Sustainable Energy and Industry Integration
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The Vienna Energy Forum (VEF)—to be held in 6-7 July 2021—is designed to facilitate a multi-sectorial, multi-stakeholder and inter-disciplinary dialogue on sustainable energy for inclusive development and productive capacities.

As preparations for the VEF 2021 progress, the VEF partners have assembled the VEF Virtual Series—a sequence of virtual consultations that will explore the pathways that stimulate demand and promote economic recovery in three end-use sectors: industry, food systems and products.

The Virtual Series have the overarching goal of progressing agreed recommendations and delivering policy briefs with action-oriented solutions in targeted locations. In this respect, it will launch three global programmes addressing the needs of developing countries and emerging economies, and unlocking opportunities to pursue the energy nexus within the three end-use sectors.

The outcomes of the consultations will feed key global events in 2021, including the Sustainable Energy Forum, the High-level Dialogue on Energy, the Clean Energy Ministerial (CEM) and the United Nations Climate Conference (COP26).

In preparation for the Virtual Series, a discussion paper on sustainable energy-industry integration was developed to:

- Provide an overview of the state of deployment of energy efficiency, renewable energy and low carbon technologies in the industrial sector; identify progress in the market in recent years, prominent barriers, and the impact of the COVID-19 pandemic on industry;
- Identify “high potential” countries presenting opportunities to achieve successful outcomes;
- Identify priority focus areas: the barriers, enablers, issues or themes emerging as most relevant to achieving the intended outcomes;
- Explore key questions: the “smart” questions that can help identify and unlock the most impactful interventions; and
- Start to explore the nature of recommendations: the multiple intervention pathways that are available to countries looking to achieve sustainable energy-industry integration, given different capabilities and contexts.

Potential areas of opportunity for industry have been identified through an appraisal of available evidence, including reviews of COVID-19 responses, NDC strategies, and industrial growth strategies for certain countries.

These areas of opportunity have been identified as: increasing renewable energy in industry, decarbonising the hard to abate sectors; increasing low carbon infrastructure; focusing on Small & Medium Sized Enterprises (SME’s); and digitalisation.

These areas of opportunity form the basis of the proposed Virtual Series, and further context is provided as part of each individual session outline provided in the Appendix.
This paper tackles issues related to the integration of sustainable energy in industry. It provides an introduction to the topic and highlights the key issues that will be addressed during eight virtual discussion sessions, to be held at monthly intervals starting from 14 October 2020, in anticipation of the Vienna Energy Forum in July 2021.

The paper is structured as follows:

- Section 1 explores the opportunities—addressing climate, energy and industrial growth objectives—arising from the integration of sustainable energy into industry.

- Section 2 contextualizes industry, examining the state of deployment of renewable energy, energy efficiency and low carbon technologies, the impact of COVID-19 and its location within Nationally Determined Contributions (NDCs).

- Section 3 outlines the analysis methodological framework and the country typology with which to explore key emerging themes, focus areas and questions to be integrated in the VEF Virtual Series and the VEF 2021.

- Section 4 proposes the focus areas and formats of the virtual sessions. Eight individual session outlines have been expanded further in the Appendix.
1. **Introduction**

Industry is a key driver of inclusive socio-economic development, placing healthy industrial growth at the core of economic strategies—especially those seeking to gain and maintain competitiveness in the global market. Issues brought by the current global context of COVID-19, falling oil prices, climate ambition and green procurement transition present a set of risks and opportunities for the industrial sector. In this respect, industrial development must be approached in parallel with the nexus between energy, climate and industrial growth in order to enhance long-term resilience and competitiveness.

Industrial energy supply has traditionally depended on dirty (fossil fuels) and been heavily subsidised—relying often on lower quality fuels and inefficient and outdated technology that leads to high energy consumption and carbon emissions in the industrial sector.

Globally, the industrial sector—refining, mining, manufacturing, agriculture and construction—accounts for the largest share of energy consumption of any end-use sector, currently at more than 50%\(^1\). Industry emissions are larger than the emissions from either building or transport end-use sectors, and represent just over 30% of global GHG emissions in 2010\(^2\).

Shifting traditional to sustainable energy supply in industry is possible—the application of renewable energy for low carbon electricity and heat has been demonstrated in different sectors and countries: using solar power for steel production, biomass combined heat and power for paper production, or wind power for cement production through on-site renewables or aggressive renewable energy procurement. Energy efficiency and energy management programmes have also had positive effects and immediate cost savings across the industrial sector.

An industrial sector predominantly supplied by sustainable energy has the potential to contribute to climate commitments, remain competitive in a market where green procurement policies from buyers are becoming more prevalent and be less exposed to the volatility of fuel prices and taxes from fossil fuel imports. In terms of manufacturing and production, industry is also a key player in the sustainable energy supply chain.

Gender-differentiated distributional effects result not just from job creation/destruction across manufacturing sub-sectors, but also because of new products and consumption opportunities made available by the development of the manufacturing sector. Industrialization can reduce gender gaps in employment if it leads to the expansion of sectors that offer women more and better job opportunities than those previously available to them in other sectors (ILO, 2017a). Technological diffusion and new consumption opportunities can reduce the time women must spend on household chores, thus reducing and redistributing the burden of unpaid domestic work and care.

