Energy and power: Do you know the difference between your sectors?

During my time working in the energy space, I've observed that many people use the terms energy sector and power sector interchangeably. Most speak similarly loosely when referring to the activities associated with each, for example energy planning versus power sector planning. Sometimes this is simply the shorthand of experienced practitioners, but occasionally it reveals a subtle misunderstanding.

This primer provides an overview of the energy and power sectors and argues why understanding the difference between them is key to understanding so much more.

Energy as an enabler of – well – everything!

Modern life as we know it depends on energy.

Sustainable economic development requires adequate, reliable, sustainable and affordable energy services. This makes the energy sector (or system) one of the fundamental enablers of our economic system, and something that underpins modern society. But this relationship is not a one-way street. Multiple links and feedback loops exist between these different systems – energy, economy and society. This is nicely illustrated in the diagram below from the International Renewable Energy Agency (IRENA)[1]. It shows the systems as nested layers, each one a core component of the next.

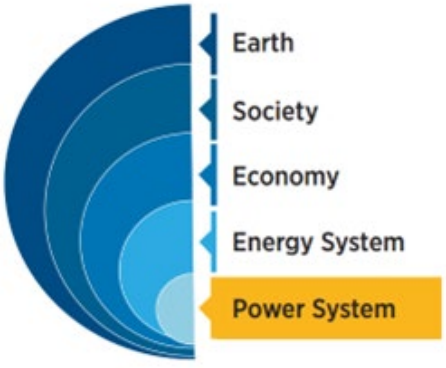

***Figure 1**: The embedded nature of power systems, and the wider picture*[1]

[1] IRENA. (2022). RE-organising power systems for the transition

These fundamental relationships of our world are why many definitions of 'the energy transition' address more than just energy. Fouquet and Pearson (2012)[2] define the energy transition as the switch from an economic system dependent on one or a series of energy sources and technologies to another. IRENA, in another of its publications[3], notes that the energy transition involves a profound economic, industrial and societal transformation, which could affect prosperity, employment, and social organization as much as the first Industrial Revolution!

While we all have an intuitive understanding of what energy is, how would we define the energy sector? The Inter-American Development Bank (IDB), in a publication on challenges and opportunities in the energy sector describes it as consisting of, "all economic activities related to the use of renewable and non-renewable resources for the production, delivery, and consumption of energy in its various forms, such as electricity, heat, or fuels for further processing, as well as the optimization of energy use through energy efficiency and conservation."[4]

So, what part does the power sector play?

The power sector (or the electricity sector) is a part of the energy sector, and physically entails all components related to the production, conversion, delivery, and use of *electric power*. This means all the tangible stuff like power plants, power lines, substations and transformers, but also the people – the consumers – and all the ways they use that electricity. As shown in the original diagram, the power sector is linked with, and subject to feedback loops with other parts of the energy sector.

Regarding the size of the power sector, relative to the whole, it is large and growing. It will continue to grow as the energy transition progresses and as the energy system is further integrated through our decarbonization efforts, and initiatives like electrification and sector coupling. Remember this point for later.

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[2] Roger, F. & Pearson, P. (2012). Past and prospective energy transitions: Insights from history [Editorial]. *Energy Policy, Volume 50*, Pages 1-7.
[3] IRENA. 2019. A new world: The geopolitics of the energy transformation
[4] Yépez-García, A., Levy, A., & Valencia J., A. M. (2016). *The Energy Sector: Opportunities and Challenges*. https://doi.org/10.18235/0010658

Why is this distinction between power and energy sectors so important anyway?

It is easy to wonder what the fuss is. After all, isn't it all just energy? It is, but understanding the distinction helps in many ways, especially if you're serious about building a career in the field. A few reasons include:

1. **You can communicate more clearly (i.e. be sure you are speaking the same language as your colleagues)**

Ask three new energy analysts how much energy the average person in a country uses, and you're liable to get three different answers. One might provide the average electricity bill consumption, reflecting electrical energy use on the average utility account. The next might consider and include the average energy consumed in transport and cooking (should he or she be lucky enough to get good data on this). While both approached the question logically, they differed in their interpretation of its scope.

