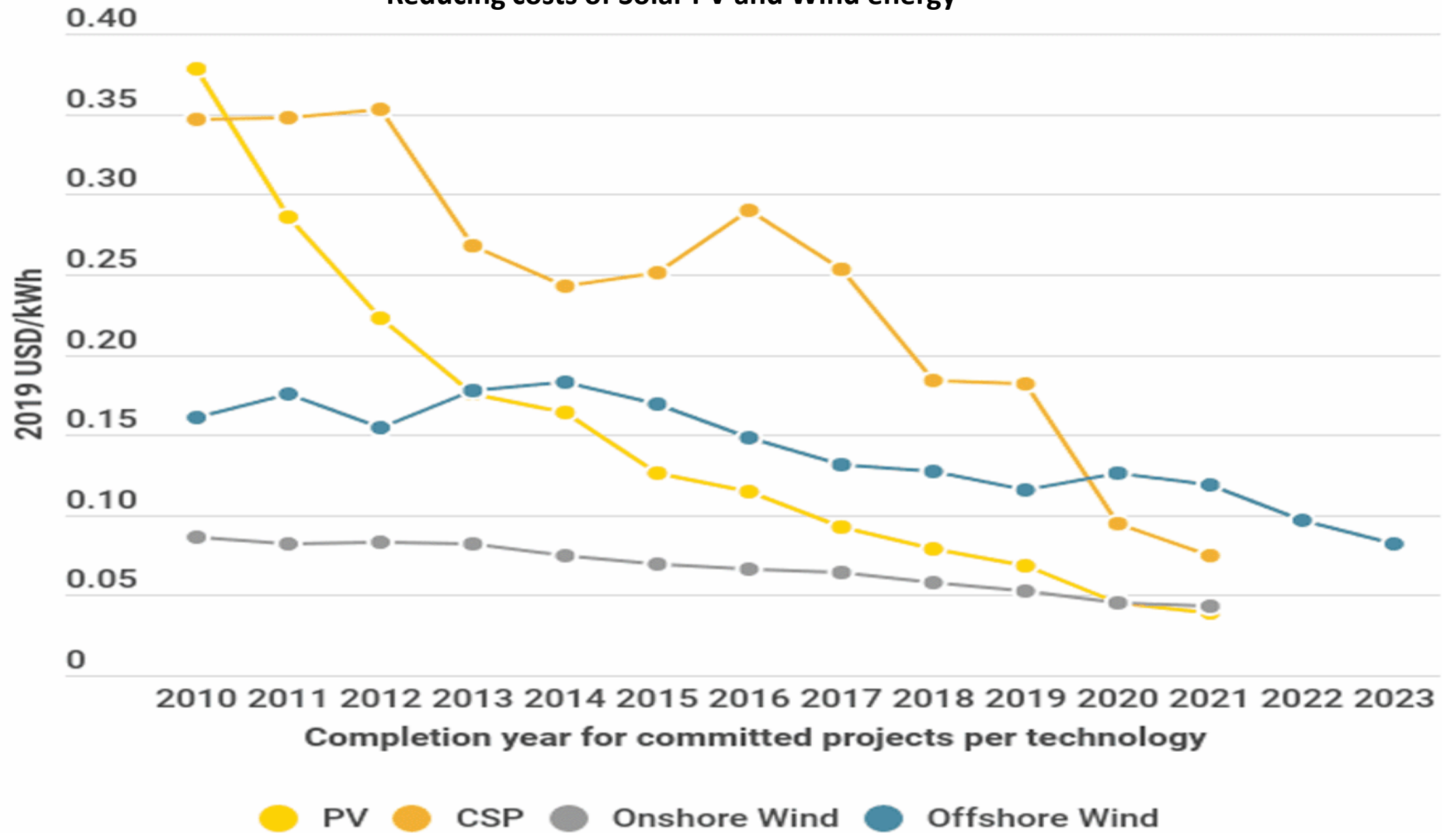


Fixed and variable operating and maintenance costs (O&M)



The levelized cost of electricity generation (LCOE)

Reducing costs of Solar PV and Wind energy



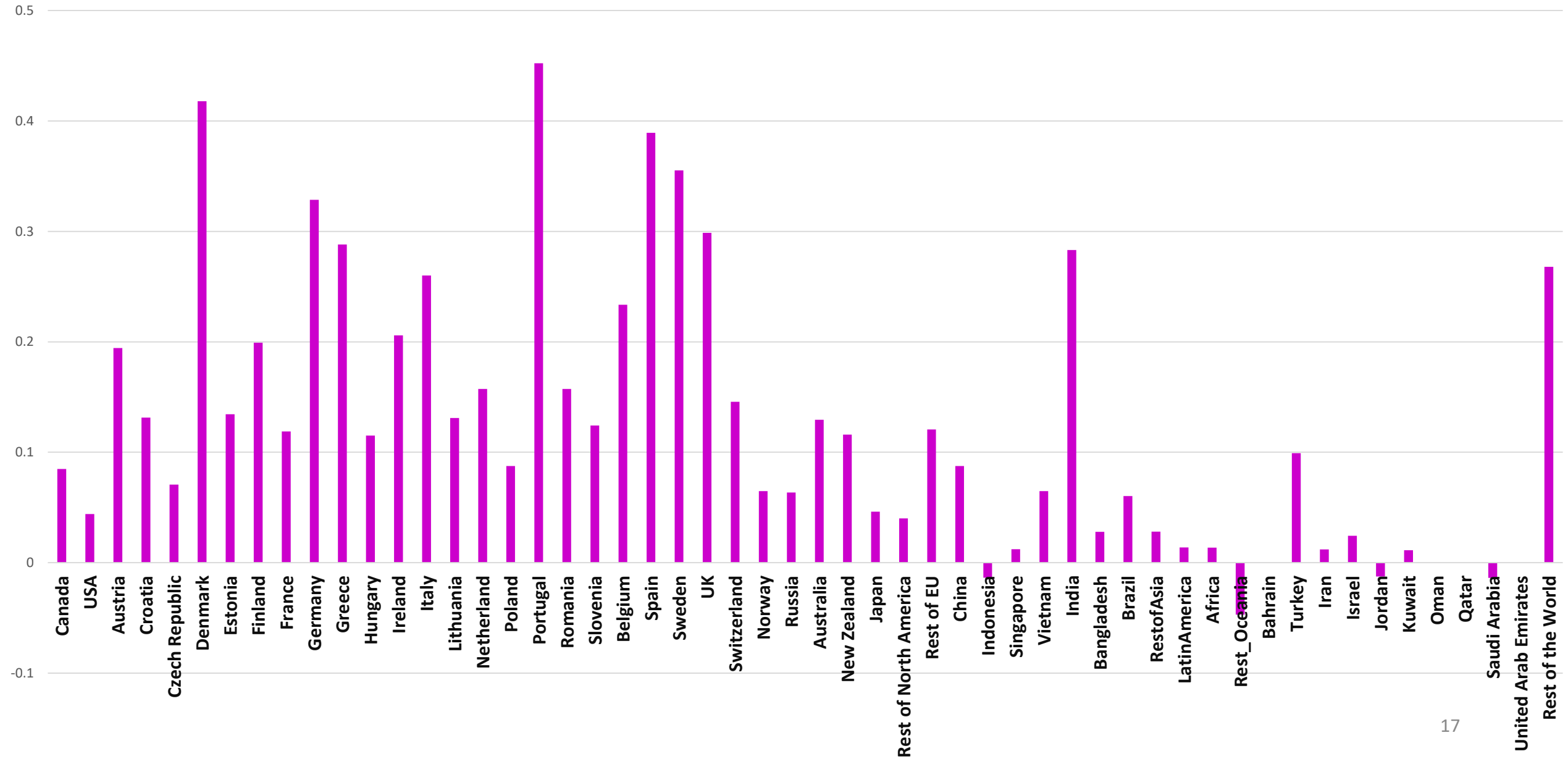
Assumptions for reduction of costs in renewable sectors (Solar, Wind and Biomass):

- Some unemployment exists in the world economy.
- As per IRENA, 2019 Solar PV energy costs have reduced by 82% in last decade, a further decrease would be between **15%-35%**. So we have shocked SolarP by average figure of 20% assuming already much costs have been reduced earlier. As per IRENA, 2019 Wind electricity costs have declined by **32%** and Biomass by **13.15%** in last decade. Hence we assume the same rate of decline in costs continue in future as well.
- We assume that productivity of capital in these renewable energy sectors is augmented by way of technological changes due to which cost reduction happens. Hence have converted costs of renewables into an exogeneous variable, swapped $pm(i,r)$ with $aoall(i,r)$.

