



OVERARCHING REPORT

2023 Technical Advisory Group Review



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Executive Summary

The key to Mission Innovation's success is delivering on the Missions and demonstrating impact through them. All seven Missions are reviewed annually by an independent panel of experts of diverse geographical and technical backgrounds (the Technical Advisory Group - TAG) to ensure that the Missions are on track, to uncover any risks and barriers to Missions' progress, and to make the Missions aware of any gaps that the TAG panel members may uncover. The first round of reviews took place in 2023.

All seven Missions are making progress in supporting clean technology innovation in the dynamic, challenging, complex and crowded energy landscape even though they are at different stages in their delivery. There is clear differentiation between missions and other global initiatives; in general, this is due to wide-reaching collaboration with international and national programs of work, via knowledge-sharing and bringing that wealth of knowledge under the MI framework.

Mission have had great **success** in producing impactful outputs. Highlights include:

- **Carbon Dioxide Removal Mission (CDRM):** [The Mapping Initiative](#)
- **Clean Hydrogen Mission (CHM):** [Hydrogen Valleys Platform](#)
- **Green Powered Future Mission (GPFM):** [Five demos on five continents flagship project](#)
- **Integrated Biorefineries Mission (IBM):** [Webinars with industry attendance](#)
- **Net Zero Industries Mission (NIM):** [Industry Awards delivered at COP28](#)
- **Urban Transitions Mission (UTM):** [Annual Summit in Riyadh](#)
- **Zero Emission Shipping Mission (ZESM):** [Green Shipping Corridors Hub](#)

Missions identified a number of **risks** that could hinder progress, including: member retention, insufficient resources, difficulties with engagement (particularly with the private sector) and unequal distribution of workload. A key risk is that Directors are crucial to the continuing operation of their Missions and there is no contingency in place to mitigate the risk of their departure, such as a Deputy Director.



Summary of Recommendations

1. As part of a rapidly evolving landscape, **Missions must continue to explore opportunities for collaboration**, including with other Missions where there are dependencies across sectors or for sharing of best-practice. With a wealth of experience now invested in the missions, the next step is to galvanise their leading role in driving the research and innovation that is needed to reach their goals, including much greater involvement with the Global South and the private sector. Both are integral for progress, enabling MI to increase its reach and impact.
2. **Missions need to be flexible to track and respond to changes** in the complex clean energy environment, which may mean adjustment of Goals to ensure that these are within the scope of Missions to influence. However, Missions also need to be granted the space to implement their Action Plans as endorsed before announcing and making changes.
3. It is critical to enhance the **role of Missions in identifying gaps and barriers within innovation ecosystems** and advocating best practices to strengthen national innovation ecosystems. Joint research and development (R&D) calls, such as the MI Call series, are a way for Missions to direct innovation. However, some Missions have had difficulty fostering international cooperation, particularly with non-European partners. Additionally, there's a need to articulate a qualitative understanding of successful pilot projects, whether conducted jointly or independently. Sharing insights into what works and why in these pilots, alongside strategies for replication, is essential for advancing innovation efforts.

4. Building on Missions' development of qualitative KPIs, it is essential to **expand quantitative KPIs** as these are needed to track short-term operational and long-term progress. More qualitative information such as lessons learned should be recorded and shared via simple mechanisms.
5. **Communications** came through as a strong cross cutting theme. Communicating success and outcomes of Mission activities is vital to achieving maximum impact. To support the Missions, MI also needs to improve its own wider communications, which will raise awareness of the Missions as a result.

Overall, the Missions are making strong progress towards their respective goals and should be commended for the work they have delivered to date. We hope that the individual Missions' reports, as well as this overarching report, provide useful guidance to help MI and its Missions continue to increase their impact and meet MI's overarching goal of making clean energy affordable, attractive, and accessible to all.