And it isn't just about your direct communication with others. In doing research on energy, you want to be 100% sure of the scope of the datasets, analyses, papers and reports. Using the right language, and understanding terminology helps you communicate clearly, find what you need, and ultimately improves your work. Figure 2 shows a chart published on the website of Jamaica's Ministry of Science, Energy and Technology (MSET) on Total Energy Supply. Can you interpret the information presented in the figure?

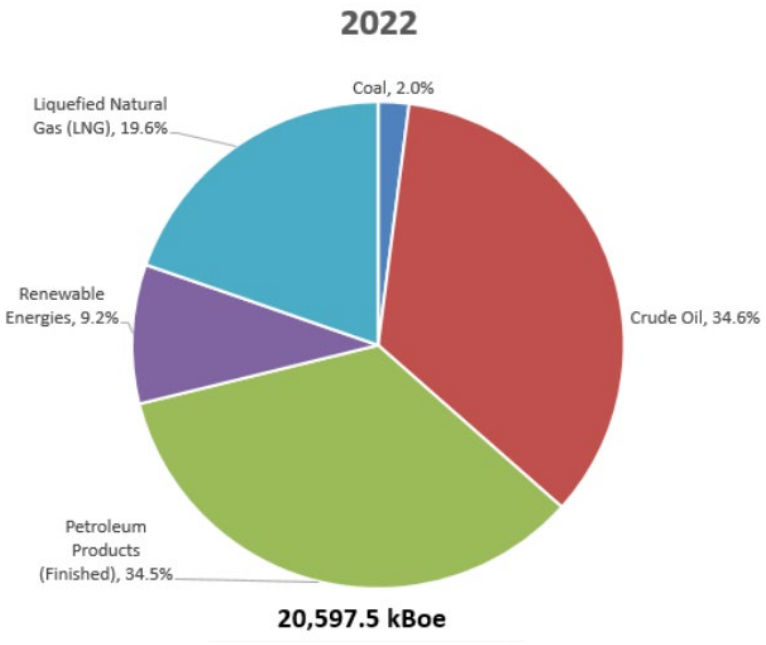

***Figure 2**: See part of an image from the MSET in Jamaica, entitled, "2008 and 2022 source shares of Total Energy Supply". What do you think the scope of this data is? What clues do you have? Hint: if you aren't sure – look at terminology (like TES), look at the listed energy sources and check out the units*[5]

2. **You will gain a better appreciation for the true scale and complexity of the energy transition**

To fully appreciate the scale of the energy transition you need the full picture. Though we are making progress in the decarbonization of the power sector, with the recent significant increases in solar PV and wind, this progress is one part (albeit an important part) of the whole.

That still leaves a lot of energy being supplied and used outside of the grid – this includes fuels for transport and cooking, and energy for industry. If you limit your focus to *current* uses of electricity, then you are only considering part of our larger aggregate energy needs. When you zoom out to look at the whole energy sector, you appreciate the scale of what is required.

The International Energy Agency (IEA) report on Net Zero by 2050[6] is a great illustration of this. In the *Net-Zero Emissions by 2050 Scenario (NZE)*, fossil fuel displacement by low-emissions electricity is one of the most important drivers of future emissions reductions, accounting for around 20% of the total reduction achieved by 2050. And something else happens between 2020 and 2050 – **Global electricity demand more than doubles**. The largest absolute rise in electricity use in end-use sectors happens in industry, increasing more than 11,000 TWh between 2020 and 2050, driven largely by increasing use of electricity for heat and certain industrial production processes. Transport sees its share of electricity increase from below 2% in 2020 to around 45% in 2050. Figure 4, below, shows these increases graphically across several different applications.

In simple terms – the need to decarbonize will change the way we produce and consume energy in the future. We aren't just looking at each individual energy or electricity application and determining how to satisfy them in a sustainable way – but we are changing the balance and relationships between them as well!

[5] Ministry of Science, Energy and Technology (MSET) Jamaica. (2021). *2008 and 2022 source shares of Total Energy Supply*.
[6] IEA. (2021). *Net Zero by 2050 – A Roadmap for the Global Energy Sector*.