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2. **Context**

2.1 Status of industry decarbonisation

Over the last decade, there have been significant developments in the deployment of energy efficiency, renewable energy and low carbon technologies in industry—evidenced by the improvements in industrial energy productivity and emissions reductions. However much work is still required to place industry within a long-term resilient, competitive and sustainable and inclusive trajectory.

Industrial energy consumption grew at just under 1% per year, between 2010 and 2018, mainly caused by a production increase to meet the growing demand for industrial products. The growth in consumption was much faster in certain regions, with South East Asian countries showing roughly 4% increase per annum. Despite this increase, CO2 emissions from industry dropped by 0.6% in 2018, indicating a reduction in industrial energy intensity. The declining emissions are partly attributable to a shift from coal to natural gas, increasing the use of bioenergy and electrification. Much of the progress achieved, however, remains in non-energy intensive industries—energy-intensive industries still prove to be the most difficult to decarbonise.

While the use of renewable energy in industry has increased, industry’s energy mix has remained largely unchanged over the last decade. The limited decline of fossil fuel use, just 4% from 73% to 69%, highlights the need to continue the search of alternative sources.

While industry’s energy efficiency has improved over the last decade, only 25% of the total industrial energy use is covered by mandatory energy efficiency standards or overall performance targets. China and India are some of the leading countries in this respect, introducing energy saving targets for industry several years ago, and establishing broader policy coverage than most countries. Voluntary energy efficiency policies have also played an important role, such as the ISO 50001 certification for industrial energy management—for which the Clean Energy Ministerial targeted 50,001 industrial operations to achieve certification by 2020. By 2018, only 18,000 had been achieved.

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Despite the concerning plateau of energy efficiency investment since 2015, energy productivity showed improvements at a rate of 2.1% per year, between 2010 and 2018. Advancing deployment in state-of-the-art technologies and operational modifications have strengthened the efficiency of industrial processes. In this respect, Europe and North America perceived major gains correlated to a shift from energy-intensive industries, to sectors of higher added value. Enhancing industrial energy productivity in countries with larger shares of energy-intensive industries have, however, proved to be more difficult. According to the IEA, improvements will need to accelerate by 2.8% per year by 2030, in order to achieve a sustainable development scenario (SDS)\(^4/5\).

The demand for energy-intensive materials, such as steel and cement, is correlated to a growth in energy consumption and carbon emissions. While levels of global demand have levelled of in recent years—mainly due to the saturation of demand in China—national levels are increasing in other parts of the world. There are material efficiency opportunities throughout the value chain, such as enhanced production efficiency, extended product lifespans, and increased end-of-life recycling. Should the adoption of material efficiency strategies not be accelerated, the demand for energy-intensive materials will continue to rise along with economic growth\(^6\).

Renewable heat consumption has gained relevance over the last decade. Renewables’ industrial energy demand for heat rose to 10% in 2018, after a steady growth of 2% per year, from 2010 to 2018—90% of which was predominantly provided by bioenergy in industries that produce biomass waste and residues. This is evidenced by the fact that bioenergy is responsible for roughly 30% of energy use in pulp and paper production, compared to only 3% in cement—suggesting that bioenergy makes an insignificant contribution to energy-intensive industries. In order to align with the IEA’s SDS, the contribution of renewables will need to accelerate to 3% a year by 2030\(^7\).


Despite the improvements in industry over the last decade, there are still a number of barriers that must be overcome, in order to establish more resilient, competitive, sustainable and inclusive long-term trajectories. The continued reliance on fossil fuels is arguably the single biggest barrier to the decarbonisation of the sector, particularly in sub-sectors, such as cement, iron and steel, and chemicals—coal meets as much as 75% of energy demand in iron and steel. Renewable energy’s inability to produce the high-temperature heat required by industries, demonstrates the need for a technological breakthrough, that accelerates a transformational change and drives decarbonisation.

As industrial improvements, such as energy efficiency, become exhausted, innovation is key to:

- Reduce process emissions through the use of hydrogen and CCUS in chemical and iron steel production,
- Inert anodes in aluminium
- Reduce the clinker-to-cement ratio and switch to low carbon fuels in the cement sector, and
- Increase the use of by-products and recycling in paper and pulp.

Although pilot projects are showing progress, innovation at commercial scales continues to present challenges.8

Weak policy environments, for instance, pose barriers for the transformation of industry. As discussed, only 25% of industrial energy use is covered by mandatory energy efficiency standards. Given that energy efficiency gains represent some of the low hanging fruits for productivity improvements of industry, widening the policy coverage could deliver relatively easy efficiency gains that have, until now, remain untapped.

