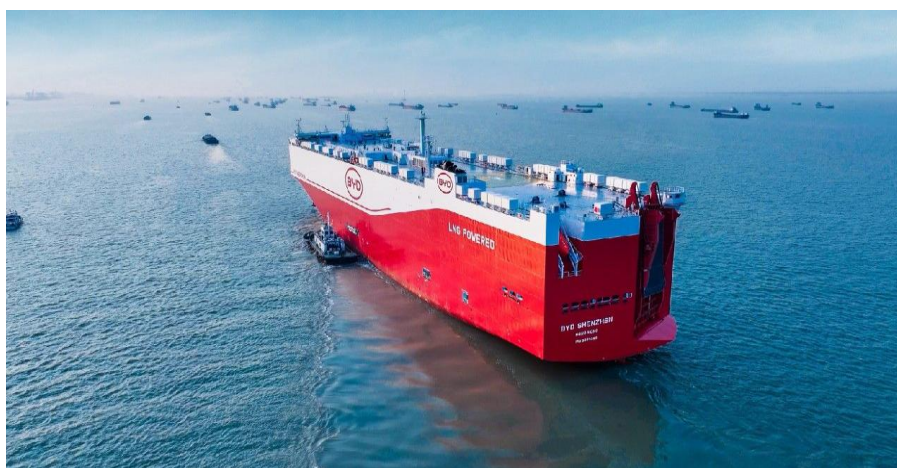


Global Energy Scenarios¹

Daslav Brkic and Roberto Mori



ABSTRACT

The migration of investments in energy systems towards new “green” technologies continues. In spite of the evident slowdown and indeed in some countries policy reversals, the “Energy Transition” continues its progress, albeit at a slower pace than originally forecast or desired. Even beyond the obvious advantages of lower emissions, the critical factors of success over the last decade have been economic: the rapid cost reduction in the applications of solar and wind-based systems to produce electric power competitively with other sources; the penetration in some markets – particularly in China and in northern European countries - of electric vehicles, also with substantial economic benefits throughout their life-cycle.

Therefore, the majority of players in the energy industry see significant transformations over the next decades. Primarily, a rapid increase in the demand for electric power, globally, which will more than double by 2050, to be satisfied by the rapid further development of generation systems based on renewable energy sources as well as on natural gas, whose demand should also grow substantially, particularly in the form of LNG. The nuclear power industry is undergoing a substantial revival. These systems with generation plants closer to the consumption also tend to provide a higher level of supply security.

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The demand for oil and coal should peak over the next decade and reach a plateau, and then start a slow decline, due – for oil – to the introduction of ever more efficient transportation engines and electric vehicles, and - for coal - to its replacement with natural gas and renewable energy sources. Therefore, by 2060 we expect the fossil fuels to account for only 40 % of the global primary energy supply, vs. about 80 % today. Inevitably, these profound changes will impact the CAPEX investments in the energy industry: following the trend already observed over the last decade, we will see the gradual slowdown of the investments in the traditional Oil & Gas industry, with the parallel increase in new ‘green’ ways of producing and transporting energy.

The supply difficulties caused by the current wars in the Middle East will actually accelerate the trends towards the energy transition, since renewable and nuclear sources are typically much closer to the energy consumption centers, without the need for long-distance shipments of oil & gas from or across low-security geographies.

INTRODUCTION

Modern project management developed in the post-World War II period in the military and infrastructure sectors, but it had its broadest growth and evolution in the oil & gas and petrochemical industry of the 1950s and 60s, when the world leaders in the sector – the famous “Seven Sisters” – began to develop increasingly complex, high-risk and capital-intensive projects: refineries, petrochemical plants, exploration, extraction, storage, transport, and distribution infrastructures. During those years, planning techniques such as PERT/CPM were born along with the EPC (Engineering, Procurement, Construction) contractual model, with its many facets that greatly influenced the development of contract management as a vital skill for this type of project. But before IPMA (International Project Management Association), the oldest project management association, and PMI (Project Management Institute) were founded in 1965 and 1969 respectively, the 'seven sisters' had already taken steps to systematize the best project management practices that contractors had to apply in managing the projects assigned to them. Project managers of a certain age will remember when those customers required compliance with these project management procedures (“basic practice”), which became an integral part of the contractual documents.