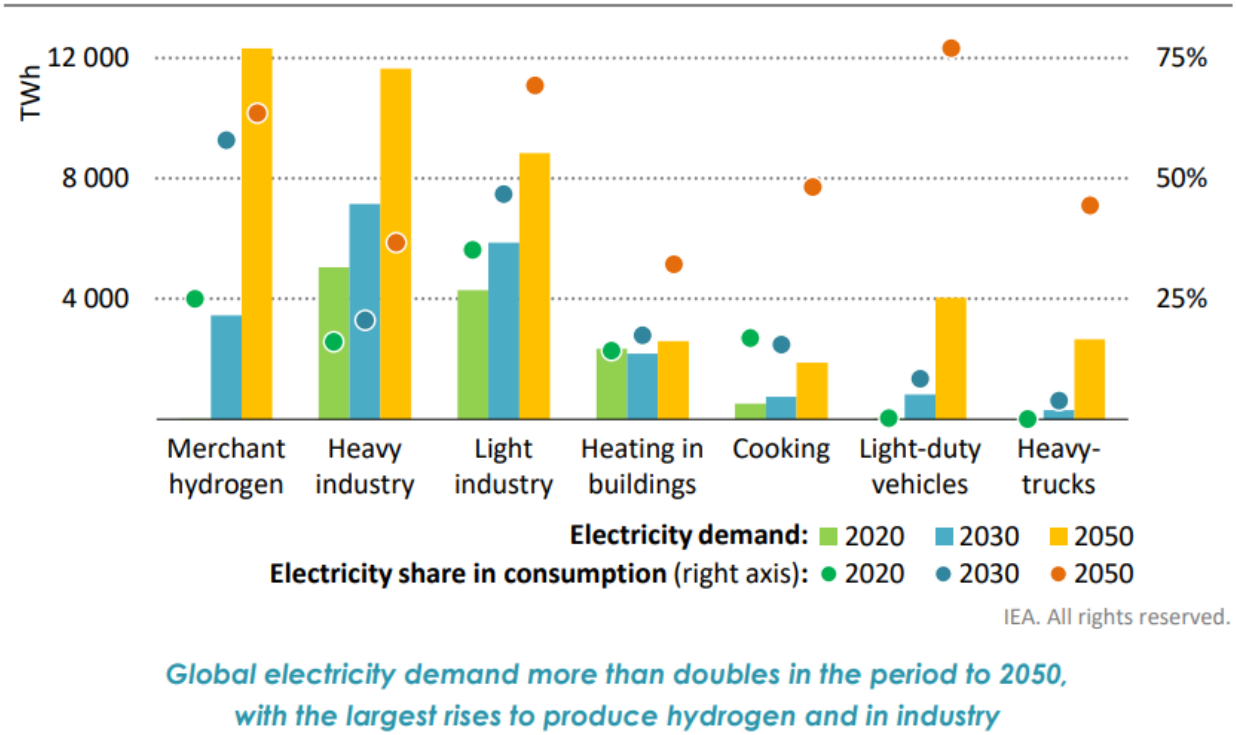

***Figure 3**: Global electricity demand (TWh) and share of electricity (%) in global energy consumption, in selected applications in the NZE, 2020 to 2050*[6]

3. You can better understand key concepts and dynamics in the field.

We have already introduced you to a few concepts above but now let's go deeper into *electrification* and *sector coupling* – two that you may have seen in news items or reports. These are both ideas that require some fundamental understanding of the sectors.

- **Electrification** means replacing energy that currently comes from fossil fuels (like gasoline or propane) with electricity. General examples include the replacement of gas vehicles with electric vehicles (EVs), or gas stoves with electric cooktops. Barbados is a great regional example of electrification in practice; the island recently added 30 more EV buses to its public transit system, to bring the total to 89. Plans are reportedly underway to add another 35 in 2025[7]. And electrification of transport goes well beyond public fleets, with over 600 EVs on the island's roads in

[7] Ministry of Transport and Works (MOTW), Barbados. (2025). *Donation of 30 new electric buses from China brings Transport Board's fleet to 89 – the largest in the Caribbean*.

2023[8]. We can better understand all the dynamics of such a transition if we clearly understand the differences between electricity (the power sector) and the fuels it is replacing (the rest of the energy sector). Think a little bit about what increasing numbers of EVs – these new 'consumers' – mean for the power sector, both good and bad.