Carbon pricing and emissions trading are another facet of the policy environment that is only present in a few regions. In this respect, emerging low-carbon processes struggle to compete with carbon-intensive processes. Policy signals, such as carbon pricing and emissions trading, have the potential to improve the competitiveness of low-carbon investments and provide the incentives needed for their growth—thus, shifting away from carbon-intensive investments in the medium term. In this respect, the launch of the EU emissions trading scheme in 2005 was determinant in the recovery and apparent growth of carbon price since 2018. Similarly, carbon border adjustment taxes emerge as potential tools to address trading risks—China, for instance, launched its own emissions trading scheme in 2017, and commenced trade in 2020. For as long as carbon pricing remains unfixed, emerging low-carbon technologies will continue to struggle against established carbon-intensive processes with at-scale operation. Conversely, carbon pricing, emissions trading and border adjustment taxes are key in the acceleration of industry decarbonisation.9

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2.3 Impact of COVID-19

From supply chain disruption and global downturn in investment, to increased unemployment and significant shifts in supply and demand, industry has been largely affected by COVID-19. Yet, it plays a pivotal role in the acceleration of a socio-economic recovery, providing vast economic and employment opportunities. In this respect, the establishment of resilient, competitive and inclusive industrial development must be at the core of the creation and execution of economic recovery packages. The construction of industry after COVID-19 is critical and, while concepts like “Build Back Better” or “Build Back Greener” offer general guidelines, its delineation must meet practical operations.

Countries, sectors and companies have assembled a number of COVID-19 response and recovery approaches. At national levels, these feature “industry” and “industrial growth” strategies, including value chain diversification in Australia and Finland; SME’s in the EU, Australia, India, Nigeria and Argentina; digitalisation and digital economy in South Korea, New Zealand, Singapore and Rwanda; eco-friendly growth in South Korea, technology-driven growth in India and China; agro-processing and technology in New Zealand; low-carbon transport subsidies in Italy and France; infrastructure construction in Nigeria, Argentina and New Zealand; hydrogen in the EU, UK, Germany and Norway; informal sector support in Nigeria; decarbonised heavy industry in the UK; and increasing renewables in Denmark, Nigeria and Morocco.\(^\text{10}\)

The myriad of strategies showcases the breadth of opportunities for industrial growth support in low-carbon, innovative and efficient manners. To unlock these opportunities, industry support programmes must be tailored to national contexts and priorities.

Finally, women’s specific needs and potential as leaders and agents of change must be considered for COVID-19 mitigation and recovery measures. The pandemic highlights and magnifies inequalities and the multiple and intersecting forms of discrimination that women and girls face, including in the energy sector. The unequal participation of women and men in different branches of manufacturing further differentiates their vulnerability during the crisis and in its aftermath.\(^\text{11}\)

\(^{10}\) From Morocco’s COVID-19 response strategy: “Our strategy is to continue to boost the competitiveness of Morocco and establish a carbon-free industrial base with domestic renewable energy generation.”

2.4 NDCs

The Nationally Determined Contributions (NDCs) outline country-driven pledges towards the collective climate efforts outlined in the Paris Agreement—which sets out a global commitment to limit warming to well below 2°C or 1.5°C. The role of industry emissions typically feature under the mitigation component of an NDC, both in terms of the country emissions profile and as an area of opportunity for future emission reductions. Some of these include articulated mitigation actions related to industry and, more recently, feature COVID-19 issues on tourism industries and livelihoods.

Given that the process for NDC development is typically country-driven, multi-stakeholder, and cross-sectoral, these are a good proxy to identify potential investment and support opportunities for low-carbon industrial growth in the specific country.

After reviewing 16 NDCs, only one was found to not make direct reference to industry. The rest ranged from outlining specific emission reduction targets, to including energy management and energy efficient programmes in the industrial sector. Additionally, NDCs commitment to increase the national share of renewable energy generation would support lower-carbon energy for industry.

Some countries, such as Rwanda, have very specific measures to allocate tailored actions to the ‘Manufacturing Industry,’ including: energy efficiency in agro-processing, climate compatible mining, efficient brick kilns, clinker substitution in cement production and energy efficient cement production. Conditional to international financial support, Morocco proposes to increase the share of natural gas—instead of fuel oil—in the industrial sector, launch a Biomass Valorisation Programme for Industry to promote biomass use as a substitute for fuel oil, implement an Energy and Output Management System (EOMS) and the ISO 50001 standard, and create a pilot project for centralised production of utilities for an integrated industrial park.

The NDC are also a platform to recognise a country’s progress towards its national climate efforts and showcase projects and programmes in a particular sector. In the case of Myanmar’s NDC, for example, specific reference is made to the project ‘Improvement of Industrial Energy Efficiency’—a Global Environment Facility project executed by the Government of Myanmar in partnership with UNIDO. The project’s spotlight offers the potential to access future funding opportunities.
3. Categorisation of Countries and Identification of Intervention Pathways

3.1 Overview of methodology

Initial work was undertaken with the following objectives:

- To identify “High Potential” Countries: countries presenting opportunities to achieve successful outcomes;
- To identify priority focus areas: the barriers, enablers, issues or themes emerging as most relevant to achieving the intended outcomes;
- To explore key questions: the “smart” questions that can help identify and unlock the most impactful interventions; and
- To explore the nature of recommendations: the multiple intervention pathways that are available to countries looking to achieve sustainable energy-industry integration, given different capabilities and contexts.

A process was developed to position this work (current and planned activities) within a change-based theoretical framework to ensure a coherent and structured process that leads to the intended outcomes of the VEF. Figure 1 presents this framework as a pathway to contributing to the integration of sustainable energy in industry.

