GLOBAL ENERGY SECTOR: LOW-CARBON GROWTH OPTIONS

Responding to a request from the German government, the International Renewable Energy Agency (IRENA) and the International Energy Agency (IEA) have shed light on the essential elements of an energy sector transition consistent with limiting the rise in global temperature to below 2°C with a probability of 66%, in line with the Paris Agreement.

The overarching objective of the joint study was to analyse the scale and scope of investment in low-carbon technologies in power generation, transport, buildings and industry (including heating and cooling) necessary to facilitate energy transition in a cost-effective manner, while also working towards other policy goals. The report findings will inform G20 work on energy and climate in the context of the 2017 German G20 presidency.

Despite the diverse approaches and models used by the IEA and IRENA, high-level outcomes show important similarities and support the necessity of a pathway and framework for the timely transition of the global energy sector. Energy demand projections, for example, vary by less than 10%. Both organisations foresee energy efficiency and renewable energy accounting for the majority of the total effort needed to reduce energy-related CO_2 emissions by 2050. Under the IEA analysis these technologies account for a 72% reduction in emissions, while the IRENA analysis shows a 90% reduction contribution. Both analyses also indicate growing electrification of end-use sectors in combination with carbon-free power generation and growing use of bioenergy as key options to mitigate energy sector CO_2 emissions.

Despite the significant uncertainty that surrounds projections of more than three decades into the future, it is evident that agreement exists on the means for energy sector decarbonisation. In respect of cost estimates, total investment needs range from USD 123 trillion to USD 150 trillion for the 2015-50 period (Table 1). This difference can be explained by the uncertainty of investment estimates for a 35-year period, while also reflecting the inherent uncertainty in the deployment of low-carbon technologies. When compared to the Reference Case, however, the incremental investment needs of both studies are remarkably similar, ranging from USD 26 trillion (IEA) to USD 29 trillion (IRENA). These figures, annualised, are equivalent to 0.3% (IEA) to 0.4% (IRENA) of total global gross domestic product (GDP) in 2050. Again, this suggests that the IEA and IRENA results are aligned as to the economic requirements of the energy transition.

The joint study analyses the scale and scope of investment needed in low-carbon technologies in power generation, transport, buildings and industry.

Table 1: Comparison of quantitative findings in IRENA and IEA studies for the year 2050

	Unit	IRENA	IEA
Total primary energy supply (TPES)	EJ/yr	640	590
Total final consumption	EJ/yr	440	400
Renewable energy share of TPES	%	65	45
Fossil fuel CO_2 emissions in 2050			
Reference Case	Gt/yr	40.2	37.0
Decarbonisation (REmap and 2°C Scenario)	Gt/yr	9.4	9.0
Contribution of abatement options			
Renewable energy	%	45	36
Energy efficiency (including electrification)	%	45	36
Others	%	10	28
Total investment for decarbonisation 2015-50 (excluding stranded assets)	USD trillion	150	123
Energy intensity improvements	%/yr	2.5	3.0
Electric mobility in transport	%	24	30
Total biomass demand	EJ/yr	130	119

Notes: All 2050 figures are projections based on the IRENA REmap case and the IEA 66% 2°C Scenario unless explicitly stated; the Reference Case is the most likely case based on current and planned policies and expected market developments; the REmap case is a low-carbon technology pathway that goes beyond the Reference Case for an energy transition to decarbonise the energy system in line with the goal in the Paris Agreement of limiting global temperature rise to less than 2°C above pre-industrial levels with a 66% probability; EJ = exajoule; Gt = gigatonne; yr = year.

Other findings differ, however, including those in relation to stranded assets. While the IEA focuses on stranded assets on the energy supply side (upstream fuel supply and power generation), IRENA also includes the end-use sectors of industry and buildings in its analysis. The buildings sector alone leads to a difference of around USD 5 trillion. Also noteworthy is that while the IEA strictly values fossil fuel production in terms of installations and past exploration and development costs, IRENA also values the fossil fuel reserves that have to stay underground, creating a contrast of around USD 3 trillion. The resulting difference is significant, with the IEA forecasting USD 850 billion of stranded assets and IRENA forecasting USD 10 trillion. These divergent values, however, do not contradict each other, but instead reflect a different understanding of what should be included in stranded asset valuations.

An additional contribution to the analysis is IRENA's estimation of the macroeconomic implications of this energy transition. Its analysis finds that economic growth can be fuelled and new employment opportunities created. Decarbonising the global energy system, as set out in the IRENA analysis, would increase global GDP by 0.8% in 2050 (USD 1.6 trillion per year), a cumulative gain of USD 19 trillion from 2015 to 2050. Increased economic growth is driven by the investment stimulus and enhanced pro-growth policies, in particular the use of carbon pricing and the recycling of proceeds into lower income taxes.

Important structural economic changes would also take place. While fossil fuel industries would incur the largest reductions in sectoral output, those related to capital goods, services and bioenergy would experience the greatest increases. The renewable energy sector alone could support around 25 million jobs in 2050, up from 9.4 million in 2015. New job creation in renewables and energy efficiency would more than offset the job losses in the conventional energy sector. In fact, net energy sector employment (including in energy efficiency) would be higher by 6 million additional workers in 2050 compared to the Reference Case. The overall increase in GDP would induce further job creation in other economic sectors.

Inconclusion, this is strongevidencethataccelerated deployment of energy efficiency and renewable energy constitutes the core of a successful, and economically viable, implementation strategy for the Paris Agreement.

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