Infrastructure Transition Pathways

Final report for the G20 Infrastructure Working Group
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Executive summary

Infrastructure influences 92% of the sustainable development goals\(^1\) and is responsible for 79% of total greenhouse gas emissions and 88% of adaptation costs.\(^2\) To achieve global climate and United Nations Sustainable Development Goal (SDG) targets, significant and fast changes in infrastructure development and service delivery are needed.

‘Transition pathways’ set a course toward shifting infrastructure development and service delivery to achieve global climate and United Nations Sustainable Development Goal targets. For this final report, the Global Infrastructure Hub (GI Hub) has identified at a qualitative level what the infrastructure transition pathways are, informed by extensive literature review.\(^3\) The GI Hub also analysed 243 long-term infrastructure strategies and plans of G20 member and guest economies to identify insights for infrastructure planning aligned with the transition pathways. The list of plans analysed has been provided to each G20 member and guest economy for review, and further comments on the list are welcomed by the end of June 2022.

Clear and reliable long-term plans provide investors with more certainty, a crucial ingredient to unlocking more private investment. The main purpose of this report is therefore to support private sector investment in sustainable infrastructure by providing clarity on global infrastructure transition pathways and the alignment of current infrastructure plans to these pathways.

Across the board, it was found that the long-term infrastructure plans analysed were addressing the range of infrastructure transition pathways found in the literature. This shows that governments are taking steps towards the transition to achieving global climate and United Nations SDG targets through infrastructure, and that there is knowledge to be shared on ways to develop plans for each of the transition pathways.

The analysis has found that almost half of the plans mention the potential for private sector investment to be involved in the implementation of the plans. At the same time, only about one-third of the plans include detailed investment amounts and quantified targets, indicating low maturity in planning to date for the other two-thirds. These results show that while supporting private sector participation is a key area of focus for governments, more knowledge and support for countries may be needed to develop and align long-term infrastructure plans with transition goals. This would be supported by an understanding of the ‘transition investment gap’ for infrastructure for each of the infrastructure transition pathways.

The greatest number and maturity of plans were found for the transition pathway of ‘increasing substantially the share of renewable energy generation.’ Infrastructure plans for other transition pathways have a smaller number of plans and levels of maturity. This includes pathways such as ‘lowering the carbon intensity of steel and cement production,’ and ‘universal access to water, education, internet, and health services.’

Across all transition pathways, the number and maturity of plans are lower in the emerging economies of the G20.

To address these findings, support could include a decisionmaking tool to support countries – particularly emerging G20 economies – to develop infrastructure plans that address the infrastructure transition pathways, particularly those with lower maturity and coverage of plans.

These findings have informed the development of the G20 / GI Hub Framework on How to Best Leverage Private Sector Participation to Scale Up Sustainable Infrastructure Investment.

The detailed data from the work on infrastructure transition pathways will be published as an online tool in early 2023 to support infrastructure practitioners and decisionmakers.

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\(^3\) See Appendix B for reference list
1 Background and context

This final report on infrastructure transition pathways is a deliverable under the G20 Infrastructure Working Group’s (IWG) Priority 1 (Scaling up sustainable infrastructure investment by leveraging private sector participation). It presents a selection of insights from GI Hub’s InfraTracker 2.0 – an initiative currently being developed under IWG’s Priority 4 (Advancing Transformative Infrastructure post-COVID-19), and a continuation of the Italian Presidency’s Transformative Outcomes Through Infrastructure initiative. This report aims to use the data insights from InfraTracker 2.0 as input into the main deliverable under Priority 1, the G20 / GI Hub Framework on How to Best Leverage Private Sector Participation to Scale Up Sustainable Infrastructure Investment (Framework).

This final report follows a draft report submitted to the IWG in March 2022. It continues the analysis of G20 infrastructure plans for insights on infrastructure transition pathways. The list of infrastructure strategies and plans used in the analysis was provided to IWG members for their review. This final report incorporates feedback received on the draft report and lists. Additional comments on the lists of plans are welcome until the end of June 2022.