![Figure 1: Process Impact Pathway for the integration of sustainable energy in industry](image)

The outcomes of the process, including the identification of virtual sessions, are presented in this discussion paper. Each of the steps in the process are described in greater detail below.
3.2 Country Categorisation

3.2.1 Criteria for Categorisation

A typology approach has been developed to focus on areas where potential impact is greatest. The typology framework is shown in Figure 2. It is intended as a guide and does not represent a strict framework that excludes any particular country. It should be viewed as a dynamic framework that can be adapted based on the outcomes of the virtual sessions, particularly the opening session whose objective is to elicit the focus areas and key questions of each session.

The analysis also considered countries that explicitly reference industry, industrialisation or targeted industrial sectors within their COVID-19 recovery plans and strategies. However, it was not possible, within the scope of this project, to assess all country’s COVID-19 recovery plans and strategies. This criteria was therefore excluded from this approach.
The first stage of the process involved developing and applying selection criteria to determine a short list of priority countries. Two types of selection processes were applied. The first included a relatively objective assessment of countries with respect to a set of criteria. These criteria are considered proxies for potential and, therefore, countries did not need to meet all of the criteria. Countries were scored (1 or zero) in terms of whether they met the criteria or not. Scores were equally weighted, with the highest scoring countries being considered. This selection criteria and scoring approach was complemented by a qualitative and more nuanced process based on countries that “emerged” through the various activities undertaken (literature review, data mining, expert interviews, and drawing on collective team experience). The approach sought to provide a transparent and structured method to selecting countries, while ensuring flexibility to consider country-specific nuances. A transparent approach was seen as necessary to enable interrogation and improvement with respect to priority countries.

The criteria used in the selection process included:

- UNIDO’s Programme for Country Partnership country (Y/N)
- Industry in NDC (Y/N)
- Top 10 industrialized “developing” country (by Manufacturing in total value added (%%))
- Top 10 non-Annex I GHG emitter (absolute, tCO2e)
- Clean Energy Investment Potential (score above 2)
- UNIDO country office (Y/N)

The initial list of “high potential” countries will be used to inform session planning.

An initial attempt was made to organise countries according to common needs, similar challenges and shared opportunities. This included a consideration of priority intended outcomes for different countries, and varying factors that would influence the key barriers / enablers or other issues on which the countries should focus in their pursuit of an integrated agenda.
The results informed the choice of focus areas and key questions proposed in the virtual sessions. Variables considered include level of industrialisation (high, medium, low) according to a combination of indicators (Manufacturing in total value added (%); Manufactured goods in total merchandise exports (%); Intermediate goods in total manufacturing trade (%)) and readiness to implement energy efficiency and renewable energy initiatives (this considered the industry-relevant energy efficiency and renewable energy RISE6 indicator scores). Other variables considered, but not yet applied, include rates of electrification, level of development, poverty and inequality, infrastructure, skills and capacity, etc.

The intention is to refine this approach and ensure a more tailored structure with sets of key questions ahead of each virtual session (to be undertaken ahead of each session and included in the specific session briefing document).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNIDO’s Programme for Country Partnership country (Y/N)</strong></td>
<td>UNIDO’s Programme for Country Partnership supports accelerating inclusive and sustainable industrial development in Member States. Aligned with the national development agenda and focused on sectors with high growth potential, the programme supports a country in achieving its industrial development goals.</td>
</tr>
<tr>
<td><strong>Industry in NDC (Y/N)</strong></td>
<td>Third party analysis: Climate Watch (WRI) has assessed country NDC’s and the extent to which they commit to (action) or seek support for (gaps &amp; needs) achieving the SDGs. This analysis filtered the Climate Watch Assessment according to SDG 9.</td>
</tr>
<tr>
<td><strong>Top 10 industrialised &quot;developing&quot; country (by Manufacturing in total value added (%))</strong></td>
<td>Level of industry as a proxy for potential to explore sustainable energy-industry integration.</td>
</tr>
<tr>
<td><strong>Top 10 non-Annex I GHG emitter (absolute, tCO2e)</strong></td>
<td>Level of GHG emissions as a proxy for mitigation potential associated with industry.</td>
</tr>
</tbody>
</table>

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13 [https://www.unido.org/programme-country-partnership](https://www.unido.org/programme-country-partnership)
14 Based on analysis undertaken by Climate Watch.
15 [https://iap.unido.org/](https://iap.unido.org/)
16 UNFCCC
Indicator | Description
---|---
**Clean Energy Investment Potential (score above 2)** | An index describing the investment potential for clean energy in 104 developing countries. A score above 2 was included (top 36 countries)\(^{17}\).

**UNIDO country office (Y/N)** | UNIDO country offices as a proxy for interest and potential for sustainable energy-industry integration\(^{18}\).

*Table 1: Criteria used as proxies to filter “high potential” countries.*

The additional countries were identified as worth considering as high potential countries. The intention behind this approach was to provide a space to accommodate countries that emerged, through this work, as having a high potential or interest in achieving the intended sustainable-energy integration outcomes, but which did not meet the requirements of the criteria and scoring approach. This was seen as important given that the criteria against which countries are scored are proxies and do not guarantee a high potential for success. Further, each criteria is weighted equally. The approach is valuable in that it allows for a relatively objective assessment of potential but it is crude and cannot accommodate all the complexity behind whether a country is likely or not to succeed in achieving significant impacts. Thus the additional qualitative approach was deemed necessary to avoid undue faith placed in the criteria and scoring approach, and to ensure that countries do not slip through the cracks.