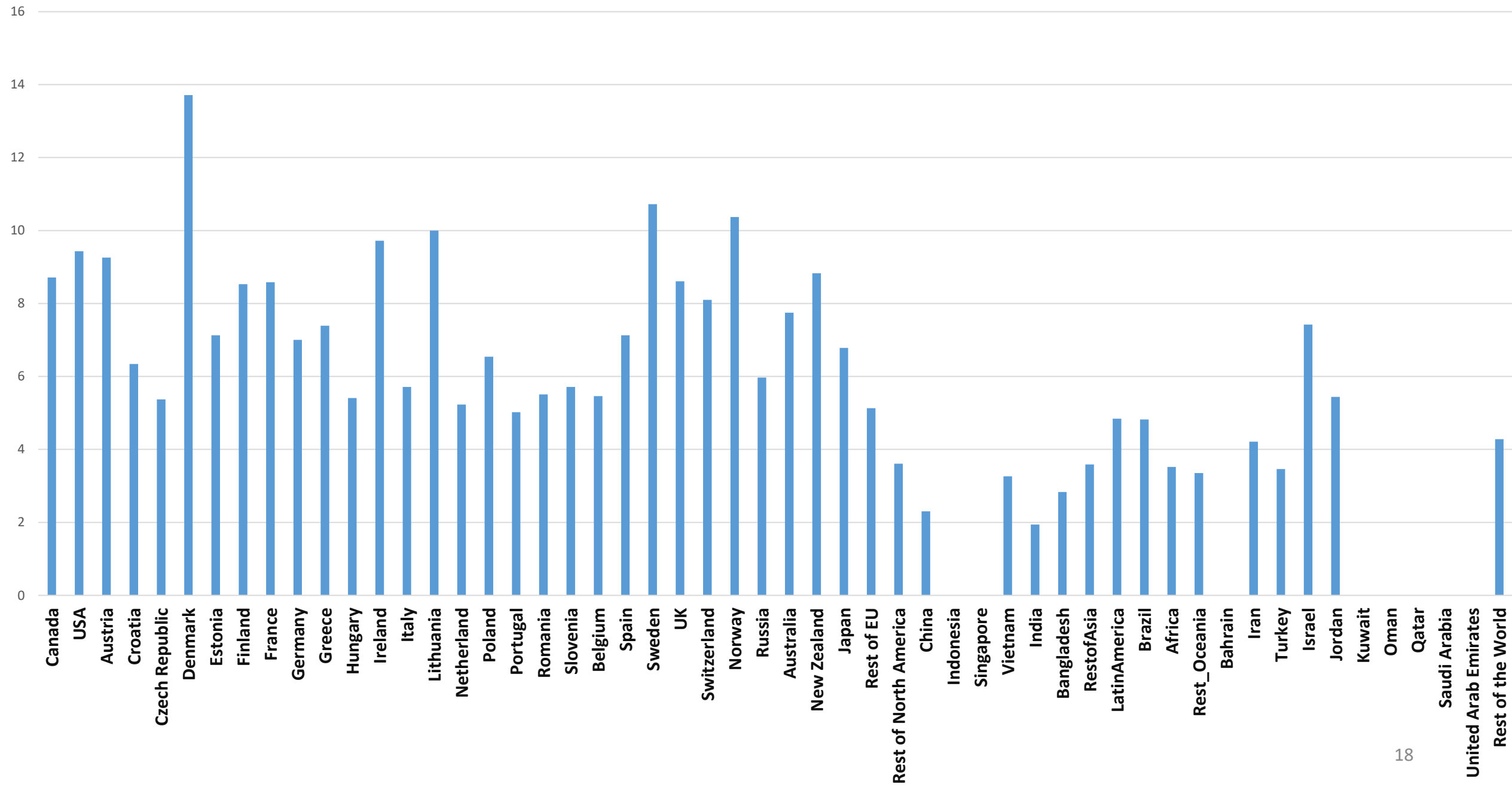
Net Rate of Return on Capital stock on Renewables (Solar, Wind and Biomass) sectors has been calculated :

$$\text{rorc}(\text{"Renewables"}, \text{REG}) = \text{GRNETRATIO}(r) * [\text{rental}(\text{"Capital"}, \text{"Renewables"}, \text{REG}) - \text{pcgds}(r)]$$

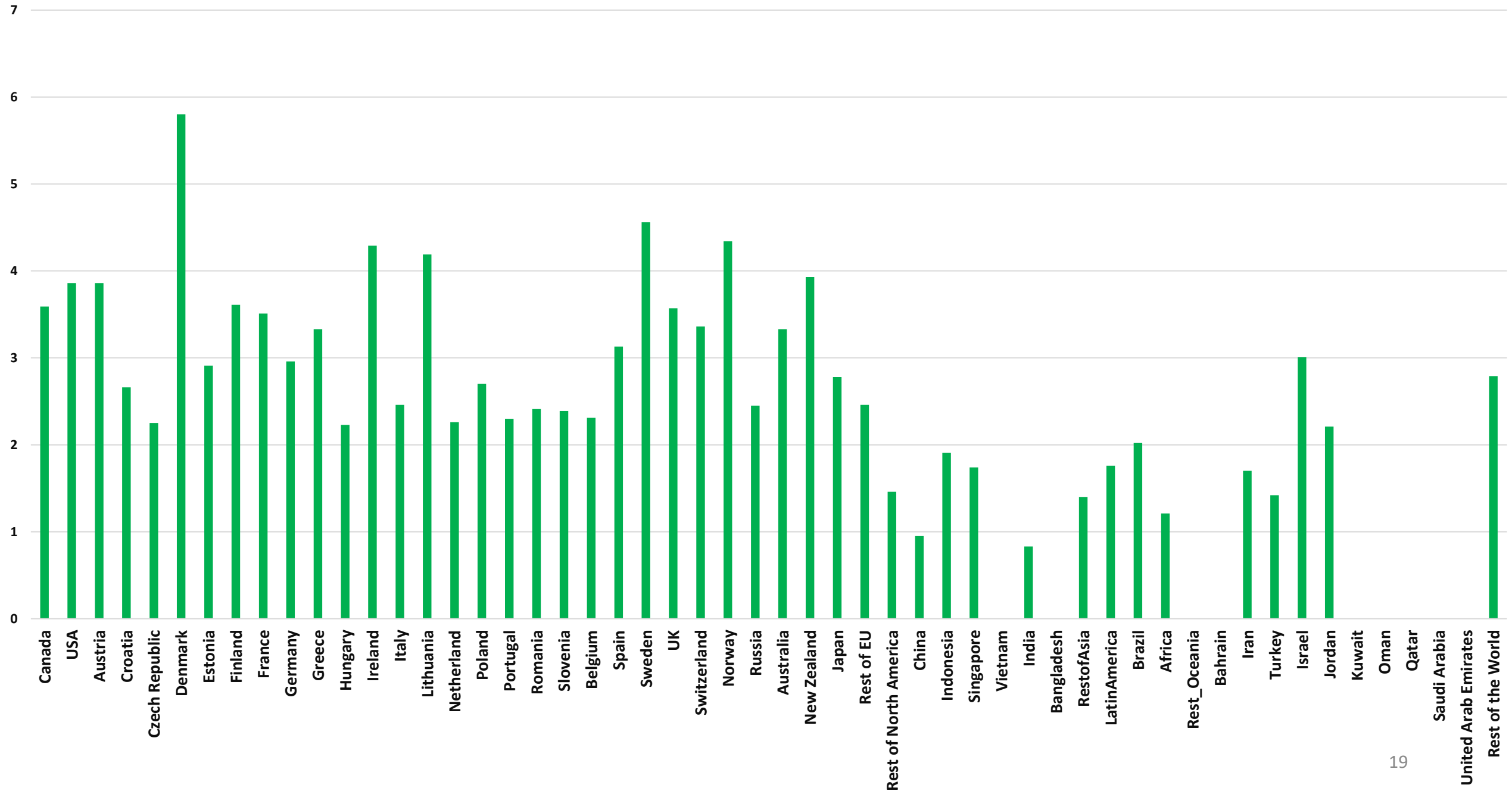
% Change in the Rate of Return on Capital Investments done on Renewables Sector due to price reduction