1.1 The need for infrastructure transition pathways

Infrastructure influences 92% of the sustainable development goals and is responsible for 79% of total greenhouse gas emissions and 88% of adaptation costs. To achieve global climate and United Nations Sustainable Development Goal (SDG) targets, significant and fast changes in infrastructure development and service delivery need to start now given the long-term impacts of infrastructure decisions. These changes can include shifts towards certain types of infrastructure assets and services or shifts away from other assets and methods for service delivery. Currently, there is limited awareness of what these changes (i.e. infrastructure transition pathways) should be. There is also a lack of transparency of current long-term infrastructure priorities for each of these changes (or infrastructure transition pathways).

Better transparency of long-term infrastructure priorities was identified by private sector investors as a key opportunity to unlock private sector investment in sustainable infrastructure. In this context, GI Hub was asked by the IWG to examine infrastructure transition pathways and to use this information as input to the G20/GI Hub Framework under Priority 1.

Why are infrastructure transition pathways important?

- Transparency of long-term investment priorities for sustainable infrastructure investment was one of the main requests from private sector investors. This is reflected in policy messages II and III of the Outcomes Document from the 2021 G20/OECD Infrastructure Investors’ Dialogue.
- Transparency can provide investors with certainty about governments’ infrastructure goals and priorities, limit the risk of investing in stranded assets and guide the development of sustainable investment strategies.
- IWG members highlighted the importance of infrastructure transition pathways in the G20 seminar on Scaling up sustainable infrastructure investment by leveraging private sector participation held on 19 January 2022.
- At the same G20 seminar, the G20 Sustainable Finance Working Group indicated that infrastructure transition pathways can support their workstream 1: ‘developing a framework for transition finance and improving the credibility of financial institution commitments’.

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1 GI Hub, 2021. Transformative Outcomes Through Infrastructure. Available at: [https://transformativeinfratracker.gihub.org/](https://transformativeinfratracker.gihub.org/)


1.2 Purpose of this work

The objective of this work is to fill two information gaps:

1. Identify the infrastructure transition pathways to achieve global climate and SDG targets.
2. Gain access to data insights from infrastructure plans on long-term infrastructure priorities and their alignment with infrastructure transition pathways.

By filling these gaps, this initiative aims to create greater transparency to support private sector investment in sustainable infrastructure and guide policymakers and practitioners as they develop their infrastructure strategies.

For clarity, this initiative does not intend to recreate infrastructure targets to achieve climate change or sustainability. It recognises that the United Nations Framework Convention on Climate Change and other international conventions are the primary avenues for the negotiation of such targets.

1.3 Approach

This work on infrastructure transition pathways was a G20 member-led initiative, developed in consultation with the IWG members. The approach is further detailed in Appendix A. In summary, the methodology used to develop the work included:

• Desktop research to draft infrastructure transition pathways based on those commonly found in research and analysis by international organisations (see Appendix B for reference list).
• Identification and validation of national infrastructure plans with each of the G20 member and guest economies.
• Review and analysis of national infrastructure plans to confirm infrastructure transition pathways.
• Collation of data on aligned policy statements, and the availability of targets and investment information, in each for the plans to identify aggregated insights for the infrastructure transition pathway.

At the time of circulation, nine G20 member and guest economies had validated the list of plans, meaning that 40% of the plans reviewed had been validated. As a result, GI Hub is proposing to extend the response period to 30 June 2022 and circulate an updated report in September 2022.

2 Infrastructure transition pathways

‘Infrastructure transition pathways’ can be identified in many ways. In the context of this work, infrastructure transition pathways are qualitative statements that reflect the changes needed in infrastructure development and service delivery to achieve global climate and United Nations SDG targets. The transition pathways were based on those commonly observed across G20 economy infrastructure plans.

The transition pathways are shown in Table 1 below. They have been reworded slightly from the list in the draft report provided to the IWG in March 2022. They may continue to evolve as new information comes to light, particularly through the work being undertaken for the GI Hub InfraTracker 2.0, which is due for final submission to the IWG in September.