- **Sector-coupling** takes the electrification idea even further. IRENA states that the term, "broadly describes an important strategy to optimise the energy system by increasing its flexibility and reliability through direct or indirect use of electricity across applications in end-use sectors, with the aim of accelerating the transformation towards 100% renewable energy"[9]. IEA adds that it can reduce primary energy demand – through efficiencies and fuel switching, promote broader macro-economic efficiency, lower power system operational costs and enable flexibility on the demand-side of power systems[10].

  A real-world application of this is using excess solar power to make hydrogen, which can then enter industrial processes. It is fundamentally about making the power sector work *with* transport, industry, and buildings. This idea might become clearer again as you zoom out to take all the parts into view, as illustrated in the diagram below from IRENA.

[8] Cherri-Ann Farquharson / CCREEE. (2022). *The Electric Vehicle Revolution: A Charge Towards a Sustainable Future*.
[9] IRENA Coalition for Action (2022), *Sector coupling: A key concept for accelerating the energy transformation*, International Renewable Energy Agency, Abu Dhabi.
[10] IEA (2020), Introduction to System Integration of Renewables, IEA, Paris, Licence: CC BY 4.0.

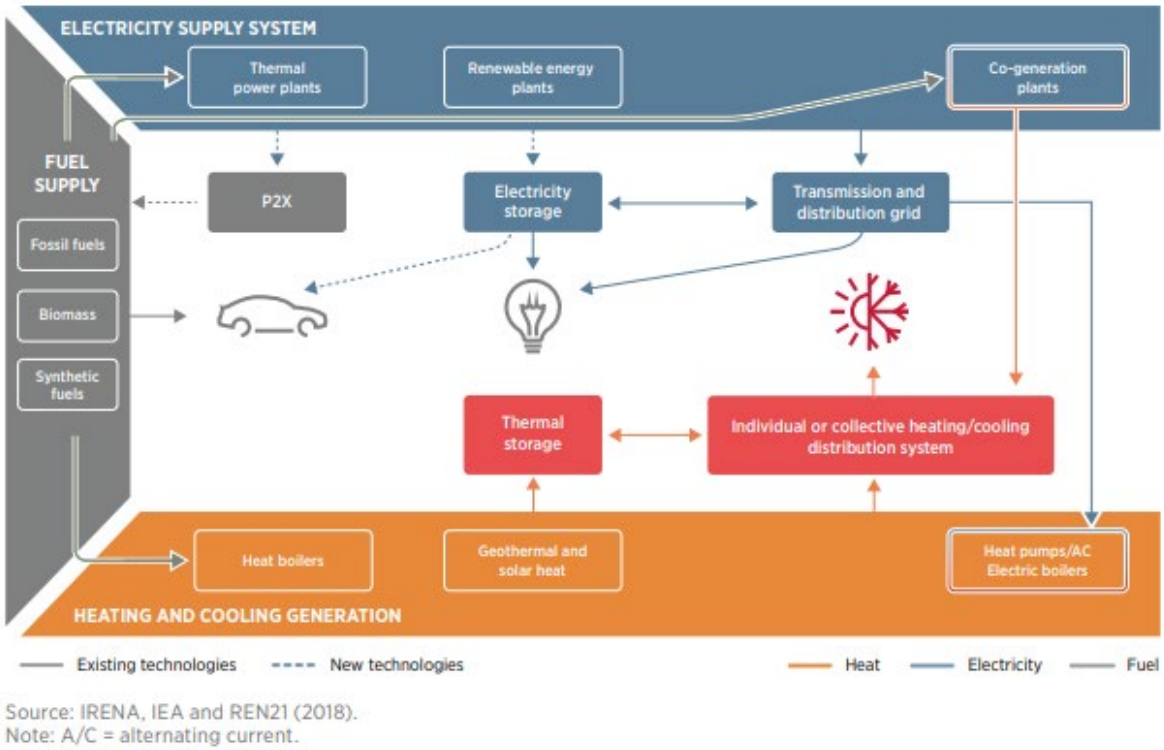

***Figure 4**: The bigger picture: the overall structure and steps for coupling different sectors*[9].

Trinidad and Tobago is a good example of a regional state actively exploring initiatives like this. T&T's Green Hydrogen Roadmap[11] outlines a strategy for developing a hydrogen economy. The strategy includes the generation of green hydrogen and hydrogen derivatives using renewable energy via power-to-X (P2X) pathways, and the channeling of this H_2 into a range of existing end-use sectors and sub-sectors (including some *hard-to-abate*[12] ones), as shown below. The 'coupling' here occurs through direct or indirect electrification of processes which, up to now, have used other forms of energy. The diagram also shows the perceived potential for application and decarbonization of the sub-sectors using the green H_2.