As anyone who has been involved in the execution of projects in this sector well knows, they require a strong emphasis on engineering aspects. In other words, project management must take these aspects into account, which are in turn related to the type of plant subject of the project. In the current global context and foreseeable future, it may therefore be of interest to the project management teams that these future projects will have to manage, to know the types of plants that will presumably be involved, and consequently the technical characteristics that can be derived from such types and which project management will have to take into account.

This article offers an overview of the oil & gas industry in the short and medium term in order to allow the interested reader to reason about the types of plants that could presumably be conceived and implemented in response to the evolution of the described scenarios.

SCENARIOS

Energy plant engineering, the migration of investments towards new “green” technologies is growing

“Hard pounding this, gentleman; let’s see who will pound the longest,” said the “Iron Duke” Wellington at the climax of the Battle of Waterloo. This phrase comes to mind when observing the energy world today, where two factions are battling: those who believe in it and continue on the path of transition, like the EU, China, and many countries of the “Global South”; and those openly opposed, even though the reversal of U.S. policies will probably have a marginal impact globally. The undertaken march continues, encouraged—beyond the always very important environmental considerations—by two economic factors: the use of renewable sources and electric cars is now cheaper compared to traditional technologies based on fossil fuels; moreover, many states have understood that wind and photovoltaic plants installed in their own country contribute to energy independence and avoid dependence, often coercive, on imports of Oil & Gas or coal. For China, this is an essential aspect.

In the opening photo, many indicative trends can be seen:

- the very modern ship is powered by liquefied natural gas – in fact, there are more than a thousand ships that “run on gas,” sailing the seas all over the world, and thousands more have been ordered;
- the ship transports Chinese electric cars to the West;
- the manufacturer BYD, a newcomer, which in 2025 has already become the third largest car manufacturer in the world;
- we are in China, a country today leading in 'green' technologies: the export value of these high-tech products in the past year exceeded that of Oil & Gas from the United States! China has installed more wind systems and has more nuclear plants currently under construction than the rest of the world all together; it produces 80% of the equipment for photovoltaics. Their technological development, economies of scale, and industrial learning curve have made the Energy Transition feasible and economically attractive.

In light of current global policies, most players see the following transformations in the world of energy and consequently in investments in energy plant engineering:

Global energy demand

Global demand is expected to increase by about 10% within ten years, then level off to a plateau (Figure 1), seeking a balance point between the increase in demand (growth of the world

population, prosperity, industrial production, etc.) and better energy efficiency. In the case of stricter new environmental policies on emissions, demand could start to decrease later. But a “Net Zero” scenario, with zero CO2 emissions by 2050, currently does not appear realistic.

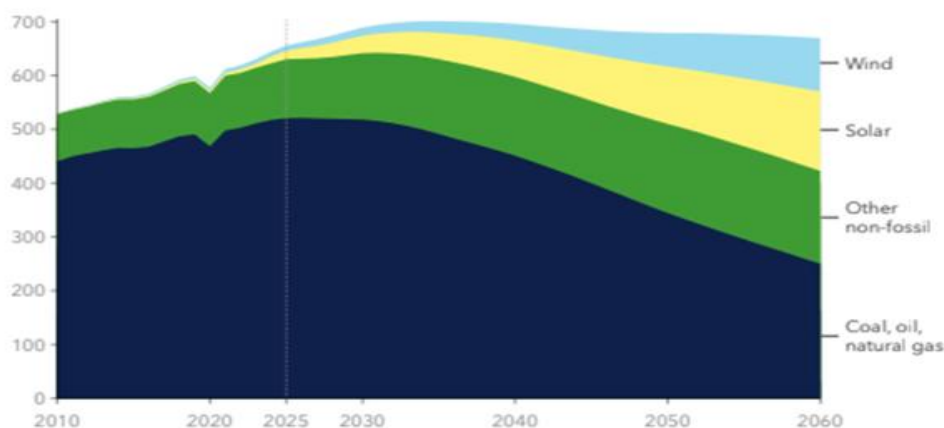


Figure 1: Global primary energy demand (Source: DNV Energy Outlook 2026)

The future is electric

A crucial factor in the future will be the rapid increase in demand for electricity, which is expected to more than double in the coming decades (Figure 2): greater prosperity in the world, increased use of air conditioning and various electrical appliances, both civil and industrial, and last-but-not-least an explosion in the demands of new data centers.