There are 13 transition pathways allocated to five categories: enabling universal access, low-carbon power generation, low-carbon infrastructure operation, optimising infrastructure benefits, and minimising infrastructure impacts.
Table 1 Infrastructure Transition Pathways

<table>
<thead>
<tr>
<th>Category</th>
<th>Transition pathway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabling universal access</td>
<td>1. Enabling universal access to safe, affordable, and sustainable infrastructure systems and services</td>
</tr>
<tr>
<td></td>
<td>a. Universal energy access</td>
</tr>
<tr>
<td></td>
<td>b. Universal access to water</td>
</tr>
<tr>
<td></td>
<td>c. Universal access to mobility services</td>
</tr>
<tr>
<td></td>
<td>d. Digitalisation of services</td>
</tr>
<tr>
<td></td>
<td>e. Universal access to internet</td>
</tr>
<tr>
<td></td>
<td>f. Universal access to health services</td>
</tr>
<tr>
<td></td>
<td>g. Universal access to education services</td>
</tr>
<tr>
<td>Low-carbon power generation</td>
<td>2. Substantially increasing the share of renewable energy generation</td>
</tr>
<tr>
<td>Low-carbon infrastructure operation</td>
<td>3. Substantially decreasing the share of coal in power generation</td>
</tr>
<tr>
<td>Optimising infrastructure benefits</td>
<td>4. Lowering the carbon intensity of fuels for transport and industry</td>
</tr>
<tr>
<td></td>
<td>5. Lowering the carbon intensity of steel and cement production</td>
</tr>
<tr>
<td></td>
<td>6. Substantially increasing the share of low emissions vehicles</td>
</tr>
<tr>
<td></td>
<td>7. Substantially reducing the carbon intensity of buildings</td>
</tr>
<tr>
<td>Minimising infrastructure impacts</td>
<td>8. Enhancing performance and efficiency of transport systems</td>
</tr>
<tr>
<td></td>
<td>9. Densifying spatial planning for decreased energy and resource use</td>
</tr>
<tr>
<td></td>
<td>10. Scaling up the adoption of InfraTech</td>
</tr>
<tr>
<td></td>
<td>11. Substantially decreasing waste</td>
</tr>
<tr>
<td></td>
<td>12. Restoring land and water ecosystems</td>
</tr>
<tr>
<td></td>
<td>13. Substantially increasing technological carbon capture</td>
</tr>
</tbody>
</table>

The qualitative transition pathways are often supported by country-specific quantified targets to guide infrastructure plans and investments and achieve climate and United Nations SDG targets. The next few sections of this report show if and how the G20 is developing infrastructure plans that support infrastructure transition pathways, as well as an indication of the maturity of these plans.

3 Overview of G20 long-term infrastructure plans

This section provides an overview of the G20 long-term infrastructure plans assessed for this report.

Through this study, 243 plans across G20 member and guest economies were identified and reviewed with five to 40 plans identified per economy. These plans were identified based on their relevance to achieving climate and United Nations SDG targets. Most of the plans identified are for the next 15 years, with 16% of the plans extending to 2050 and beyond. The high number of plans identified provides a good representation of long-term infrastructure priorities on which to base the analysis.

Three areas of interest were chosen for this analysis: 1) the level of investment detail included in plans, 2) whether policy statements made in plans included quantified targets, and 3) the sectoral focus of plans.
3.1 Level of investment detail

| 243 plans were analysed | $28% of plans include detailed investment amounts | 46% of plans mention private sector investment |

High levels of investment detail can indicate a strong commitment to the implementation of the plans and associated transition pathways. This also provides greater transparency for investors on future infrastructure development and investment.

The analysis showed that only 28% of plans included high levels of investment details. At the same time, 46% of plans mentioned private sector investment. This could indicate that while private sector participation is a key focus for governments, transparency on the amount of investment required from the private sector needs to be further developed.