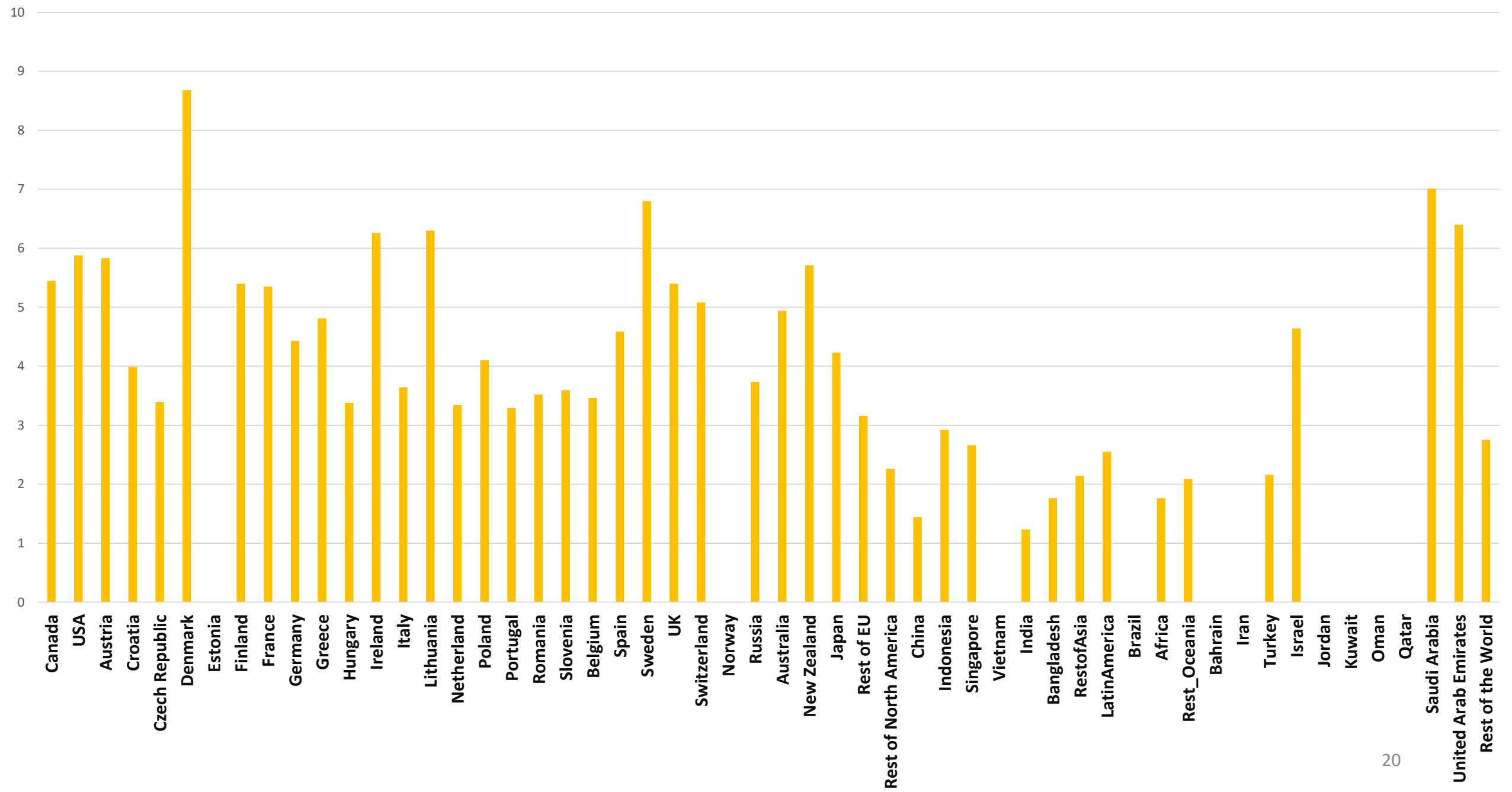
% change in Wind power generation



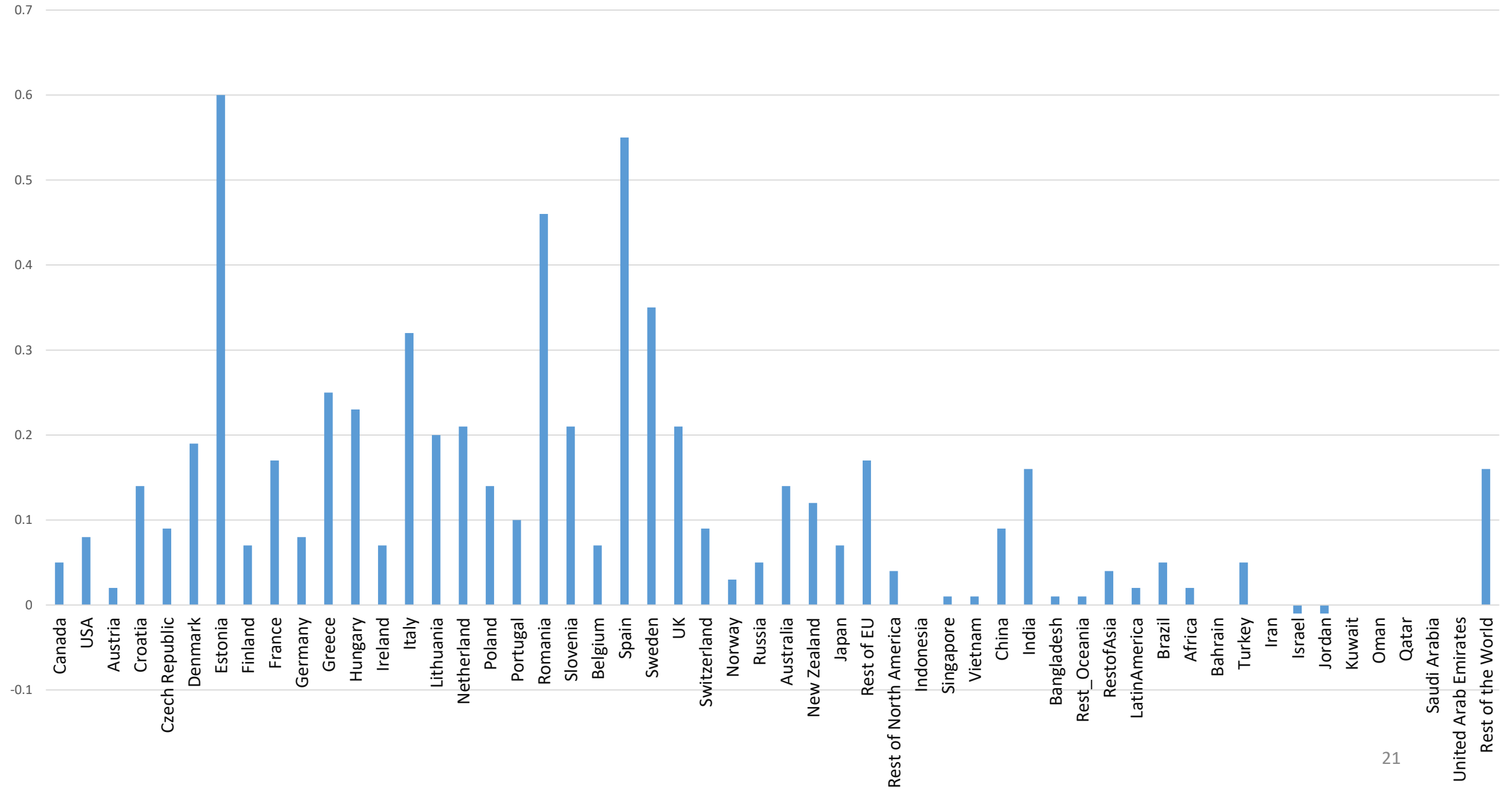
% change in Bioenergy generation



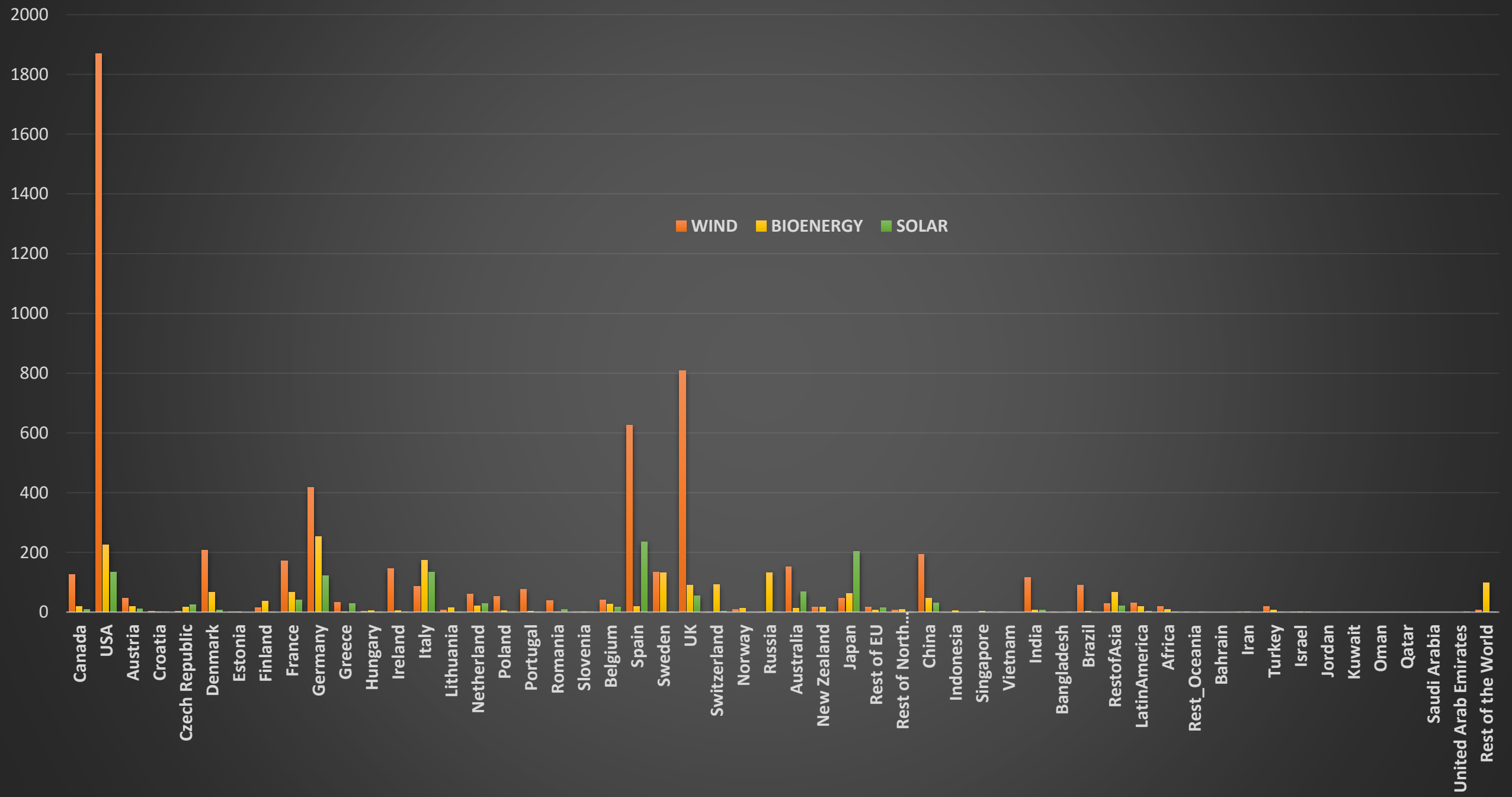
% change in Solar power generation



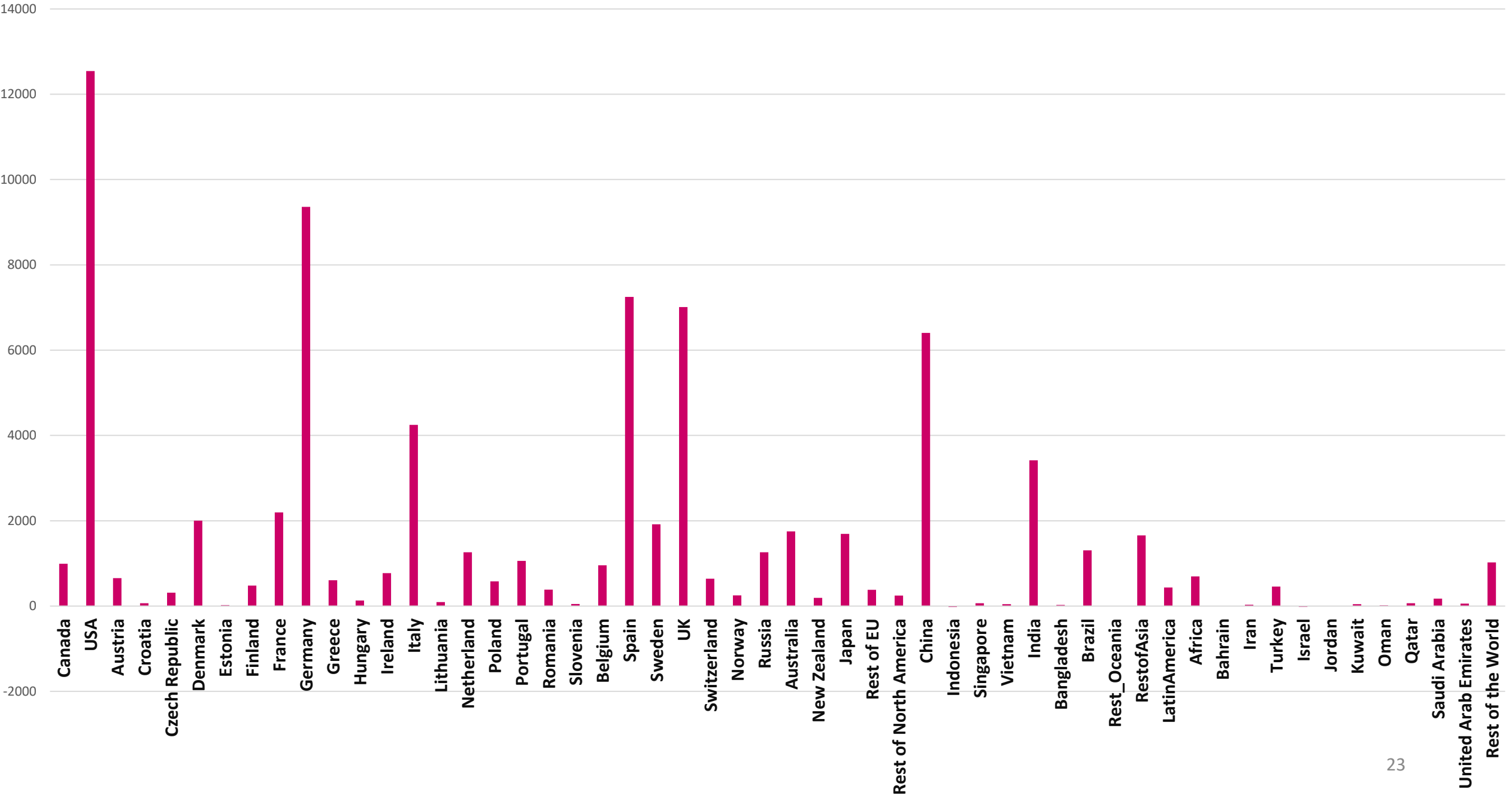
% Change in GDP due to cost reduction in renewable sector



Change in renewable energy generation due to cost reduction (In Million US\$)



Change in Welfare (in Million US\$)



II. MITIGATING COUNTRY RISKS



Sovereign Risk(Includes Forex risk, interest rate risk, liquidity risk)



Economic Risk



Political Risk

Eliminate Country Risk via risk management:

- Enabling Policies
- Political risk insurance
- Guarantee instruments
- Currency hedging instruments
- Currency risk guarantee fund
- On-lending
- Subordinated debt
- Convertible loans