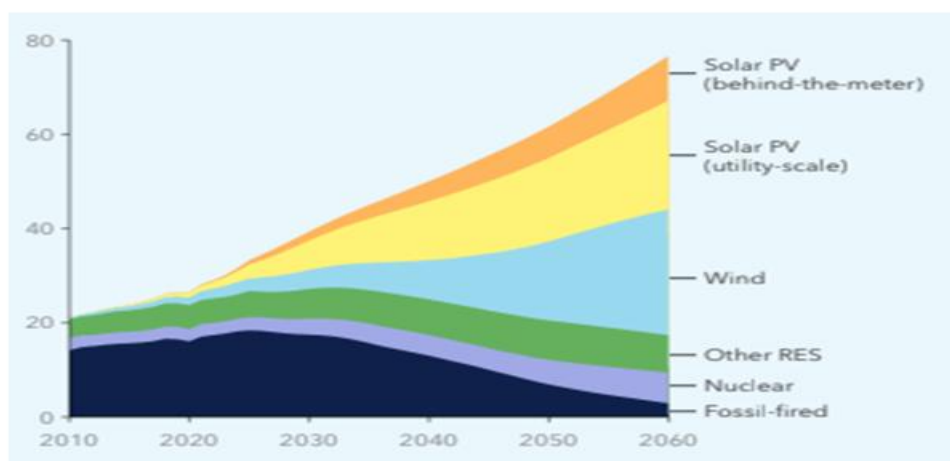


Figure 2: Global electric power demand (DNV Energy Outlook 2026)

This increase will be met predominantly by renewable sources, mainly photovoltaic and wind, which are growing rapidly almost worldwide after a reduction in production costs of 80% over

the past ten years. The International Energy Agency predicts a doubling of installed capacity by 2030 (Figure 3).

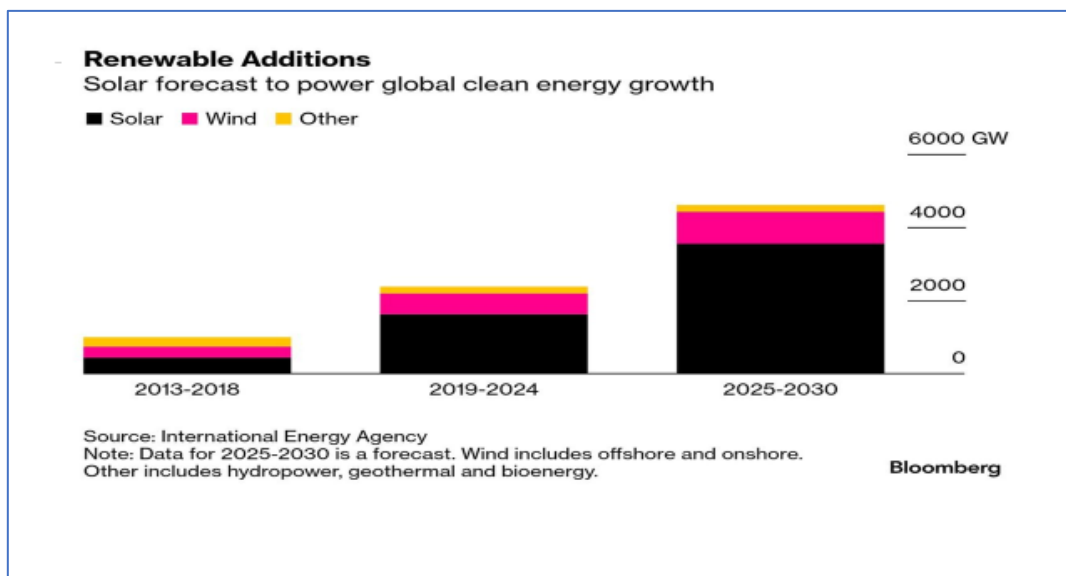


Figure 3: Power from renewable energy sources to double by 2030 (Source: International Energy Agency)

These renewable but by their nature intermittent solutions will increasingly be accompanied by gas plants, industrial batteries, or other energy storage systems. The main drivers are China and Asia, Europe, but also numerous other developed and developing countries, which are more than compensating for the slowdown in the United States (Figure 4).