3.2 Level of quantified targets

| 37% of plans have quantified targets | 55% of plans have unquantified targets | 8% of plans have no target |

Where plans included quantified targets, the direction of future infrastructure development and investment is likely to be clearer and therefore more attractive to investors. The analysis shows that 37% of plans included quantified targets. An example of a quantified target is: ‘Active transport and micro-mobility options will comprise 50% of journeys in towns and cities by 2030’.

In aggregate, 8% of plans included policy statements that have no targets, whether quantified or unquantified. These types of plans (and associated transition pathways) could be at the ‘vision setting’ or early planning stage.

3.3 The sectoral focus of plans

| 22% of plans were economy-wide | 24% of plans covered many infrastructure sectors (cross-sectoral) | 54% of plans were specific to one infrastructure sector |
To achieve global climate and United Nations SDG targets, cross-sectoral plans for an economy-wide transition are likely to be needed. More than half of the plans (54%) were specific to one sector whereas the others were cross-sectoral (plans that cover many infrastructure sectors) or economy-wide (consider transition across infrastructure and other parts of the economy). Economy-wide plans were commonly plans for green economic growth or recovery. This indicates that sectoral infrastructure planning is more common than cross-sectoral planning. These results show that further efforts may be needed on economy-wide or cross-sectoral planning.

4 Insights by infrastructure transition pathway

The next few sections provide further insights on infrastructure transition pathways in the context of the three areas of interest highlighted above, as observed within the G20 infrastructure plans. This includes aggregated insights for the G20 on:

• The infrastructure transition pathways that are being targeted by the plans, and by when
• The level of planning maturity for infrastructure transition pathways across the G20
• How frequently private sector investment is mentioned in plans for each infrastructure transition pathway.

4.1 Increasing renewable energy generation was the transition pathway with the largest number of plans

Figure 1 below shows the number and planning horizon of G20 infrastructure plans that relate to each infrastructure transition pathway.

Figure 1 shows that the largest number of infrastructure plans focused on the infrastructure transition pathway ‘substantially increasing the share of renewable energy generation’. This is interesting given that renewable energy was not one of the top public sector areas of investment for stimulus post-COVID-19 as shown by GI Hub’s data analysis in the 2021 InfraTracker. Further, half of the plans relating to increasing the share of renewable energy generation extended to 2040 and beyond.

The transition pathway with the second-highest number of plans was ‘scaling of adoption of InfraTech,’ showing that technology in infrastructure (InfraTech) is a key focus for governments. This is an encouraging result given that almost half of the technologies required for greenhouse gas reductions to achieve net-zero by 2050 are currently at the demonstration or prototype stage and concerted effort is needed to scale up financing and development of InfraTech.

The third most common transition pathway mentioned by the plans was related to the transition pathway ‘enhancing the performance and efficiency of transport systems.’ This shows that there is a high focus on planning in the transport sector.

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8 GI Hub, 2021, Transformative Outcomes Through Infrastructure. Available at: https://transformativeinfratracker.github.org/
### Figure 1 Number and date of G20 infrastructure plans identified for each infrastructure transition pathway