(Reference: Malcolm, Gerard. 1998. “Modeling Country Risk and Capital Flows in GTAP.” GTAP Technical Paper No. 13.)

This paper describes a technique that can be used to examine the impact of changes in country risk. Rate of return equalization rule determines the investment demand in GTAP. Gerard Malcolm makes the risk premia as the factor responsible for the changes in the investment levels.

$$r_{ore}(r) = r_{org} + risk(r)$$

$$r_{ore}(r) = r_{org} + cgds_{lack}(r) \text{ (Here } cgds_{lack} \text{ may be interpreted as the risk premium).}$$

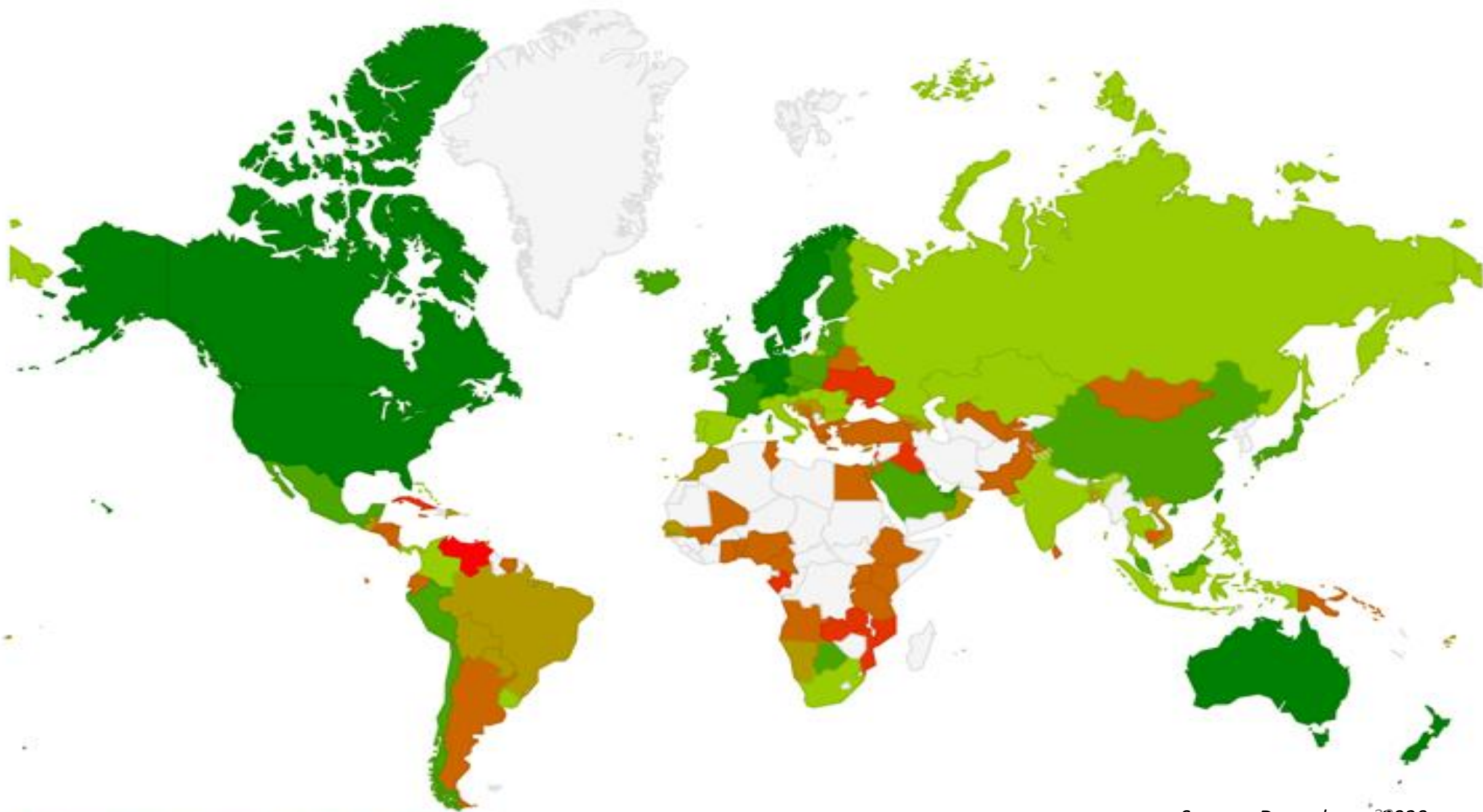
r_{org} is the global rate of return.

Assumptions for completely eliminating country risk :

- Some unemployment exists in the world economy.
- $Cgds_{slack}(r)$ is converted into an endogenous variable and $r_{ore}(r)$ into an exogeneous by swapping $cgds_{slack}$ with r_{ore} .