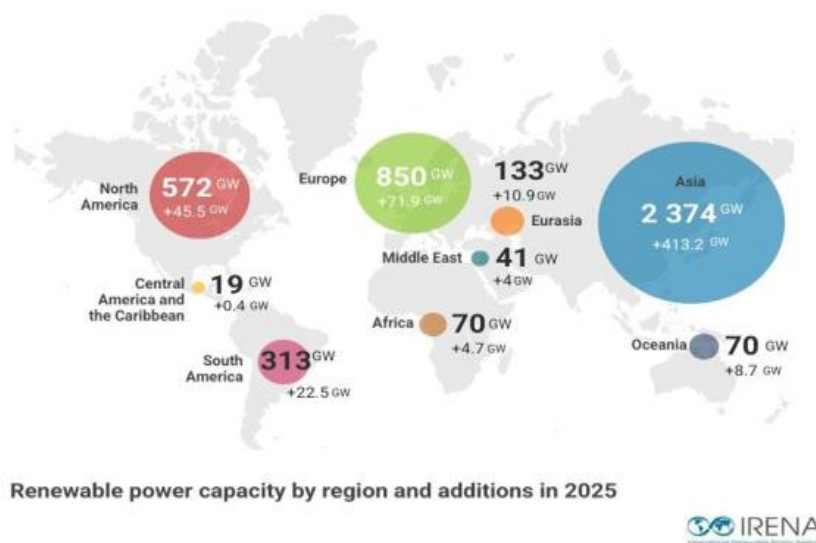


Figure 4: Renewable power capacity and additions in 2025 (Source: IRENA February 2026)

Part of this growing demand will also be met by a strong return to nuclear power, facilitated by the spread of SMRs (Small Modular Reactors). The use of coal, which is in decline due to harmful emissions, could also increase in the short term, bringing back into service plants that were shut down and placed in mothballing, before likely beginning a decline in the next decade, as other technologies (renewables, natural gas) gain ground with significant economic and environmental benefits.

Oil & Gas

With current policies, the demand for natural gas is expected to grow in the coming decades by around 25%, likely reaching a plateau by the middle of this century, due to increasing industrial activity, global heating, and contribution to electricity generation, both as a base-load fuel and as a peak shaver, that is, as a companion to renewables to offset their intermittency (Figure 5). In many situations, natural gas is already replacing coal and fuel oil. By around 2050, more than a third of all the natural gas produced worldwide will cross the oceans as LNG, a sector of great vitality, where demand is expected to double by 2050, with related major opportunities for plant engineering. Furthermore, the direct use of LNG as fuel for maritime and road commercial transport is becoming increasingly common.