<table>
<thead>
<tr>
<th>Infrastructure Transition Pathway</th>
<th>Number of Plans</th>
<th>Date of Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantially increasing technological carbon capture</td>
<td>40</td>
<td>2020-2030</td>
</tr>
<tr>
<td>Restoring land and water ecosystems</td>
<td>30</td>
<td>2020-2040</td>
</tr>
<tr>
<td>Substantially decreasing waste</td>
<td>20</td>
<td>2020-2050</td>
</tr>
<tr>
<td>Densifying spatial planning for decreased energy and resource use</td>
<td>10</td>
<td>2020-2050+</td>
</tr>
<tr>
<td>Enhancing performance and efficiency of transport systems</td>
<td>5</td>
<td>2020-2030</td>
</tr>
<tr>
<td>Scaling the adoption of InfraTech</td>
<td>2</td>
<td>2020-2040</td>
</tr>
<tr>
<td>Lowering the carbon intensity of steel and cement production</td>
<td>60</td>
<td>2020-2030</td>
</tr>
<tr>
<td>Reducing substantially the carbon intensity of buildings</td>
<td>50</td>
<td>2020-2040</td>
</tr>
<tr>
<td>Lowering the carbon intensity of fuels for transport and industry</td>
<td>40</td>
<td>2020-2050</td>
</tr>
<tr>
<td>Substantially increasing the share of low emissions vehicles</td>
<td>30</td>
<td>2020-2050+</td>
</tr>
<tr>
<td>Substantially decreasing the share of coal in power generation</td>
<td>20</td>
<td>2020-2030</td>
</tr>
<tr>
<td>Substantially increasing the share of renewable energy generation</td>
<td>10</td>
<td>2020-2040</td>
</tr>
<tr>
<td>Universal access to health services</td>
<td>50</td>
<td>2020-2030</td>
</tr>
<tr>
<td>Universal access to education services</td>
<td>40</td>
<td>2020-2040</td>
</tr>
<tr>
<td>Universal access to water</td>
<td>30</td>
<td>2020-2050</td>
</tr>
<tr>
<td>Universal access to internet</td>
<td>20</td>
<td>2020-2050+</td>
</tr>
<tr>
<td>Universal access to mobility services</td>
<td>10</td>
<td>2020-2030</td>
</tr>
<tr>
<td>Universal energy access</td>
<td>5</td>
<td>2020-2040</td>
</tr>
<tr>
<td>Digitalisation of services</td>
<td>2</td>
<td>2020-2050+</td>
</tr>
</tbody>
</table>

**Figure 2** below illustrates the percentage of G20 economies with infrastructure plans for each transition pathway. It also shows the level of planning maturity for the transition pathways. Transition pathways with ‘high maturity’ indicate the availability of plans with quantified targets and investment details, ‘medium maturity’ indicate plans with quantified targets but no investment details, and ‘low maturity’ indicate plans that have no target or investment details. Plans with a higher level of maturity are also likely to provide more transparency for investors. The levels of maturity could be indicative of two things:
The stage of development of the plans related to transition pathways (for example, plans for enhancing performance and efficiency of transport systems are more progressed than plans related to lowering the carbon intensity of steel and cement production)

The capacity to deliver against the transition pathways.

Figure 2 indicates that the transition pathways with the highest maturity of plans across the G20 were those relating to ‘substantially increasing the share of renewable energy generation’. The transition pathway with the second-highest maturity was ‘enhancing the performance and efficiency of transport systems.’ Although, as can be seen, all other transport-related transition pathways also had plans with higher levels of maturity (e.g. ‘increasing the share of low emissions vehicles’ and ‘universal access to mobility services’).

Figure 2 Percentage of G20 economies with high, medium, and low maturity transition pathways
Delving a bit deeper into this data, Figure 3 below shows the comparison between developed and emerging G20 economies for plans with ‘high maturity’ across the infrastructure transition pathways. There are similarities in maturity plans for transition pathways relating to transition pathways ‘universal access to mobility’ and ‘enhancing the performance and efficiency of transport systems.’ However, all other transition pathways, and in particular the transition pathways ‘restoring land and water ecosystems’, ‘lowering the carbon intensity of cement and steel production’, and ‘universal access to health services’, show large gaps in the maturity of plans. These findings align with the well-recognised need for further capacity building in emerging economies across most transition pathways.

Figure 3 Percentage of G20 emerging and developed economies with plans with a high level of maturity

### 4.3 Private sector investment is commonly mentioned in plans relating to the transition pathway for increasing renewable energy generation

Given the magnitude of the global infrastructure investment gap, private sector participation in infrastructure is more important now than ever before. In this context, mentions of private sector investment in the plans were investigated. It was found that 46% of all plans mentioned private sector investment. When the trends are assessed by transition pathway, it was found that almost all countries have plans that mention private sector investment for the pathway of ‘substantially
increasing renewable energy generation’ (Figure 4). This aligns with recent insights from the GI Hub Monitor initiative, which show that 47% of all private sector investment in infrastructure in 2020 was in renewable energy infrastructure.\(^\text{10}\) On the other hand, a lower percentage of countries had plans that mention private sector investment for the pathways of ‘densifying spatial planning for decreased energy and resource use’, and universal access to water and health services.

