Professor Jean-Michel Glashant, Professor Andries Bollino, ,
Distinguished faculty, excellencies, friends, Ladies and gentlemen,

I am profoundly honored to address the 18th IAEE European Conference. This year is particularly memorable as I was also given the privilege to speak at the IAEE's 44th Annual Conference in Riyadh. I am thrilled to share the stage with esteemed officials from IAEE and various multilateral organizations, including my friend, Dr. Birol. [54]

For much of my career, Dr. Birol and I have crossed paths numerous times, often sharing insights on energy security and sustainability on global platforms. While our perspectives may vary, they are often complementary, mirroring the theme of this conference.[40]

When energy security dominated global discourse, we both highlighted the importance of addressing both the supply and demand aspects of energy security. We emphasized the need for maintaining an open dialogue that would cater to the diverse perspectives at different levels, considering both "net importers" and net exporters from developing countries. [53]

While concerns of climate change overshadowed energy security for decades, the war in Ukraine has thrust it back to center stage. An equally crucial yet often neglected energy driver is affordable access to energy services. Therefore, the shift towards decarbonization must equitably address all three pillars of the Energy Trilemma. [50]

The war's ramifications, and COVID-19's repercussions, represent two recent energy related developments that have reshaped our approach to the energy transition. Both events have changed our perception of the energy trilemma, which should compel governments, multi-lateral organizations and industry to revisit their scenarios and strategies, especially concerning energy supply chains, trade flows and investments. [54]

Decarbonization of the complex global energy system is intricate, with various potential paths. Each nation or economic region has its unique journey, influenced by resources, technology, development stages, and sometimes ideologies. Leveraging models and scenarios, we can blend optimal technology and policy tools, for viable pathways, updating them as new insights and technologies emerge. This rational approach, grounded in

past energy developments, is more likely to pave a less risky, more cost-effective, and inclusive path. [76]

Numerous scenario-driven pathways have been studied. For instance, the IPCC's AR6 examined around 1200. Some are advocated as optimal for achieving the Paris Agreement goal of limiting global temperature rise to less than 1.5 C, like the IEA's NZE2050 pathway showcased in WEO2021. This scenario assumes a priori renewables will be the overwhelming primary energy source by 2050 and works backward to derive policies for this premise. It appeals to many governments, and the public, given the rapidly decreasing costs of solar and wind energy over the past two decades, assisted by substantial subsidies, which accelerated their deployment, in OECD, China and even in large oil and gas producers like UAE and Saudi Arabia. However, such scenarios underestimate sizable challenges like providing massive storage and sufficient backup capacity for grids' stability and to ensure meeting demand always . [137]

Despite the strong policy push and massive investments in renewable over the last two decades, the world still lags well behind NZE2050 milestones, with the energy demand continue to rise, even in Europe and share of fossil sources remaining around

80%. The problem, as Dan Yergin put it succinctly at the 44th IAEE conference, the math for reaching NZE by 2050 does not add up, when only Europe, and most OECD countries, and a handful of small economies have pledged or enacted laws to achieve this, while countries like China and India have more extended timelines, 2060 and 2070 respectively, and many others have either not pledged at all or stated it's impossible without huge funding and technology transfer from developed countries. This divide was a point of contention at the recent COP meetings, including COP27 and will likely resurface at COP 28. [146]

Dr. Sultan AlJaber, the President of COP28, recently emphasized the need for all stakeholders to commit to the Paris agreement goals as the guiding North Star. He introduced a four-pillar plan: fast-tracking the energy transition, fixing climate finance, focusing on people's lives and livelihoods, and full inclusivity. The plan would include a multi-fold expansion of renewable globally and a smooth phase-down of fossil fuels. His approach contrasts with popular but risky calls by some countries to phase out fossil fuels and a halt to investments in new oil and gas immediately, echoed unfortunately recently by the UN Secretary General and the IEA. With no immediate replacement available, annual supply

would decrease naturally, fuel prices and volatility will jump ski high, harming world economy. [123]
We must be cautious placing a premature bet on the dominance of renewables, not sidelining other available and promising low-carbon sources, such as nuclear, a proven, mature, safe, and competitive low-carbon energy. [Don’t put all eggs in one basket]

And that is why many hydrocarbon producing nations, like Saudi, UAE and others in the Gulf, are actively participating in the energy transition, not merely observing it emerging, introducing comprehensive sustainability agendas that touch upon various sectors. They are making large investments in reducing the carbon footprints of their industries, in renewables for domestic and export markets, nuclear, and energy efficiency, while maintaining sufficient investments in oil and gas, to meet rising demand from developing countries and reforming energy prices and governance, all at once" [85]

Finally, a crucial point to remember: achieving sustainability isn’t just about halting pollution - that’s necessary but not enough. We must also proactively remove exiting pollution in the atmosphere. Luckily, carbon dioxide removal (CDR) technologies, including

CCS based direct air capture (DAC), are maturing rapidly, but haven't gained enough traction in global discussions despite their critical role for achieving sustainability. Industrialized nations, who've contributed most of the 2500 Giga-tons CO_2 added to atmospheric over past 150 years, must assume responsibility, take a proactive stance removing say around 15%, potentially doubling the carbon budget remaining to 1.5 C limit – thus providing developing nations more time to contribute their share to sustainability. [otherwise there will be a need for massive direct transfer of trillions USD to developing countries]. [112]

In conclusion, the journey to decarbonize the global energy system and achieve the true sustainability requires open mind and continuous learning and adjustment of the transition pathways, paying equal attention to all three pillars of the energy Trilemma. The transition must be fair, inclusive, and improves the lives of all, especially the underprivileged. The IAEE plays a vital role in this journey through its research, publications, public awareness programs, and conferences.

Thank you all for your attention and for contributing to the ongoing search for practical pathways for energy transition to sustainability.