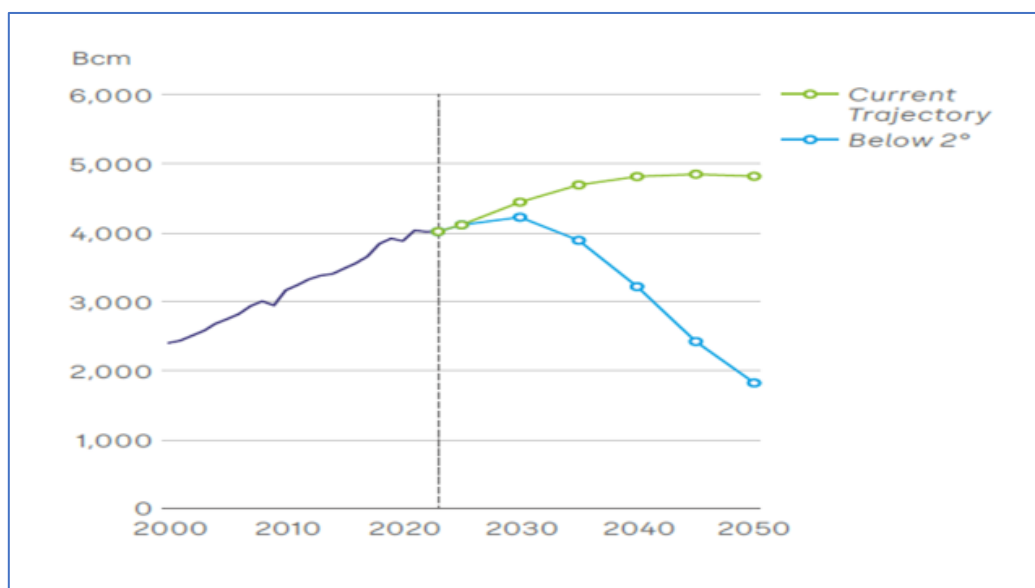


Figure 5: Global demand for natural gas (Source: BP Energy Outlook 2026)

On the other hand, oil demand is expected to grow over the next decade in a modest way compared to current levels, reaching a maximum (peak oil) around 2030, and then beginning a slow decline (Figure 6).

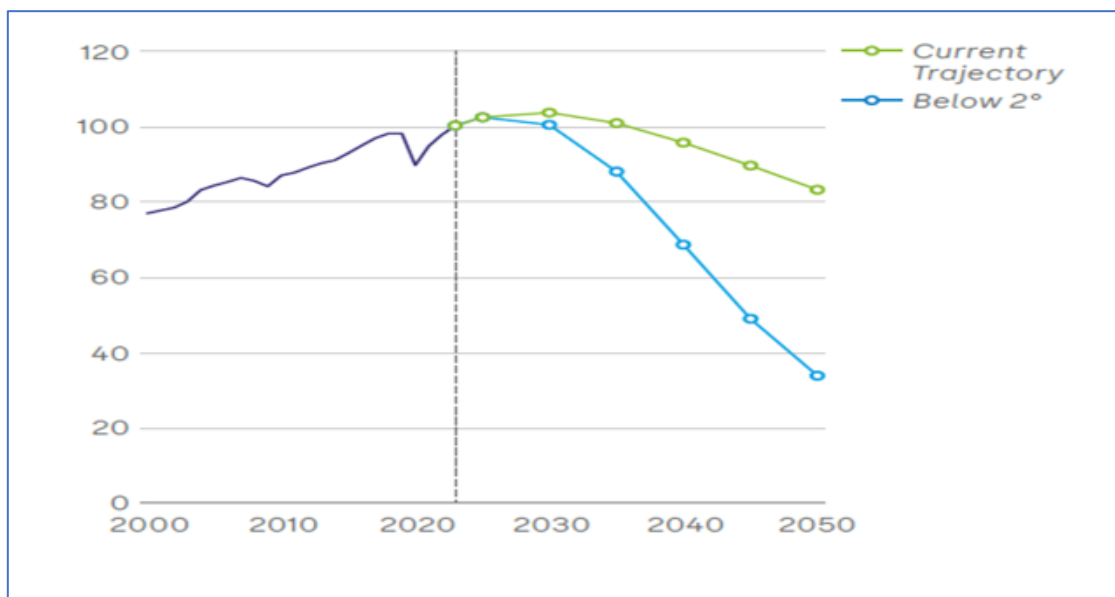


Figure 6: Global oil demand (BP Energy Outlook 2026)

This expectation is shared by most operators, including OPEC (Figure 7). The uncertainty only concerns the timing and the level of the plateau.

The current spike in prices due to the wars in the Middle East – if lengthy - might further enhance these trends: lower the demand for oil and to some extent also of natural gas.