<table>
<thead>
<tr>
<th>Managing infrastructure impacts</th>
<th>Substantially increasing technological carbon capture</th>
<th>Restoring land and water ecosystems</th>
<th>Substantially decreasing waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimising infrastructure benefits</td>
<td>Densifying spatial planning for decreased energy and resource use</td>
<td>Enhancing performance and efficiency of transport systems</td>
<td>Scaling the adoption of InfraTech</td>
</tr>
<tr>
<td>Low-carbon infrastructure operation</td>
<td>Lowering the carbon intensity of steel and cement production</td>
<td>Reducing substantially the carbon intensity of buildings</td>
<td>Lowering the carbon intensity of fuels for transport and industry</td>
</tr>
<tr>
<td></td>
<td>Substantially increasing the share of low emissions vehicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-carbon power generation</td>
<td>Substantially decreasing the share of coal in power generation</td>
<td>Substantially increasing the share of renewable energy generation</td>
<td></td>
</tr>
<tr>
<td>Enabling universal access</td>
<td>Universal access to health services</td>
<td>Universal access to education services</td>
<td>Universal access to water</td>
</tr>
<tr>
<td></td>
<td>Universal access to internet</td>
<td>Universal access to mobility services</td>
<td>Universal energy access</td>
</tr>
<tr>
<td></td>
<td>Digitalisation of services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{10}\) GI Hub, 2022, Data Insights: Renewables dominate private investment in infrastructure. Available at: https://www.gihub.org/infrastructure-monitor/insights/renewables-dominate-private-investment-in-infrastructure/
to the achievement of the transition pathways. This section provides a breakdown of those sectors and sub-sectors for two key transition pathways:

- Substantially increasing the share of renewable energy generation (41% of plans), and
- Scaling up the adoption of InfraTech (29% of plans).

For purposes of this report, only these two transition pathways were broken down by sector. However, the data is available to extend this analysis to all transition pathways. This more detailed analysis will be included in the GI Hub’s InfraTracker 2.0 initiative due to be submitted to the IWG later this year.

### 5.1 Substantially increasing the share of renewable energy generation

The transition pathway of ‘substantially increasing the share of renewable energy generation’ was most commonly associated with plans for renewable generation (unspecified), wind, solar, and biofuels (Figure 5). Energy storage, transmission, and distribution (particularly hydrogen and energy storage), as well as transport-related plans (notably zero-emissions vehicles), were also commonly associated with this transition pathway. Cross-sectoral plans were also common, i.e., plans that consider the use of renewable generation across multiple sectors.

![Figure 5 Sector and sub-sector breakdown relating to the transition pathway ‘substantially increasing the share of renewable energy generation’](image-url)

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*Infrastructure Transition Pathways*

8 July 2022

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5.2 Scaling up the adoption of InfraTech

The transition pathway of ‘scaling up the adoption of InfraTech’ was most associated with the communications and digital infrastructure sectors (such as digital enterprise solutions, data centres, and broadband) and transport sectors (such as zero-emissions vehicles, active transport, rail, and roads) and of course renewable generation (Figure 6). This shows that technology was a feature across many types of infrastructure plans.