1 Value Added to the Clean Energy Landscape

The clean energy landscape is complex and crowded, so it is important for Missions to understand that environment, focus on areas where they can provide added value through global collaboration and to not duplicate already existing efforts. The area Mission Innovation (MI) can add the most value to international collaborations is in using research and innovation (R&I) to drive progress in clean energy. Most Missions effectively mapped the clean energy space they are operating within and have tried to differentiate themselves, as a global initiative, so they have the ability to link together various in-country efforts as well as other international initiatives and bring them under the MI umbrella. The key international initiatives some Missions are collaborating with are the International Energy Agency (IEA) Technology Collaboration Programs (TCPs) and the Clean Energy Ministerial (CEM) workstreams.



Fostering collaboration and knowledge-sharing is vital for getting the biggest impact out of R&I and this is a key value add across the Missions. The Green Powered Future Mission (GPFM) is an example of this; it has actively facilitated international collaboration on national-scale large demonstration projects and the information and knowledge developed from those projects is shared on the Mission's knowledge exchange platform. The Mission has also assisted with projects on the national scale, which have benefitted from the global perspective of the GPFM.

The Zero Emissions Shipping Mission (ZESM) has been proactive in ensuring it is adding value, by undertaking a comprehensive "roadmapping" exercise to identify "who is doing what" in the zero-emission shipping field which highlighted gaps and areas where the Mission can add value, which helped shape its Action Plan.

The Carbon Dioxide Removal Mission (CDRM) claims to be the only R&D-focussed multilateral international effort in this field. They are collaborating with the Clean Energy Ministerial (CEM) and the IEA and are trying to encourage more stakeholders through

demonstrating the economic value of carbon dioxide removal (CDR). This is an interesting value add and is different from other Missions.

It can be difficult for Missions to differentiate themselves when they are operating in an environment where there are multiple overlapping initiatives. The Clean Hydrogen Mission (CHM) is operating in a complex landscape of at least 20 global initiatives, and it is difficult to show a clear value-add. It needs to have a laser focus on its strength, which is innovation to reduce the cost of hydrogen production and technologies, that can be applied to hydrogen valleys as economic value-added demonstration platforms. In doing so, it could demonstrate how R&I can lead to cost reductions to move towards the hydrogen production at \$2/kg target.



Recommendations

1. Undertake a roadmapping/stocktake exercise, like the ZESM, to identify gaps and understand where each Mission can truly add value with a particular focus on innovation.
2. Understand the benefit the work of each Mission can bring to the broader political context and the priorities of governments as rallying points around which other collaborators can engage, and highlight this as a value-add.
3. Explore collaborations, including with other Missions, that add value to the Missions goals.
4. Continue the development of tools to enable the sharing and exchange of information on demonstration projects globally (e.g. GPFM online repository of demonstration projects)
5. Explore synergies at wider MI level with other international initiatives, like CEM.

2 Impact of Mission Activities

The Missions need to demonstrate the tangible impact they are having in reaching their goals and on the broader clean energy landscape where they operate. Demonstrating high-value results to a wide audience will encourage more participation in MI and collaboration with the Missions, which will lead to greater impact; a positive feedback loop.

Mission collaboration with the private sector is key to getting new technologies and processes out in the field and into demonstration projects, which will lead to commercialisation and positive impact towards reaching goals for the Missions. Several strategies have been used by Missions to engage with the private sector:

- The conferring of awards, a strategy used by the Net Zero Industries Mission (NIM) and the CDRM has been successfully used to raise the profile of Missions and MI. This will help to increase the opportunities for collaboration with external stakeholders, such as industry, which is vital to the success of MI and the NIM, in particular.
- The development of hydrogen valleys which bring the private sector and academia together to demonstrate clean hydrogen technologies is being enhanced through the development of a knowledge-sharing platform with support from the CHM. The Urban Transitions Mission (UTM) is using a knowledge-sharing platform to bring cities together to share ideas and increase impact.
- The Integrated Biorefineries Mission (IBM) has been supporting smaller private enterprises with building international partnerships, which leads to recognition of new innovations and builds impact.

Missions need to be mindful when engaging with the private sector to avoid working with just one or two companies to prevent potential biases, instead adopting a broader approach by engaging with industry associations. Industry associations can provide funding for research and development (R&D), which would be a positive outcome for Missions if they can tap into this resource. Alternatively, Missions can establish advisory boards with a more diverse set of private sector actors. These boards, comprised of corporates, investors, innovators, incubators, industry associations, financiers, and research institutions, can provide specific feedback into the activities of the Mission, guiding their development and ensuring that they remain relevant for the challenges facing companies throughout the supply chain.