\(^{17}\) Climatescope is a comprehensive index and report assessing the environment for low-carbon investment in 100+ markets in Africa, Asia, Europe, the Middle East, Latin America and the Caribbean, developed by the UK Department for International Development and BloombergNEF. [https://resourcwatch.org/](https://resourcwatch.org/)

\(^{18}\) [https://www.unido.org/who-we-are/unido-worldwide](https://www.unido.org/who-we-are/unido-worldwide)
3.3 Identifying Intervention Pathways

The next step included identifying different focus areas, or opportunities, that countries could pursue to contribute towards the overall intended outcomes (in terms of energy, climate & industrial growth objectives). These focus areas were determined from opportunities in the industrial sector outlined in COVID-19 response strategies, NDCs, Industrial Development plans, and industry-relevant literature. The nature of the focus areas are to be relevant/inclusive regardless of the level of industrialisation of the country. Therefore a spectrum of dimensions were considered and organised around categories defined as foundation, emerging and ambition:

<table>
<thead>
<tr>
<th>Description</th>
<th>Example - Digitalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foundation</strong></td>
<td>Ensuring the underlying enabling infrastructure and conditions are in place</td>
</tr>
<tr>
<td><strong>Emerging</strong></td>
<td>Building on the foundational requirements and expanding a particular focus area</td>
</tr>
<tr>
<td><strong>Ambition</strong></td>
<td>Striving for the highest level of ambition realistic for your country context</td>
</tr>
</tbody>
</table>

These categories should serve as a basis for considering the key questions depending on the stage of industrialisation and capability of each country.

Key questions were developed and proposed for each session. They represent the “smart” or most pertinent questions that are intended to focus the virtual session discussions to help identify and unlock the most impactful interventions. The current questions represent a starting point and are expected to be refined and further tailored based on feedback obtained prior to each session. Initial questions are included in the draft session outlines in the Appendix.
The process leading up to the virtual sessions has considered possible recommendations and intervention pathways in an effort to ensure coherence and alignment with the intended outcomes, and ultimately, the intended impact of the VEF. However, it is during the virtual sessions, the lead up to the VEF, and the VEF itself that recommendations and concrete implementation steps will be identified and acted upon.

The virtual series will include eight virtual sessions. See Appendix for a more detailed description of the session aims, proposed structure and summary of each session.

A key outcome of each session will be a series of recommendations focused on opportunities to achieve the intended outcomes. Recommendations will take the form of “Intervention Pathways” and other steps to galvanise action. Intervention pathways represent the different options for achieving sustainable energy-industry outcomes, structured according to the different focus areas and dimensions, and packaged with different country capabilities and contexts in mind.

In developing the intervention pathways, it will be important to balance the need for context-specificity with the need to illustrate general options given of shared circumstances amongst countries. The country typology framework, and the approach undertaken to identifying focus areas and key questions, has been designed to contribute to this.

The final virtual session (“Industry Decarbonisation: Gaps, Opportunities & Pathways”) is designed to consolidate intervention pathways (refine the key intervention pathways emanating from the virtual sessions), to identify the key “so what” questions that need to be answered to galvanise action and to start to identify next steps leading up to the VEF session.

Recommendations determined during the virtual sessions will determine priority steps with respect to a series of policy briefs and will inform the function and form of the VEF sessions. The broader goal is to facilitate action-oriented pathways to achieve the intended outcomes. These recommendations will also inform the design of a potential global initiative that brings together various partners to engage with high potential countries.
4. Appendix: Virtual Series

4.1 Outline of virtual sessions

Eight virtual discussion sessions will be held at monthly intervals in the lead-up to the 2021 VEF Forum. The virtual sessions aim to:

- Provide a platform to collectively explore intervention pathways available to countries looking to achieve sustainable energy-industry integration, given different capabilities and contexts;
- Facilitate learning and partnerships that can unlock these opportunities;
- Collectively inform a set of policy briefs and other initiatives to be undertaken ahead of the VEF; and
- Provide a basis for designing VEF sessions and a potential global initiative that can galvanise action towards the intended outcomes.

4.2 Proposed sessions

Each session will be tailored according to the focus areas, dimensions and specific questions relevant given the stakeholders in the room.

The introductory virtual session will serve, among other things, to explore interest in the sessions and to identify potential stakeholders that should be invited. The focus areas and dimensions will then be considered for further identifying and grouping participants in the virtual sessions, as well as refining the key questions.

It is expected that sessions will adopt the following basic structure:

<table>
<thead>
<tr>
<th>Introduction and framing</th>
<th>Context and objectives behind exploring pathways for stimulating demand and promoting economic recovery in end use sectors like industry, food system and products.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Context and objectives of the session.</td>
</tr>
<tr>
<td>Unpacking opportunities</td>
<td>Exploring the dimensions of the focus area/s of the session</td>
</tr>
<tr>
<td></td>
<td>Sharing experiences, challenges and successes from participants</td>
</tr>
<tr>
<td></td>
<td>Discussing key questions</td>
</tr>
<tr>
<td>Galvanising action</td>
<td>Collectively identifying intervention pathways</td>
</tr>
<tr>
<td></td>
<td>agreeing on next steps and how to leverage this initial work through the VEF sessions and a potential global initiative that brings together various partners to engage with high potential countries</td>
</tr>
</tbody>
</table>

19
Session 1: Energy-Industry Nexus (Framing Session)

Main question: What evidence and dissemination strategies are needed to demonstrate that the integration of sustainable energy in industry can ensure transformational development outcomes?