Reference for data on Country Risk Premium :

Damodaran, Aswath, Country Risk: Determinants, Measures and Implications – The 2020 Edition (July 14, 2020). NYU Stern School of Business, Available at SSRN: <https://ssrn.com/abstract=3653512> or <http://dx.doi.org/10.2139/ssrn.3653512>

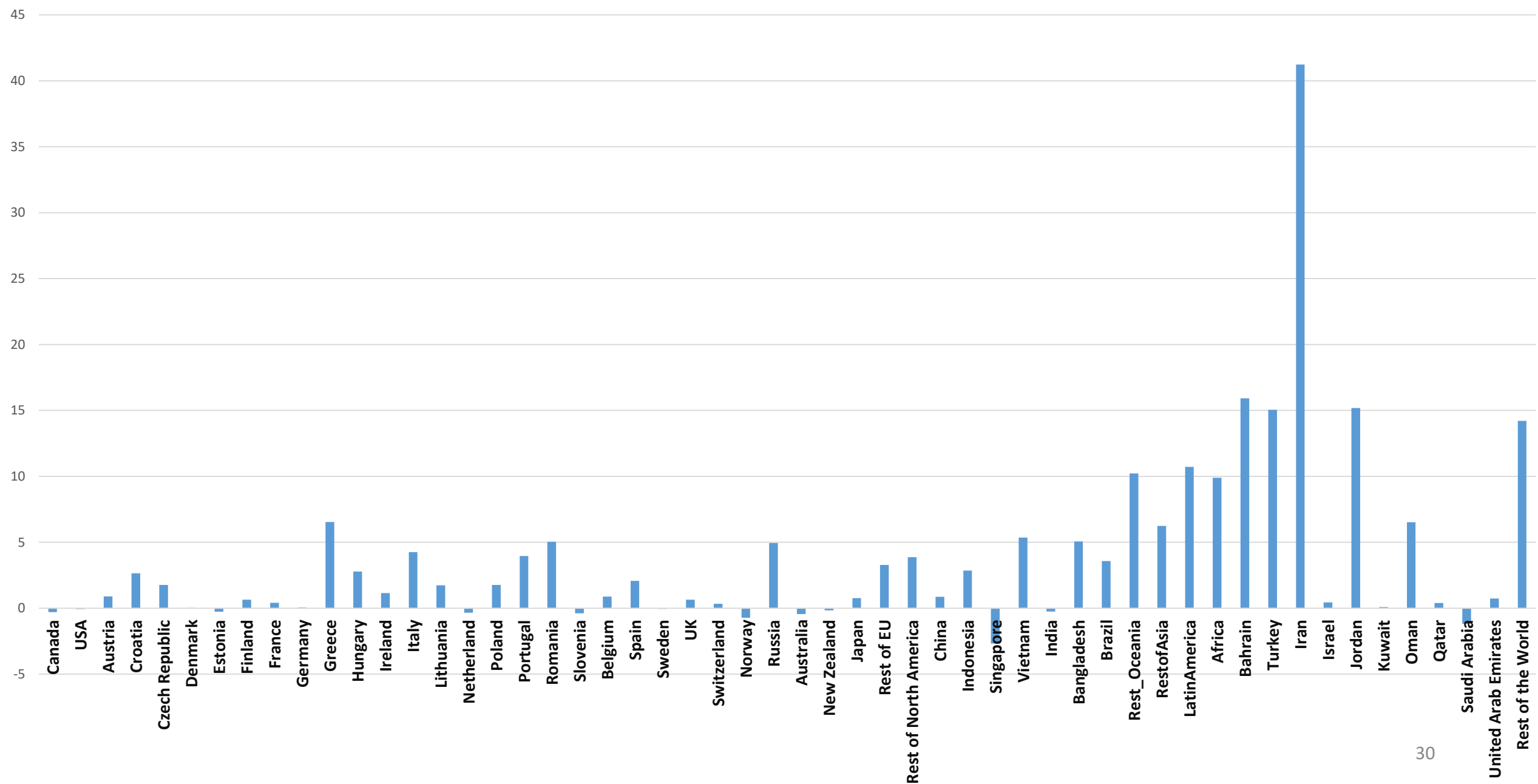


Aaa  D

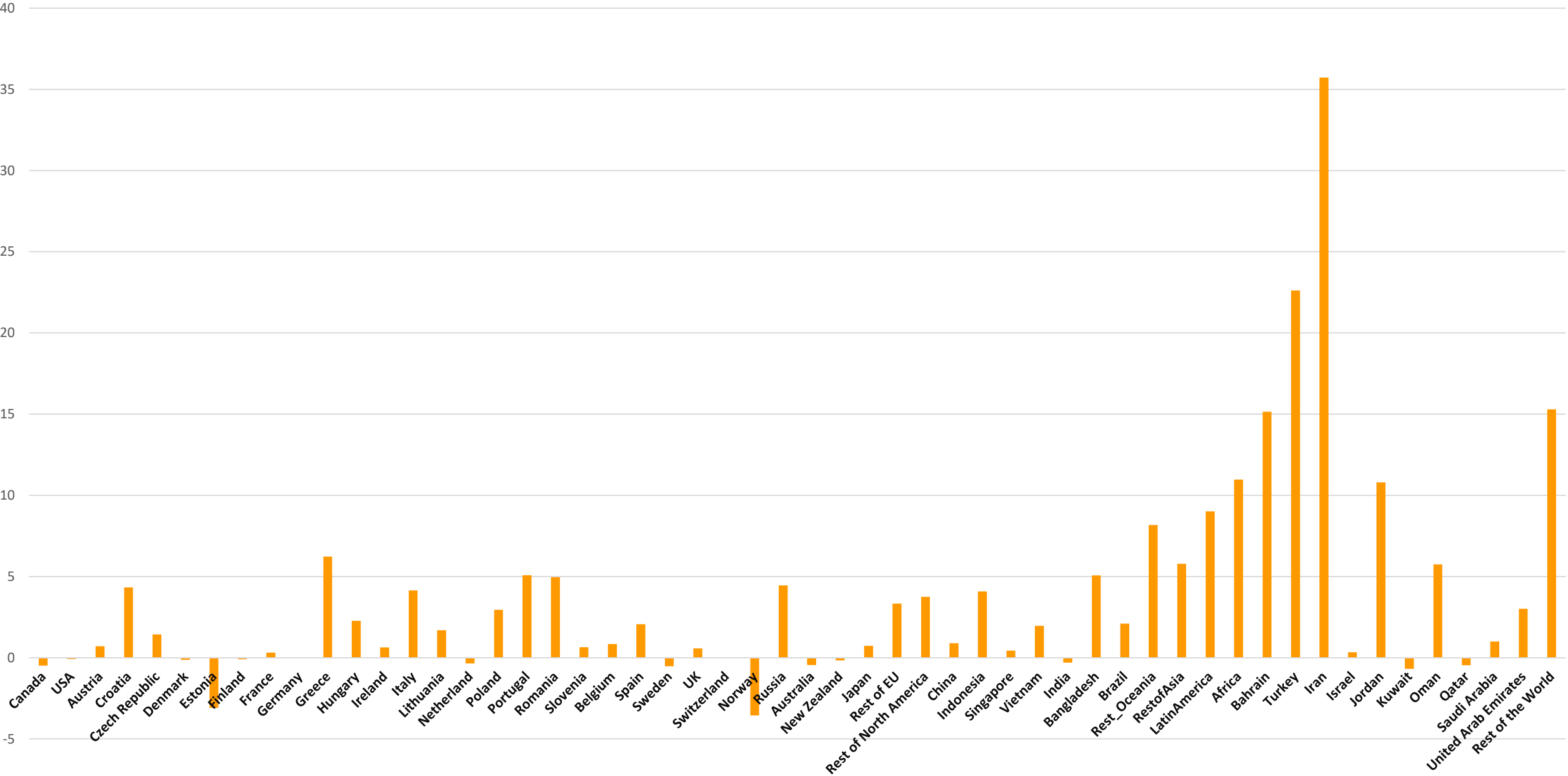
Source : Damodaran, 2020

**(i). Very Ambitious
Scenario of Complete
elimination of Country
Risk.**

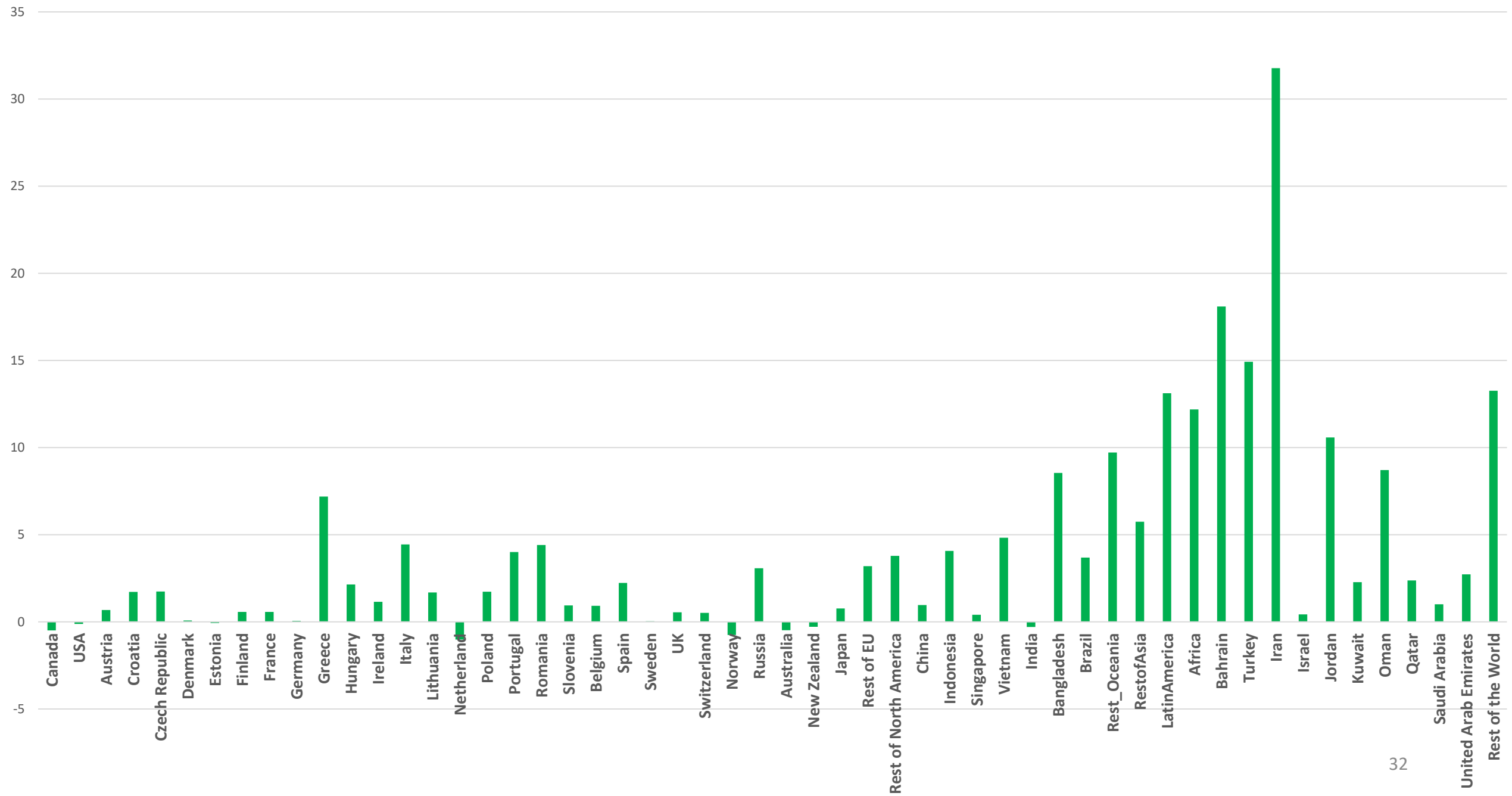
% change in demand for Capital in Wind power due to complete elimination of country risk