A key activity across all Missions is using knowledge-sharing not only to increase engagement with the private sector but also with other non-member countries, thereby enhancing impact. It is also important to focus on developing countries, which seem to be difficult to reach in MI as they are generally not member countries. The CHM has been successful in achieving impact in developing countries by running knowledge-sharing workshops in Latin America, for example.



Recommendations

1. Include high-profile activities such as awards to attract interest, broaden reach and hence impact.
2. Use knowledge-sharing to bring in other countries, including developing countries and stakeholders.
3. Seek broad, but targeted engagement particularly with the private sector so there is concrete collaboration without bias. This can be done through partnering with industry associations and/or establishing private sector advisory boards.
4. Use “impact indicators” to track and trace impact (see Section 3).

3 Mission Progress Against Action Plan and Towards Mission Goal

All Missions have been making steady progress against their Action Plans and tracking towards their Mission Goal, although in some cases the Goal may need refinement as it largely falls outside of the scope of the Mission's direct influence.

Key Performance Indicators (KPIs) are a widely used mechanism by the Missions for tracking progress. All Missions are finalising their KPIs, with guidance from the MI Secretariat, and this work should be prioritised. One example of success is the ZESM, which has engaged DNV (Det Norske Veritas) to work on its KPIs and the recommendations are already being acted upon. This includes an "impact indicator" which is a short-term indicator of impact linked to each Mission deliverable.



It is important for Missions to have quantitative KPIs which are targets to be met, to complement qualitative KPIs which can be difficult to measure. It can also be difficult to track progress if there are too many KPIs, given the resource constraints all Missions have. The KPIs need to be defined so they address the Missions' strategic objectives (e.g., number of demonstration projects) and their short-term operations (e.g., number of workshops) that will allow the monitoring of progress towards the long-term goal and tracking the day to day functioning of the Mission.

Other initiatives that are being used by Missions to support their Goal include a simple template developed by the GPFM which is used by pilot project developers to record data and track progress, to be shared not only amongst MI but also the European Taskforce. It includes useful qualitative information such as lessons learnt, which can be invaluable for new projects.

Tracking progress against a Mission's goal can be difficult when there are several factors that are outside of the Mission's control. As previously mentioned, the CHM has a goal of clean hydrogen production at \$2/kg by 2030, which is largely outside of the Mission's ability to influence since the cost of electricity is the largest input into the cost of clean hydrogen production. Additionally, this goal has already been achieved in some regions. The ZESM is focussed on the development of viable shipping with zero-emission fuels by 2030, and parts of this goal are outside of the Mission's scope of influence, such as the creation of new business models. However, since being reviewed by the TAG, the ZESM aims to refine their goal to be more in line with what they can actually achieve. The IBM has an easy-to-understand goal, but it needs to develop a robust methodology to track progress.



Recommendations

1. Ensure all Mission Goals fall within the scope of the Missions to influence.
2. Refine KPIs to be quantitative and connected to the areas where the Missions can have real impact to track day-to-day and long-term progress.
3. Share qualitative information between partners, as this is vital; develop a simple methodology to do this.

4 Mission Outputs Since Launch

All the missions have made appreciable progress since their launch dates with a range of impressive outputs delivered by all Missions. The following is a short summary of the highlights of the mission outputs:

Highlights of Mission Outputs

CDRM



CDR online mapping tool of local and global CDR potential; LCA case studies which have led to new collaborations with resultant publications; and the CDR Launchpad by a coalition of countries which has led to an initial workshop.

UTM



Urban Transitions Net Zero Framework; four case studies published including an overview of needs, gaps and cluster activation; Annual Summit in Riyadh; and mayoral-ministerial dialogues with R&I priorities outlined such as funding, contribution to the marketplace, and the Global Innovation Alliance.

ZESM



Transatlantic Green Ammonia Bulk Carrier pilot (includes a public report and follow up workshop with US authorities); online platform on green shipping corridors together with a project launch event at COP28.