Sub-questions:

- Which countries offer the most potential for sustainable energy-industry integration? What evidence can be used to best identify these countries and prioritise the intervention pathways to be explored?

Outputs: Which are the most important enablers to allow effective interventions that consider dimensions relevant to country's capabilities and contexts?

Discussion Points

Industry is a key driver of inclusive socio-economic development, placing healthy industrial growth at the core of economic strategies—especially those seeking to gain and maintain competitiveness in the global market. Issues brought by the current global context of COVID-19, falling oil prices, climate ambition and green procurement transition present a set of risks and opportunities for the industrial sector. In this respect, industrial development must be approached in parallel with the nexus between energy, climate and industrial growth in order to enhance long-term resilience and competitiveness.

Shifting traditional to sustainable energy supply in industry is possible—the application of renewable energy for low carbon electricity and heat has been demonstrated in different sectors and countries: using solar power for steel production, biomass combined heat and power for paper production, or wind power for cement production through on-site renewables or aggressive renewable energy procurement. Energy efficiency and energy management programmes have also had positive effects and immediate cost savings across the industrial sector.

Key opportunities relate to increasing renewable energy and energy efficiency in industry, decarbonising the hard to abate sectors; increasing low carbon infrastructure; focusing on Small & Medium Sized Enterprises (SME’s); and digitalisation. Cutting across these areas are opportunities to innovate as markets evolve and R&D is increasingly focused on relevant technologies and interventions; to rapidly and sustainably recover from COVID-19; to deliver significant greenhouse gas emissions reductions and build resilience to a changing climate; and to leverage the direct and societal benefits associated with greater diversity, particularly through mainstreaming gender and youth into sustainable industrial strategies.

There are multiple intervention pathways that are available to countries looking to achieve sustainable energy-industry integration, given different capabilities and contexts. Appropriate pathways need to be refined, drawing on examples of success, implemented and disseminated through collaborative partnerships and international processes that can facilitate replication and upscaling of transformative outcomes.
Session 2. COVID-19 recovery with focus on SMEs & local value chains

Main question: How can sustainable energy-industry integration enable SME’s to contribute to COVID-19 recovery and low carbon industrialisation, particularly in the global South?

Sub-questions:

- What are the opportunities to increase energy efficiency and the uptake of renewable energy by SMEs in industry? And how would this benefit SMEs (e.g. security of supply, low cost electricity)?
- Which parts of the renewable energy value chain are most suitable for SMEs to play a role in?
- Which sub-sectors have SMEs been most effective in responding to the impacts of COVID-19? And how could SMEs be included in low carbon COVID-19 recovery options?

Outputs: Identify opportunities to increase energy efficiency and the uptake of renewable energy by SMEs in industry; identify greatest potential for SMEs’ involvement in renewable energy value chains; and an improved understanding of the vulnerabilities of SMEs in industry that have been highlighted by the impacts of COVID-19 and the opportunities for SMEs to contribute to industry’s role in driving socio-economic recovery from COVID-19.

Discussion Points

SMEs play crucial roles in industry but often rely on outdated technology and have been some of the hardest hit by the impacts of COVID-19. At the same time other SMEs have shown agility and innovation to adapt to the changing conditions and to capitalise on the opportunities that have emerged. SMEs need to be considered when contemplating options for renewable energy-based post COVID-19 socio-economic recovery.

Promoting SMEs can be an effective strategy for driving low carbon industrialisation particularly in the global South due to:

- The massive growth in SMEs in industry in the last decade
- Energy efficiency and renewable energy potential remains largely untapped by SMEs in industry
- SMEs occupy various positions in the value chain and therefore offer diverse entry points for improvements
- SMEs are major employers and hold the potential to improve livelihoods and create new employment opportunities
- SMEs have been some of the most vulnerable to the impacts of COVID-19 and some of the most agile in responding (e.g. through eCommerce platforms, growing digital payment platforms, and adapting their focus of production) and therefore provide valuable lessons for COVID recoveries.\(^{19/20}\)

\(^{19}\) Quintás, M. A., Martínez-Senra, A. I., & Sartal, A., 2018. The role of SMEs’ green business models in the transition to a low-carbon economy: Differences in their design and degree of adoption stemming from business size. Sustainability, 10(6). https://doi.org/10.3390/su10062109

Main question: Where are the biggest opportunities for rapid and sustained post-COVID economic recovery through integrating RE and EE in industry, as well as industry participation in the RE and EE value chains?

Sub-questions:

- How can the opportunities from renewable energy (electricity and heat) applications for industry (including solar energy, wind energy, biomass, renewable heat, waste heat, etc.) be scaled up?
- What are the "big ticket" energy efficiency interventions for high potential sectors, given different country capabilities and contexts?
- Which specific opportunities are there for increasing RE in industry as part of the post COVID-19 economic recovery? And how could industry benefit/capitalise on these?

Outputs: Identify the key opportunities within different sectors/countries to integrate RE and EE solutions in industrial applications (both electricity and heat).