Figure 7: Global oil demand, as forecast by key players (WoodMackenzie 2025)

This trend is caused by increasingly efficient engines, the spread of electric cars, the future of which is considered certain: according to a very recent study by the U.S. Bloomberg NEF, in 2040 the annual sales of such vehicles should reach 70 million units, more than half of which in China, a country that is a leader both technologically and commercially (Figure 8). In China, more electric cars are already sold today than all cars in the USA. With the lower prices they can achieve thanks to these enormous economies of scale, with the learning curve and with their production increasingly globalizing, it is only a matter of time before they conquer a significant portion of the world markets. Even in the USA, despite the current administration's aversion to such cars, ever greater penetration is expected, reaching 27% sales already by 2030, although this figure is lower compared to the forecasts from a year ago.

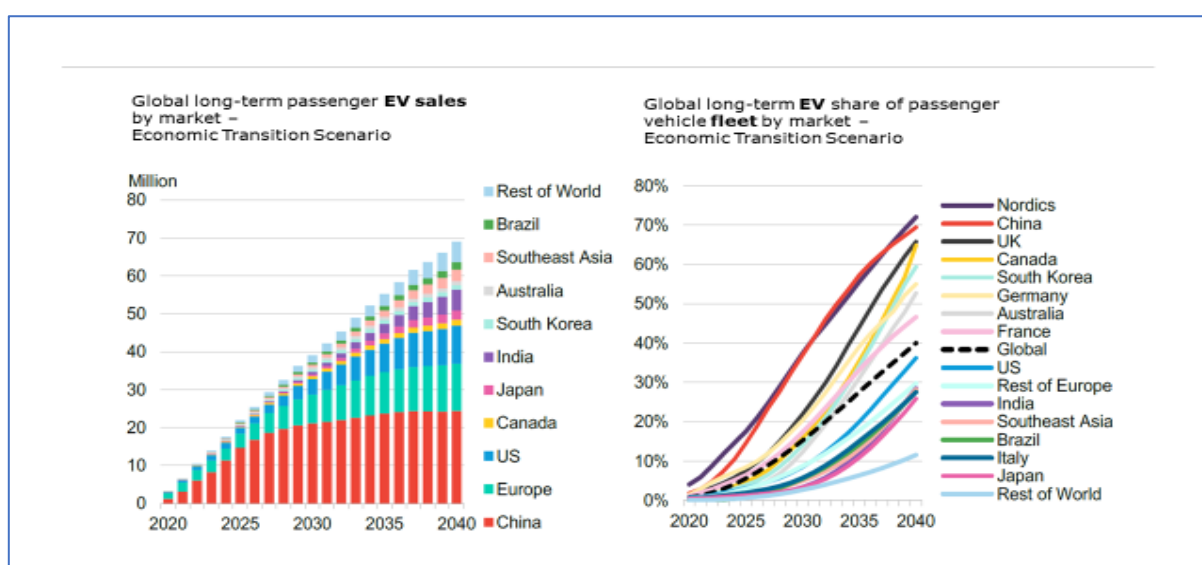


Figure 8: Global electric vehicle sales and fleet composition (Bloomberg August 2025)

“Green” and “Blue” Hydrogen

Over the past 12 months, more than 500 FIDs (Final Investment Decisions) for new hydrogen projects have been signed, with a total value of over 110 billion dollars. But so far, significant reductions in its production cost toward levels competitive with other energy solutions have not been seen. Therefore, "the jury is still out." However, all players agree that this energy vector will have a great future – but later, after the results of the many projects currently in development or under implementation. The CCS (Carbon Capture and Sequestration) solution, on the other hand, seems very attractive, constantly rising, and by producing "blue" hydrogen allows the decarbonization of natural gas reserves. There are many new projects underway – but here too we will have to wait for the results of technological-industrial development with the related economics, as well as the future strategies of governments, after these initial phases of development.

(Note: Hydrogen is classified by 'colors' based on the production method and environmental impact. Gray hydrogen is the most common, produced from methane with high emissions of CO2. Green hydrogen is produced through water electrolysis using renewable energy (zero emissions), while blue hydrogen comes from fossil fuels with CO2 capture. Green is 100% sustainable, but expensive; blue is a low-emission transition. Both are crucial for 2050 decarbonization.)