GPFM



Five demos on five continents flagship project; GPFM Internet Platform; large number of workshops including with the private sector and other initiatives.

NIM

Industry Awards with very high impact and awareness among policymakers at a ministerial level and with industry.

CHM

89 hydrogen valleys out of 100 targets identified.

IBM

Webinars with broad stakeholders including industry.

One key point to improve Mission outputs would be to ensure the delivery of joint R&D calls which have been highlighted as a key priority for Missions across all individual TAG Mission review reports. GPFM is an example of success in this space through development of cooperation with the Clean Energy Transition (CET) Partnership, through which we would encourage continued cooperation. Some barriers were highlighted by Missions: the CDRM explained that differences in national R&D funding policies, rules and cycles is a key barrier for the delivery of joint calls, while the UTM highlighted a lack of success to date through the MI Call series in part due to European-centric schemes which does not allow the full membership of the Mission to participate.



Recommendations

1. Although the Mission outputs shows overall good shape, strategy, approach, the ambition should continue to be raised and efforts should be made to raise the visibility of outputs. **The MI website should become the single-entry point for all Mission outputs, like those listed herein.**
2. The **Zero Emission Shipping Mission** should leverage high quality outputs from the Mission to support high-level engagement with the goal of securing commitment of incremental resources.
3. The **Urban Transitions Mission** should have a strategy to assess pilots and create plans for scaling if successful. A plan for using the Global Innovation Alliance for effectively meeting the Mission goals should be evolved. The approach of the Mission on simplification, scaling and synergies needs to be kept in mind while holistically assessing the Mission outputs.
4. The **Net-Zero Industries Mission**, as discussed in the review, should put more emphasis on communication activities (see Section 7). This will help the Mission greatly to increase the buy-in both from governments and industrial partners.
5. The **Integrated Biorefineries Mission** should focus its attention on the need to innovate to cheaper technologies and where development can drive down costs. It is unclear from the Mission's current engagement with external stakeholders – to date, largely webinars and workshops – how it is cultivating sufficient outputs that can achieve this goal.

6. Though there are a large number of outputs planned, the TAG advises the **Green Powered Future Mission** to focus on the main learnings – what works, what doesn't work, and why.
7. It would be useful for knowledge-sharing to provide summaries of key findings from these workshops on the **Clean Hydrogen Mission** website. This is particularly important for trying to engage the private sector; the information needs to be targeted to their needs and describe how the CHM can assist them.
8. R&D is an essential aspect of the **Carbon Dioxide Removal Mission** allowing progress in CDR technologies. Differences in funding policies should be addressed in funders dialogue or on ministerial level. Mission outcomes should give input based on science and technology to policy discussions on CDR.

5 Collaboration and Engagement

It is essential that MI and its Missions collaborate closely across the landscape with other international initiatives/organizations, including with other MI Missions, academia, and industry associations, with a focus on joint R&D actions and knowledge-sharing. For example, in the CDRM, the stakeholder mapping exercise represents an impressive effort to detail not only crucial stakeholders but to analyse their value proposition for the Mission. This is a fantastic product, and we would encourage sharing the process of developing this with other Missions.

Some good examples of collaboration across the landscape are with CEM workstreams and IEA TCPs, including collaboration of IBM with the CEM Biofutures workstream and the IEA Bioenergy TCP, and the GPFM relationship with the International Smart Grid Network (ISGAN) (both a TCP & CEM workstream). We would encourage the continuation of these networks to increase impact and ensure alignment across the landscape.



MI should expand its geographic reach, with a specific emphasis on extending its presence to more regions and countries in the Global South. Climate change is a worldwide issue and technological solutions will need to be implemented globally in order to substantially reduce greenhouse gas emissions and to ensure a just and equitable transition. Each country/region has its own needs and perspectives and solutions that are suitable for one country/region may not be practical in other countries/regions. Global collaboration is therefore key for MI to support a just transition that ensures clean energy is accessible and affordable for all.