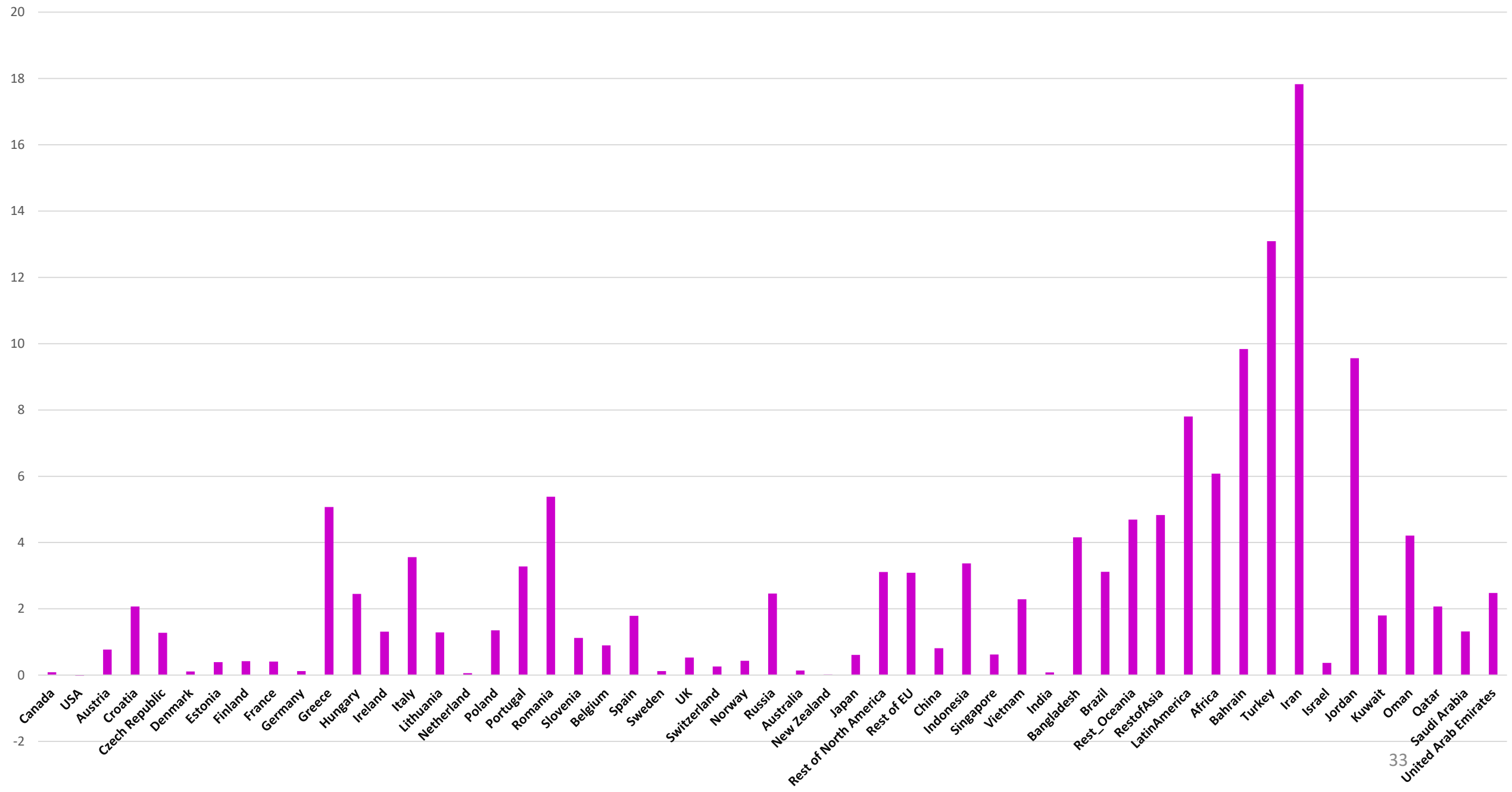
% change in demand for Capital in Solar power due to complete elimination of country risk



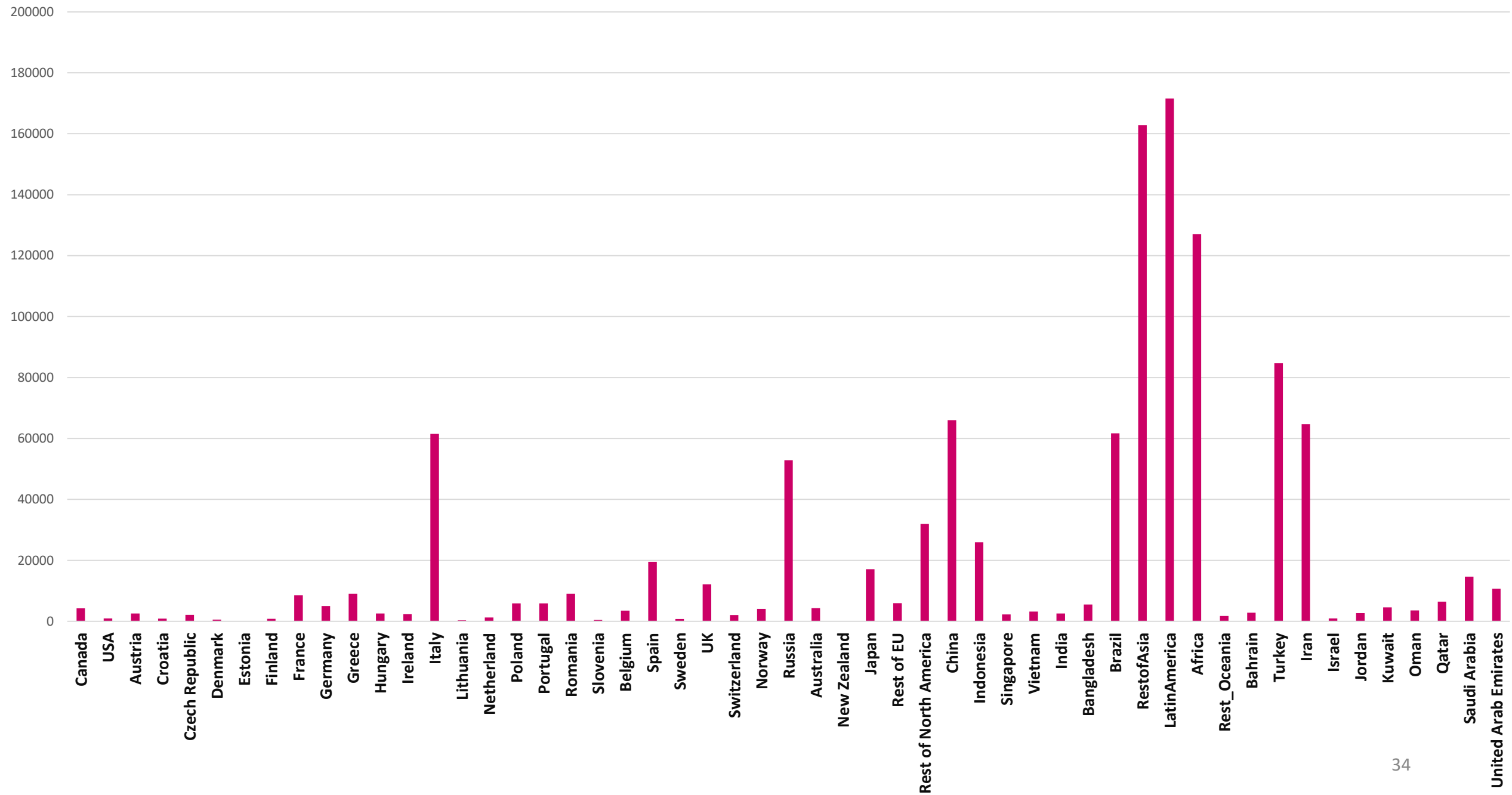
% change in demand for Capital in Biomass power due to complete elimination of country risk