Discussion Points

The uptake of renewable energy in industry remains slow. Low carbon electrification or heat through renewable energy offers huge potential for industry, but RE technologies have not yet been able to provide the high-temperature heat needed at scale for industrial processes.

Examples of RE applications in industry include:

- Solar PV for large electricity centres such as data centres.
- Wind energy for steel & cement production (Sweden, Morocco)
- Biomass Combined Heat & Power for the paper industry & residential/business heat (UK)
- Hydro power for steel smelting (Iceland)

Industries involved in the RE supply chain will have suffered significantly from the COVID-19 crisis, yet have the opportunity to strategically participate in rebuilding and growing the RE sector to stimulate economic growth.

Industrial energy efficiency options are well understood and offer a compelling business case. Challenges to implementation, particularly relating to the human factor, can be overcome and carbon emissions can be reduced competitively.

While energy efficiency options will not achieve a step change in sustainable energy-industry integration, they are important in enabling early progress; addressing the relatively untapped potential in small and medium industries; and are essential to reducing energy consumption of existing, long-lived industrial assets.
Session 4: Equity, gender and youth in industry

Main question: How can a more sustainable-energy driven industry increase diversity and opportunities for youth employment?

Sub-questions:
- What are the opportunities for women and youth job creation through increasing the integration of sustainable energy into industry?
- How can we foster entrepreneurship, empower women and youth within industry through ICTs and digital technologies?
- What are the key challenges and opportunities for women leaders in industry and business for accessing finance? How can a transition to sustainable energy-industry integration affect this?

Outputs: Identify practical steps and highlight productive opportunities presented for women and youth’s economic empowerment and improved resilience along sustainable energy-industry value chains.

Discussion Points

The impacts of COVID-19 on youth unemployment will be felt both in the short term, due to the sudden downturn in the global economy and loss of immediate employment, and the long term, due to current disruptions in education and early career opportunities. Low-skilled labour has been particularly hard hit, whereas opportunities are emerging for those focusing on new areas of the economy e.g. developing digital skills\textsuperscript{21}.

Women have a harder time accessing and raising finance for shareholding, investment and/or raising capital for sustainable energy projects. “\textit{Globally, women only receive about 2\% of venture capital, and \textit{in sustainable energy} this is less}\textsuperscript{22}.”

Across all industries, women currently make up on average 33\% of junior level staff, 24\% of mid-level staff, 15\% of senior level staff and 9\% of CEOs\textsuperscript{23} yet women-led businesses have been found to be more efficient and achieve higher growth in profits\textsuperscript{24}. Within the renewable energy sector ‘women account for no more than 14\% of the workforce’ and only 8\% across the conventional energy sector\textsuperscript{25}.

New economic sectors such as the digital economy, the green economy offer valuable opportunities for incorporating youth in a creative manner. UNIDO is focusing on a dynamic creative industry sector to generate new jobs and empower opportunity-driven women entrepreneurs, youth groups and peripheral communities to transform that sector and industrial landscapes with innovation and to respond to new opportunities, utilizing creativity, rich cultural heritage and diverse knowledge to create competitive goods and services.

\textsuperscript{22} GWNET, 2019. Women for Sustainable Energy – Strategies to Foster Women’s Talent for Transformational Change. \url{https://www.globalwomennet.org/women-for-sustainable-energy/}
\textsuperscript{23} WEF, 2016. World Economic Forum Annual Meeting. \url{https://www.weforum.org/events/world-economic-forum-annual-meeting-2016}
\textsuperscript{24} UNIDO, 2020. Can women fast-track South Africa’s energy transition? \url{https://www.unido.org/stories/can-women-fast-track-south-africas-energy-transition}
Session 5. Industry Decarbonisation - Hard to Abate Sectors

Main question: What is the potential role of sustainable energy-industry integration in building the resilience of hard to abate sectors and taking advantage of opportunities driven by the net zero carbon industry transition?

Sub-questions:

- Which industrial sectors are most at risk from the net zero climate transition? What are the key interventions needed, per high risk sector, to enable developing countries to continue to operate in global value chains?
- What global value chains, associated with new and growing markets, will present the greatest opportunity for developing countries to participate in?
- What are the main gaps with respect to each of these high potential opportunities and how best can they be plugged.

Outputs: Identify intervention pathways to build resilience given the climate transition to net zero emissions (exploring threats to existing industries in key countries particularly the hard to abate sectors) and identify key gaps with respect to the high potential opportunities.

Discussion Points

When the pandemic dies down, industrial sectors in developing countries face two key threats: trade protectionism and decreasing demand for carbon-intensive industrial products.

Net zero climate transition poses threats to existing industries particularly the hard to abate sectors such as cement, steel, chemicals and aluminium. COVID has exacerbated the challenge for developing countries by increasing the risk premium paid by private sector players and governments in countries perceived as riskier. Various efforts to drive the transition are underway and should be leveraged such as the Mission Possible Platform26 and the "Leadership Group for Industry Transition"27. One way to achieve industrial decarbonization targets is through industry transition roadmaps, which are long-range strategic plans that set out actionable measures on innovation, policy, public-private partnerships and the finance required to transform industries.

The transition to a lower carbon, more climate resilient global society will create new markets and see certain sectors grow (while others shrink). Examples include electromobility, green hydrogen, renewable energy that will require particular materials, products and services.