Investments in the coming decades: Oil & Gas vs. new green technologies

Consequently, for several years we have been witnessing a slow but steady 'migration' of investments from traditional sectors to new and green ones (Figure 9). After the recovery of the Oil & Gas industry in the post-Covid years 2021-2024, the CAPEX forecast for 2025 in upstream shows a slight decrease compared to last year, due to the great uncertainty at the current moment - geopolitics, tariffs, world economy, Ukraine, Middle East, etc., etc. This is the first time this has happened since the Covid crisis.

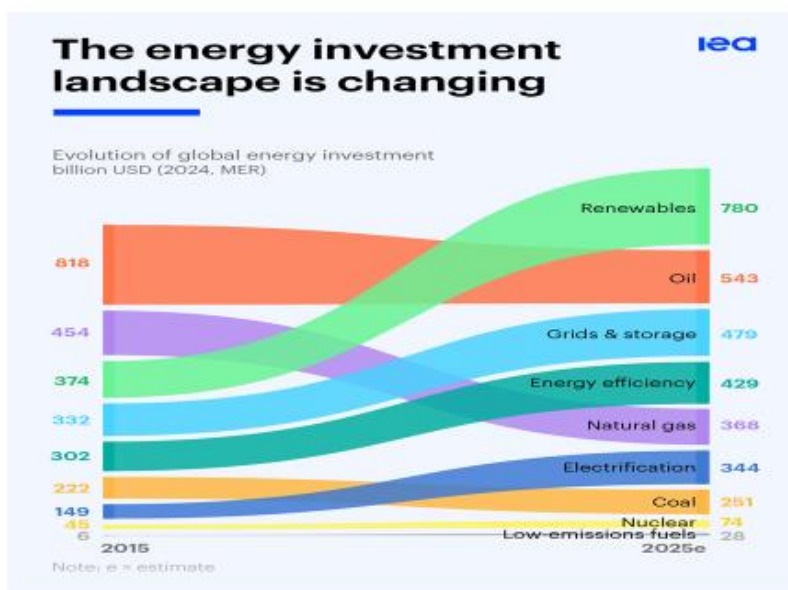


Figure 9: (Source: International Energy Agency 2025)

In perspective, however, we foresee a significant growth in investments in the renewable sector, both in solar and onshore and offshore wind, and of the very important electric networks, for example the major lines that go from renewable sources to large consumption centers (Figure 10), while investments in the traditional world of fossil fuels should gradually decrease. Obviously, the transformation of supply chains from the "traditional" to the "new" will be indispensable, and is already underway.

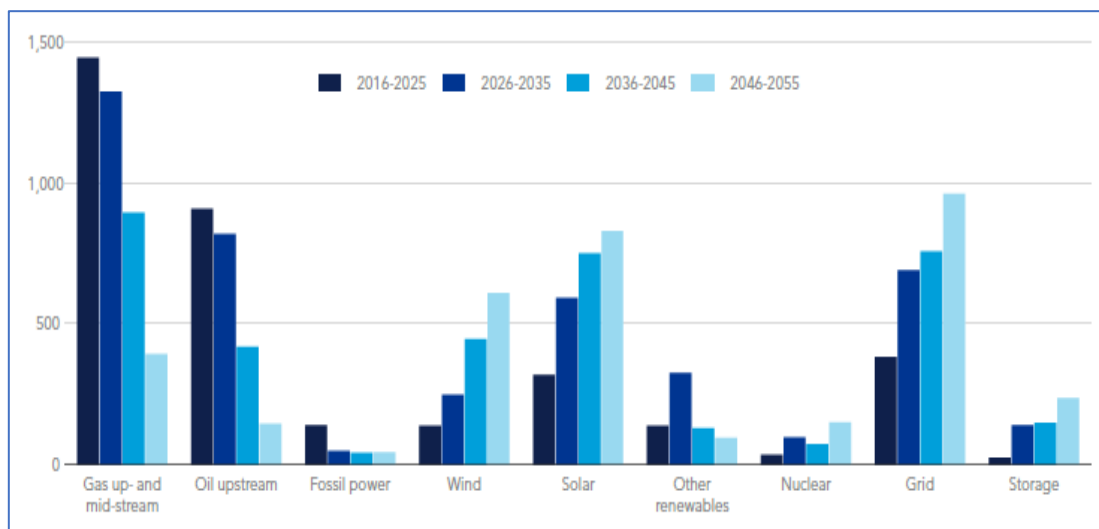


Figure 10: Global energy investment in key areas (Source: DNV Energy Outlook 2026)