% change in GDP due to complete elimination of country risk

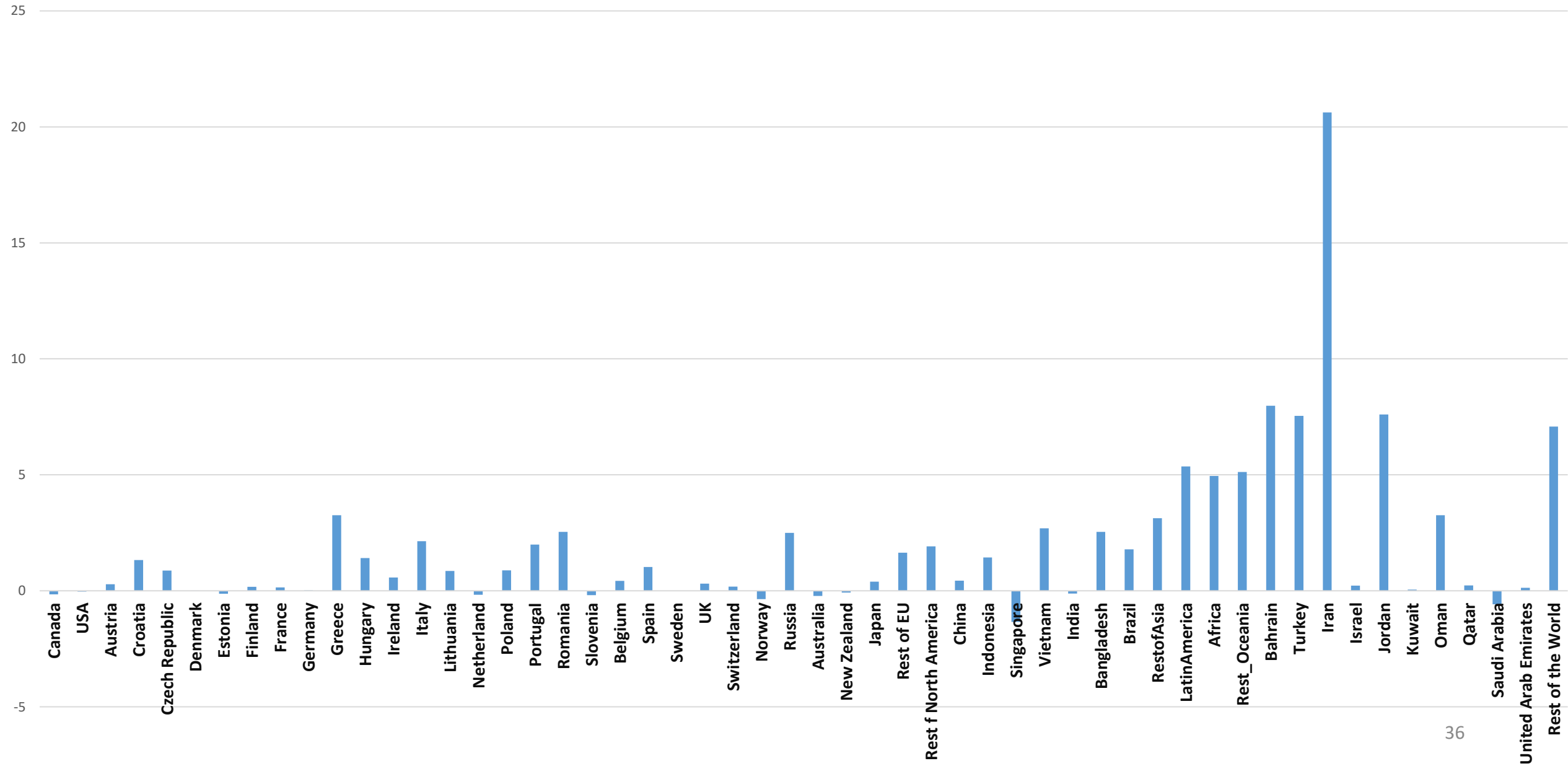


Change in Welfare due to complete elimination of country risk (in Million US\$)

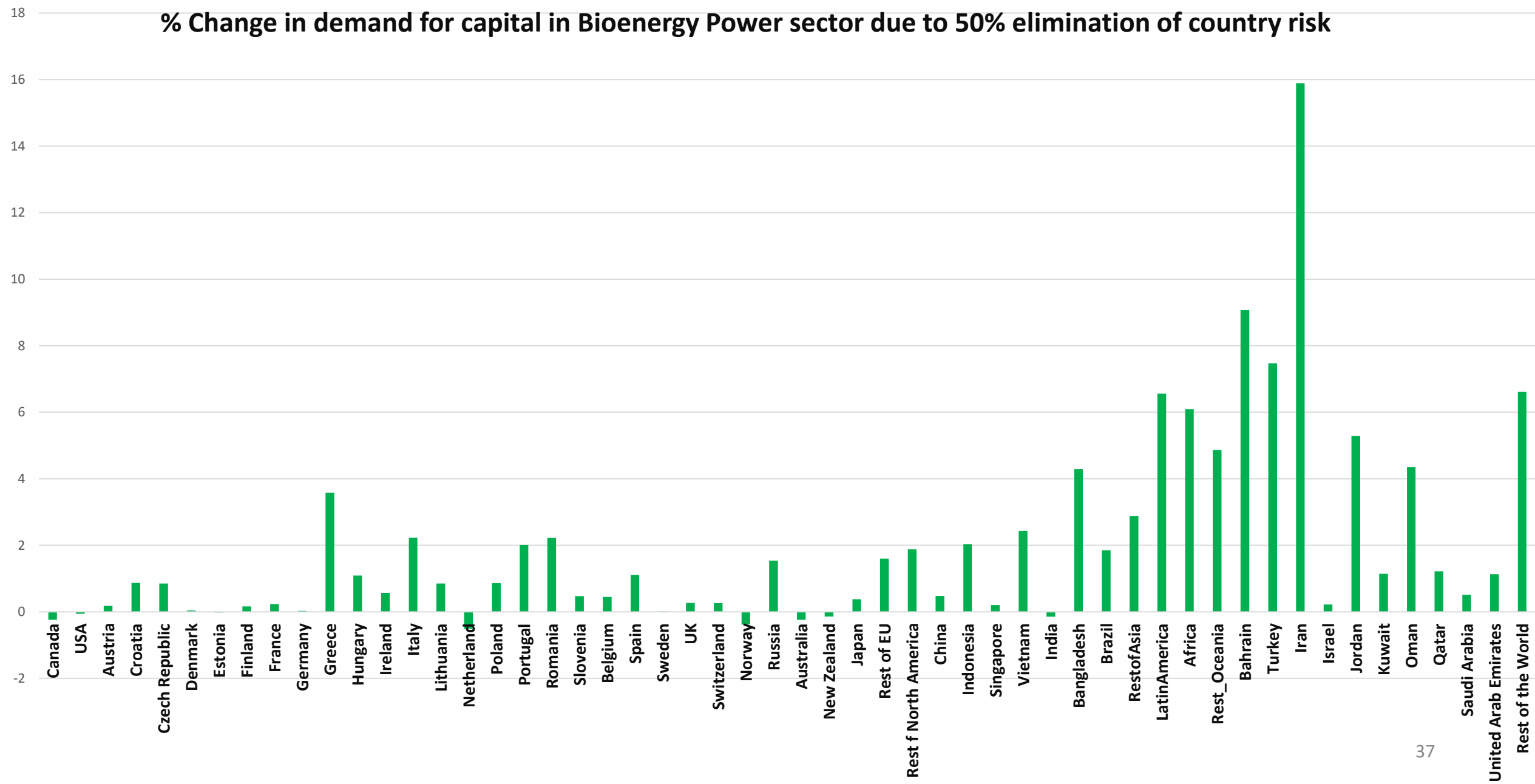


**(ii). Moderately Ambitious
Scenario of 50%
elimination of Country
Risk.**

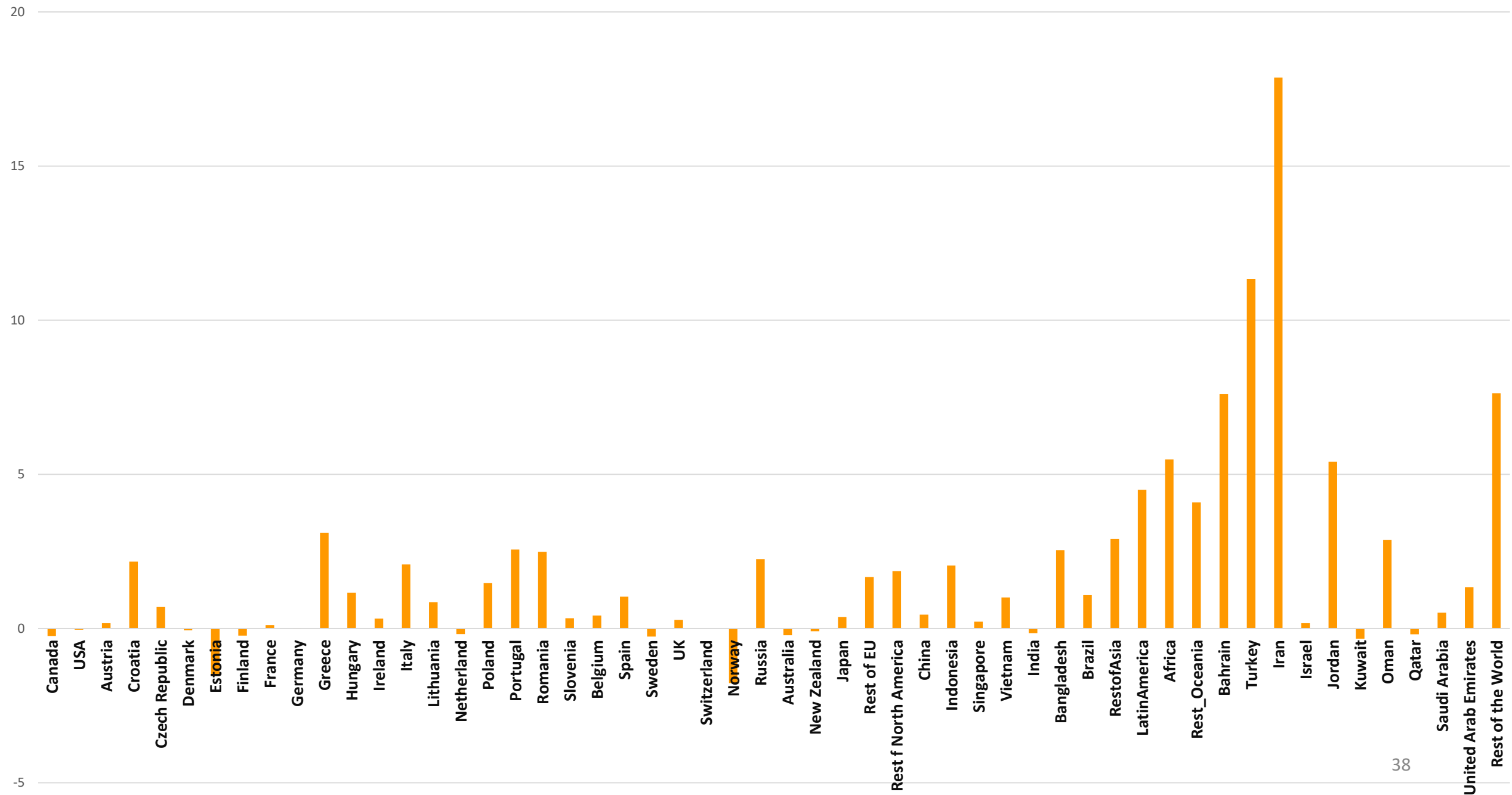
% Change in demand for capital in Wind Energy due to 50% elimination of country risk