There is some collaboration with the Global South across Missions, but not enough. Large emerging economies are increasingly investing in R&D. Therefore, working/collaborating with regional associations such as Latin America Olare and ASEAN, African Union and sub-regional associations should be encouraged. This type of collaboration would be more efficient than approaching individual countries. One example of success in this field is the CHM, who delivered workshops with Latin American countries with a focus on pillar three (enabling conditions), to encourage knowledge-sharing.

Inter-Mission and other MI workstream collaborations should be encouraged. This is particularly important where dependencies exist across sectors and Missions working together will be more productive and increase impact. Some examples where synergies exist are the ZESM and CHM; the UTM and the Innovation Community for Sustainable Heating and Cooling; and the CDRM, NIM and CHM. Closer collaboration between Missions would be useful for sharing of best practice/ good processes. For example, UTM have made progress on legal frameworks for collaboration, and other Missions may be able to learn from this. Indeed, CHM were recommended to explore legal frameworks to support knowledge-sharing across Hydrogen Valleys.



Recommendations

1. Missions are encouraged to engage more with emerging and developing economies, including through regional associations.
2. Missions are encouraged to increase inter-Mission & other MI workstream collaboration, for both collaboration across sectors and general best-practice sharing.
3. Missions are encouraged to proactively engage across the landscape, including through collaboration with the IEA TCPs and CEM workstreams where relevant.
4. Missions may further elaborate on the value propositions for both government and the private sector to clearly articulate the benefits of engaging actively with the Mission.

6 Risk Management

Generally, most Missions have not developed formal risk tracking and management; GPFM being the exception. Risk management is essential for effective programme management. It can also be a useful way to develop solutions to risks. For example, developing a formal risk register noting a lack of commitment from members could be used to highlight this issue and encourage members to increase resources to the Mission.



Two key risks were identified across most Missions. The first major risk is the varying level of involvement of countries in Missions. It is understandable that different countries have different levels of resources to commit, but this can create an imbalance in Missions. Generally, Missions which had the highest resource dedication from their co-leads were found to be delivering more successful outputs. To mitigate that risk, work programmes for Missions should indicate the level of resources they should devote to particular sections of work. Members countries would then have an indication of whether Missions deliver as planned and, if not, where participating signatories need to increase their commitment.

The second major cross-cutting risk is the lack of Mission leadership contingency planning. This risk was clearly demonstrated in CHM and ZESM, where TAG reviews were delayed due to Director illness and changeover, respectively. This was also directly raised by Missions where they flagged the need to consider retirement or role changes amongst Mission leadership. We would recommend that every Mission develop some leadership contingency planning, with our main recommendation being to create deputy director (or equivalent) roles in every Mission. For example, the NIM has a Mission coordinator who has sufficient knowledge and resources to assist with operating the Mission, and this has proved to be a successful model.

Cybersecurity is an additional risk that has been flagged and will need to be considered by some Missions in the future.



Recommendations

1. Missions should all develop a formal risk tracking system to ensure risks are identified early and managed.
2. Mission members should increase commitment to their Missions and ensure these are sufficiently resourced to be able to deliver on plans.
3. Mission members should create and resource a deputy director (or equivalent) role for each Mission.

7 Communications

Enhancing communication efforts within MI is crucial to boosting visibility and expanding outreach for the Missions. The MI website can be unreliable; it was not operating during the TAG reviews, which meant information was harder to reach. Therefore, we encourage more focus from members on providing resources for communications, both for MI as a whole and for the Missions. A more active communication program would be very helpful as it can raise awareness at the private sector and government level, which in turn can bring in buy-in from the private sector and more public-private resources.

Indeed, communications were highlighted as a common area for development for all Missions, particularly around communicating impact. Some missions have been more successful at communicating the impact of their work than others. Ultimately, the Missions want to share best practices and lessons learned to increase progress in these areas, and, to do so, they need to have broad audience reach. When Missions are planning their communications, it is important for them to think about their target audience - the decision makers who will use the information - to develop targeted communications products.



Recommendations

1. Prioritize communication efforts across the board. It is important to first raise the awareness of MI as a whole, and then of each Mission. Therefore, members are encouraged to increase resources and attention to communications efforts, not only within the Missions themselves, but also extending beyond them.



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