Impact on the increase of Earth's temperature

The current Energy Transition, with today's policies, will not be sufficient to limit the increase in the planet's temperature by the end of the century within the +2°C limit defined by the Paris COP a decade ago, with the hope of containing it within +1.5°C. According to the very recent study by the United Nations Environment Program, with current policies we are heading towards +2.8°C – certainly better than the possible increase of about 4°C in the absence of these mitigation actions. A “half-full glass”, in short.

CONCLUSIONS

We live in times of rapid breakthroughs in new technologies, for example in geothermal, direct air capture of CO₂, possibly nuclear fusion, etc., which should provide a further contribution to the energy landscape and lower emissions. In the end, future directions will be defined by disruptive technological development.

Paradoxically, even if the transition seems to have gone out of fashion, investments continue and in the United States the growth in stock market value of listed companies active in the sector surpasses that of the S&P and Nasdaq indices.

In summary, the crucial question is not 'if' the Energy Transition will continue, but 'with what intensity.'

According to the already mentioned very recent study by DNV (Figure 1), by 2060 only about 40% of the global primary energy demand will be met by fossil sources, compared to 80% today – the rest by renewables, nuclear, geothermal, etc.

About the Authors



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Daslav Brkic is a corporate management consultant for marketing and business development, with decades of experience in the engineering industry in the Oil & Gas, environment, power, and telecommunications sectors. Visiting Professor at the Graduate School of Management and the Department of Chemical Engineering of the Politecnico di Milano, the BiG Academy, and the Baker Hughes University of Florence. He has also taught at the International Business School of the Gubkin State University of Oil & Gas in Moscow. His experience includes multiple roles in business development, sales, technology development, licensing, and strategic planning in the U.S.A., the United Kingdom, the Netherlands, and Italy, initially with Honeywell UOP, ABB, and Sirti. From 2002 to 2016 he was at Saipem (the first years at Snamprogetti), where as Senior Vice President he directed business development, strategic planning, external communication and institutional relations, technology development, and licensing.

After graduating in Chemical Engineering from the Politecnico di Milano in 1975, he obtained in 1979 a Ph.D. in Chemical Engineering from a joint program between the Politecnico di Erlangen–Nuremberg, Germany, and the Politecnico di Milano. Subsequently, he attended the M.B.A. program at the University of Chicago and executive courses in industrial strategy at Stanford University and the Corporate Universities of ABB and Eni. Today he is Editorial Director of the magazines “Impiantistica Italiana” and “Industrial Plants” and a consultant for the ANIMP Study Center; an associate member of the CEEPR - Center for Energy and Environmental Policy Research at MIT and of the Paris Energy Club. He has been Vice President of ANIMP, Advisor and board member of Assomineraria, the World Energy Council, the Society of Petroleum Engineers, and other international and Italian industrial associations; he has also been a member of the Committees for Internationalization of the industrial Italian associations Confindustria and Assolombarda.

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Roberto Mori has been member of the Italian National Association of Plant Engineering (ANIMP) since the early 90's, taking major part in the activities performed by its Project Management Section, IPMA Italy, of which he has been President till February 2015. Information about ANIMP can be found at www.animp.it/IPMA

He has been Chairman of International Project Management Association (IPMA) 2013- 2014, after having served as Vice President and President for four years. He has been Prize Winner of the IPMA Project Excellence Award 2006 and obtained the IPMA Otto Zieglmeier's Award for Excellent Project Management Performance in 2008. Today he is IPMA Honorary Fellow and member of the IPMA Ethics Committee after having served as its Chair for three years. More about IPMA at www.ipma.ch

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