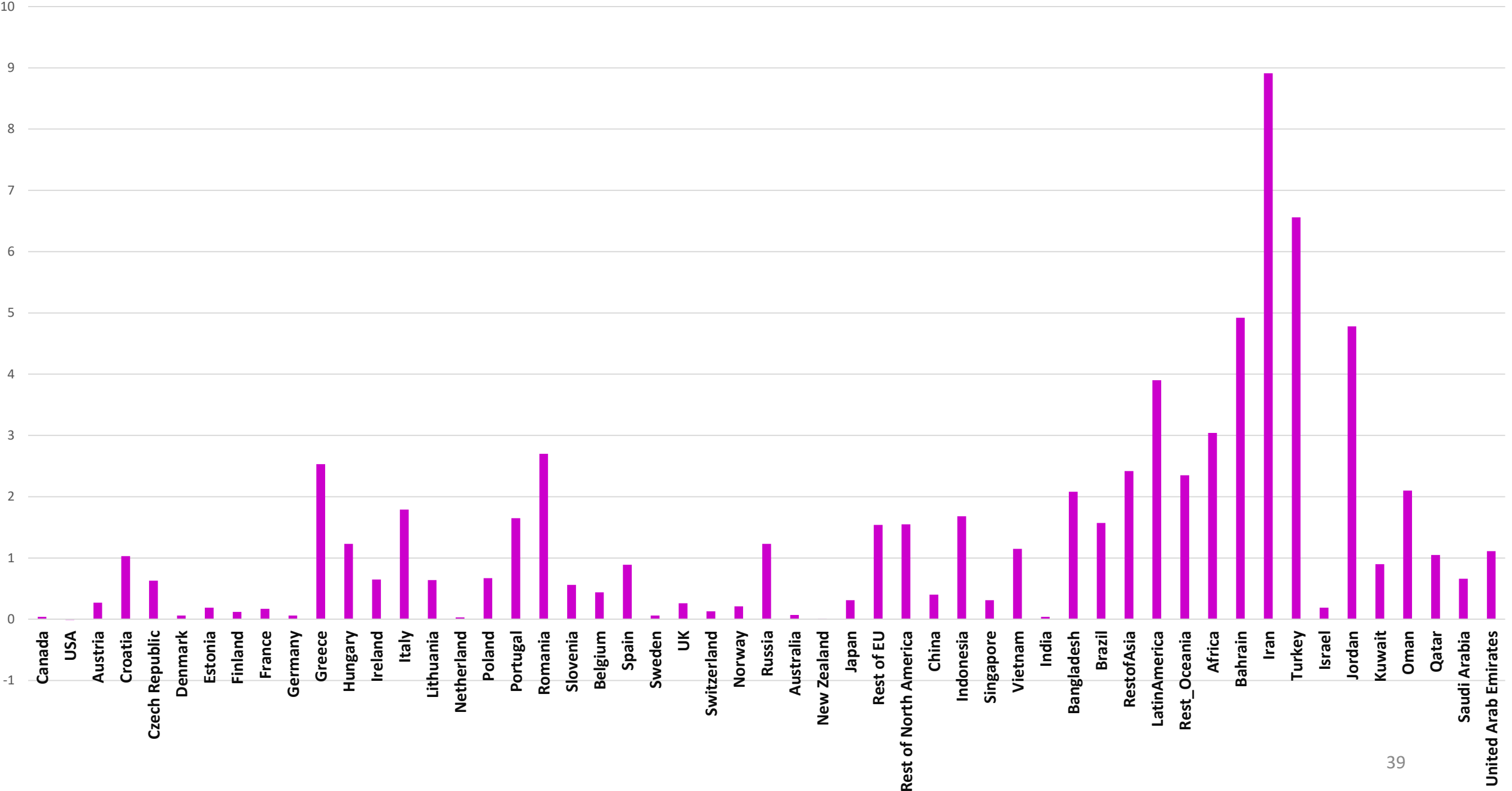
% Change in demand for capital in Bioenergy Power sector due to 50% elimination of country risk



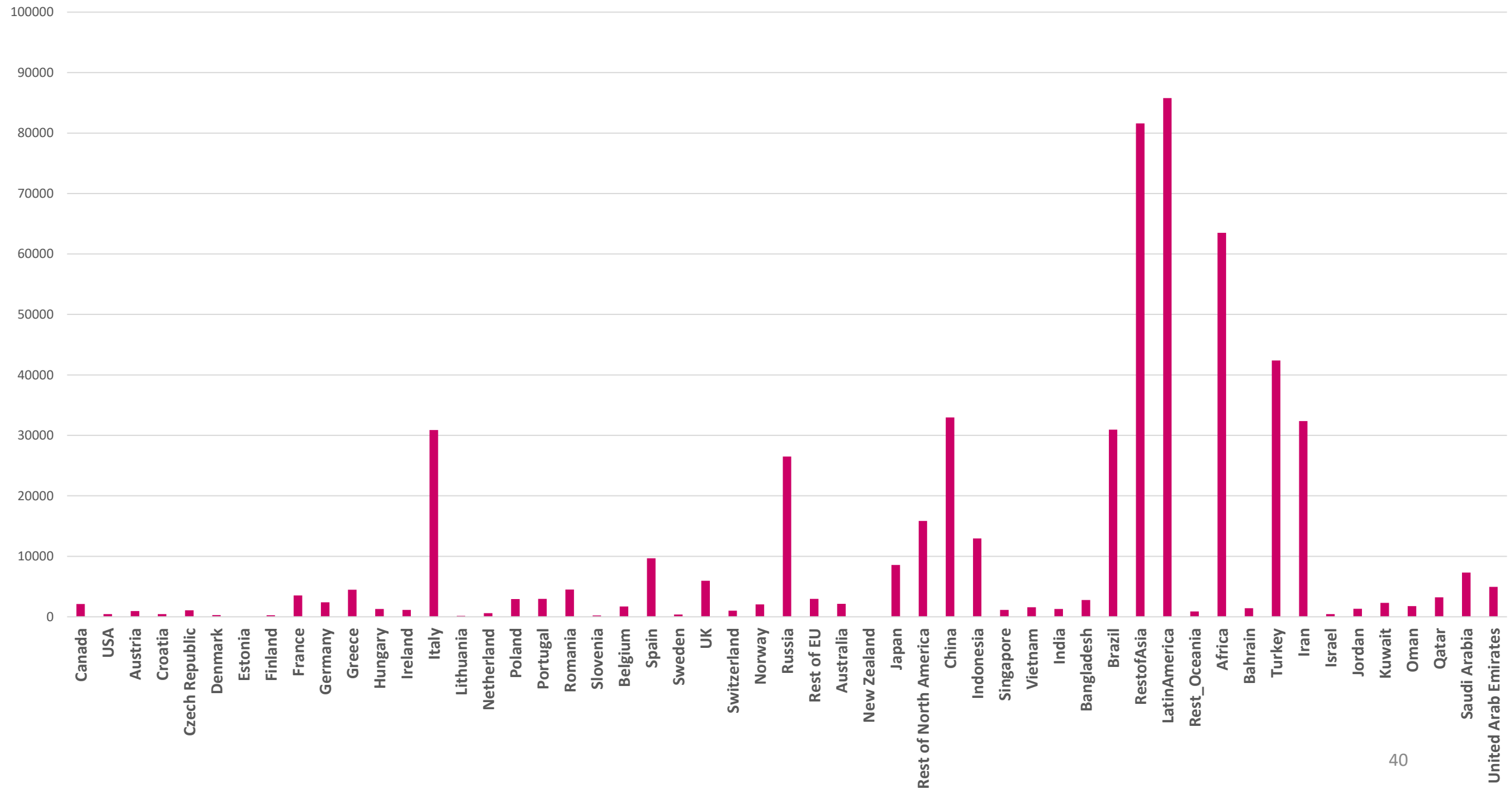
% Change in demand for capital in Solar Power sector due to 50% elimination of country risk



% change in GDP due to elimination of 50% of country risk



Change in Welfare due to 50% elimination of country risk (in Million US\$)



Ways to mobilize private investors on renewable energy projects:

- Tax incentives to domestic investors
- Standardized contracts
- Financial instruments like Green Bonds
- Promoting “Sustainable Energy Trade Agreements” between countries.

THANK YOU