[11] IDB & National Energy Corporation of Trinidad and Tobago. (2022). *The Roadmap for a Green Hydrogen Economy in Trinidad & Tobago*.

[12] Basically, those sectors or industries which face greater difficulties to lower their carbon emissions, though some argue that the term is no longer applicable, and an excuse to delay possible (if expensive) interventions

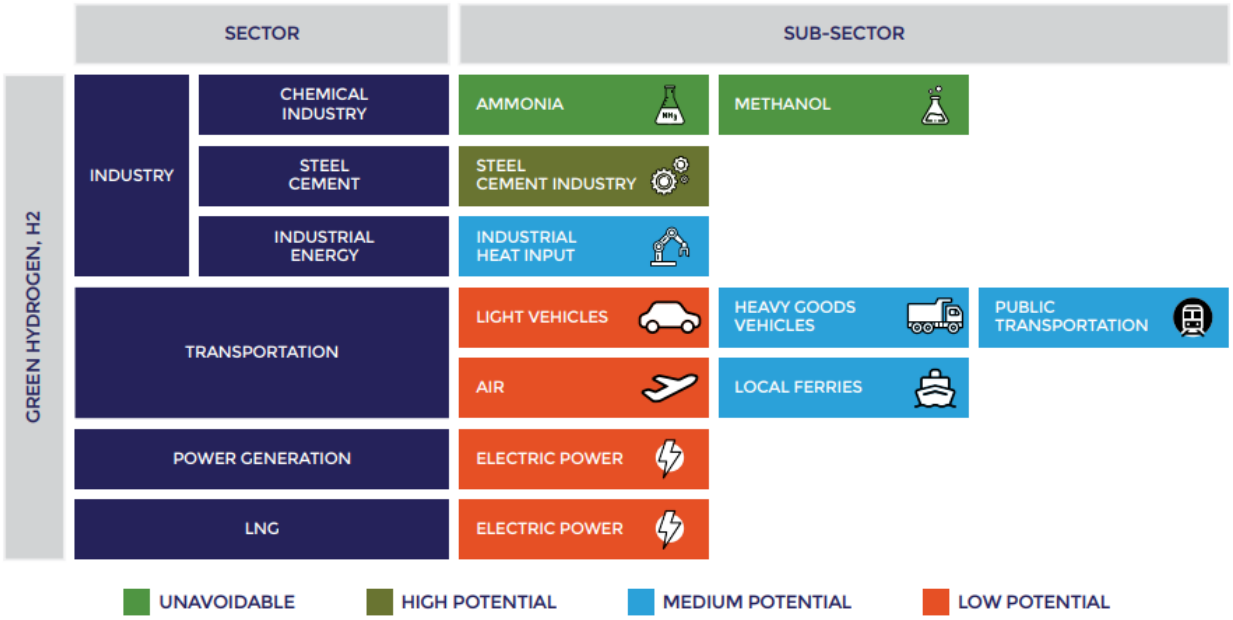

***Figure 5**: Assessment of potential for future application of green hydrogen, by sector, in Trinidad and Tobago*[11]

OK, I get it! What can I do next?

Try applying your sharpened energy sector lens as you engage practically with the news, industry reports and energy issues locally and regionally. Is a particular agency or regulator responsible for energy, *broadly*? Does this act (law) govern the activities for the energy sector, or only the electric utility? Does the scope of this policy cover all energy activities in the country; if it purports to, does it do so comprehensively? Does my country's Nationally Determined Contribution (NDC) target the energy sector for emissions reductions, and if so, which applications of energy?

A strong understanding of these nuances will help us make smarter decisions, design better policies, and work more efficiently and effectively to facilitate a just energy transition in our societies.