Session 6. Digitalisation and Opportunities to Innovate

Main question: How can industry achieve greater digitalisation, and therefore greater resilience?

Sub-questions:

- What aspect of digitalisation is realistic for key sectors of industry? (Consider data collection & optimisation capability, automation network realities, artificial intelligence etc.)
- What are the key challenges for expanding the application of digital solutions in industry/different industrial sectors?
- What are the key innovations in industry that have emerged from the COVID-19 crisis? And what can we learn for future industrial growth?

Outputs: Identify opportunities for digitalisation in industry that present the greatest potential for countries/sectors given their capabilities and specific contexts.

Discussion Points

The response to COVID-19 is speeding up digitalisation and spurring innovation. Those sectors, countries, companies that have already made the shift (to digitalisation) have survived the crisis better. Innovative solutions such as upscaling digitalisation can address energy, climate and industrial growth targets. How can industry capitalise on this moving forward?

Many opportunities exist for industry. Advances in digitalisation can optimise processes that can result in efficiencies (energy, carbon, and financial) at various levels: at an organisational level, within the supply chains, to increase financial transparency and optimise production (e.g. Machine learning, artificial intelligence, digital twinning).

Shifts in digital solutions since COVID-19 include:

- Increased supply chain visibility – upstream & downstream
- More eCommerce in retail
- Greater use of digital platforms for payment
- Increased remote working
- Shift in lending/loans – small businesses

Digitalisation can spur innovation that reduces environmental impact and improves efficiencies e.g. packaging processes that through digital twinning can reduce heat and materials. Digital technology can cut business flights by 50% or more. Local co-working hubs can reduce commuting emissions by around 50–60% annually for many people.

Session 7. Inclusive infrastructure development for driving low carbon industrialisation

Main question: What is needed to establish the necessary physical, digital and socio-economic infrastructure required to enable industrialisation that is resilient, competitive and low carbon?

Sub-questions:

- What are the physical, digital and socio-economic infrastructure needs that should be prioritised by industrial parks, or to increase the use of hydrogen in industry?
- What have been some of the successes and failures of Industrial Parks & SEZs or hydrogen infrastructure in your countries?
- Which industries or clusters of industries hold the greatest potential for contributing to low carbon industrialisation by being included in industrial parks?

Outputs: identify the "big ticket" physical, digital and socio-economic infrastructure requirements for driving low carbon industrialisation, through two examples, namely Industrial Parks & SEZ and hydrogen use in industry.

Discussion Points

Quality low carbon infrastructure (e.g. energy, transport, ICT) is a prerequisite for achieving low carbon industrialisation but remains a bottleneck in many parts of the world. Addressing these bottlenecks by investing in the necessary physical, digital and socio-economic infrastructure can enable industrialisation that is resilient, competitive and low carbon.

Achieving SDG 9 will be dependent on addressing the intersection between infrastructure, industry and innovation. Investing in Industrial Parks & SEZs offers a strategy for driving infrastructure development for industrialisation through providing reliable services, such as renewable energy and infrastructure to a cluster of industries and establishing the digital and ICT infrastructure that delivers improvements in efficiency, productivity and integration of industries. Industrial parks can also create an enabling regulatory environment, establish public private partnerships and promote skills development and knowledge transfer.

The use of hydrogen in industry has been identified as a key opportunity to decarbonise industry. Whether hydrogen is used as a reductant in industrial processes or an energy carrier, the physical, digital and socio-economic infrastructure needs to be in place. Hydrogen production, transportation, storage, supply chain management, and safety & maintenance all have varying hard and soft infrastructure requirements.

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30 UNIDO, 2015. Promoting climate resilient industry. Available at: https://www.unido.org/sites/default/files/2015-12/01_UNIDO_Promoting_Climate_Resilient_Industry_0.pdf
Session 8. Galvanising political action

**Main question:** How can decision-makers at national and international levels be motivated to place greater focus on sustainable energy/industry policies and interventions?

**Sub-questions:**
- What are "big ticket" intervention pathways that should be explored in greater detail through policy briefs, at the VEF and a possible global initiative?
- What are the key gaps and priority steps to be undertaken by different stakeholders?
- Which decision-makers, and at what levels, need to be influenced most?
- What questions still need to be answered?

**Outputs:** Consolidated intervention pathways; identified “so what” questions that need to be answered to galvanise action; identified priority steps with respect to shaping policy briefs and informing the function and form of the VEF sessions to facilitate action-oriented pathways to achieve the intended outcomes; and steps towards the design of a global initiative that can galvanise action towards the intended outcomes.

**Discussion Points**

A key outcome of each session will be a series of recommendations focused on opportunities to achieve the intended outcomes. Recommendations will take the form of “Intervention Pathways” and other steps to galvanise action. Intervention pathways represent the different options for achieving sustainable energy-industry outcomes, structured according to the different focus areas and dimensions, and packaged with different country capabilities and contexts in mind.

Recommendations determined during the virtual sessions will feed into a process to identify priority steps, with respect to a series of policy briefs, and to inform the function and form of the VEF sessions to facilitate action-oriented pathways to achieve the intended outcomes. These recommendations will also inform the design of a potential global initiative that brings together various partners to engage with high potential countries.