<table>
<thead>
<tr>
<th>Communications</th>
<th>Social</th>
<th>Energy storage, transmission and...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital / enterprise solutions</td>
<td>Healthcare and wellness infrastr...</td>
<td>Other public buildings and structures</td>
</tr>
<tr>
<td>Transport</td>
<td>Housing</td>
<td>Urban landscapes/public spaces</td>
</tr>
<tr>
<td>Transport (unspecified)</td>
<td>Justice</td>
<td>Tourism, Art...</td>
</tr>
<tr>
<td>Data centres</td>
<td>Energy distribution (unspecified)</td>
<td>Energy storage</td>
</tr>
<tr>
<td>Fixed - e.g. broadband</td>
<td>Waste</td>
<td>Hydrogen</td>
</tr>
<tr>
<td>Renewable Generation</td>
<td>Cross-sectoral</td>
<td>Waste</td>
</tr>
<tr>
<td>Cross-sectoral</td>
<td>Waste</td>
<td>Industrial and trade waste</td>
</tr>
<tr>
<td>Waste</td>
<td>Water</td>
<td>Recycling and waste minimisation...</td>
</tr>
<tr>
<td>Water</td>
<td>Water efficiency solutions</td>
<td>Non-Renewable...</td>
</tr>
<tr>
<td>Water</td>
<td>Agr... and ind...</td>
<td>Carbon capture, utilisation...</td>
</tr>
<tr>
<td>Disaster...</td>
<td>Co...</td>
<td>Oil and gas fired</td>
</tr>
</tbody>
</table>

Figure 6 Sectors commonly addressed by plans relating to the transition pathway ‘scaling up the adoption of InfraTech’

6 Conclusion

To achieve global climate and United Nations SDG targets, significant and fast changes in infrastructure development and service delivery are needed. However, there is limited awareness of what these changes are, or what the infrastructure transition pathways should be. There is also a lack of transparency around the alignment of current long-term infrastructure plans to these infrastructure transition pathways.
To address these gaps, the GI Hub has identified qualitative infrastructure transition pathways and mapped these to G20 infrastructure plans. Thirteen key transition pathways were identified across the following five categories:

- enabling universal access
- low-carbon power generation
- low-carbon infrastructure operation
- optimising infrastructure benefits
- and minimising infrastructure impacts.

The GI Hub analysed 243 long-term infrastructure plans from across G20 member and guest economies to draw out insights on long-term infrastructure priorities for these infrastructure transition pathways.

6.1 Findings

6.1.1 Long-term infrastructure planning

Across the board, it was found that the long-term infrastructure plans analysed were addressing the range of infrastructure transition pathways. This shows that governments are taking steps to transition towards achieving global climate and United Nations SDG targets through infrastructure, and that there is knowledge to be shared on ways to develop plans for each of the transition pathways.

In light of imminent climate and United Nations SDG milestones, this is an encouraging trend. However, the analysis also found significant gaps in the coverage and maturity of the plans for some transition pathways. In general, more knowledge and support for countries may be needed to develop and align long-term infrastructure plans with transition goals.

6.1.2 Coverage of plans

The coverage of long-term infrastructure plans differed across the 13 infrastructure transition pathways. G20 economies primarily focused on the three transition pathways: ‘substantially increasing the share of renewable energy’, ‘scaling up the adoption of InfraTech’, and ‘enhancing the performance and efficiency of transport systems.’ The greater coverage of plans for these transition pathways is likely to provide more transparency for investors.

6.1.3 Maturity of plans

The level of planning maturity of each transition pathway was evaluated by determining the level of quantified targets and investment details contained within the long-term infrastructure plans. Plans with a higher level of maturity are likely to provide more transparency for investors. The transition pathways with the highest level of maturity appear to track those with the highest coverage, namely ‘increasing substantially the share of renewable energy generation’ ‘scaling up the adoption of InfraTech’, and ‘enhancing the performance and efficiency of transport systems.’ Although, as can be seen, all other transport-related transition pathways also had plans with higher levels of maturity (e.g. ‘increasing the share of low emissions vehicles’ and ‘universal access to mobility services’).
6.1.4 Mention of private sector investment

Almost all countries have plans that mention private sector investment for the pathway of ‘substantially increasing renewable energy generation’. This aligns with recent insights from the GI Hub Monitor initiative, which show that 47% of all private sector investment in infrastructure in 2020 was in renewable energy infrastructure.11

6.1.5 Transition pathways with lower coverage and maturity of plans

Infrastructure plans for other transition pathways have a smaller number of plans and levels of maturity. These include plans for the transition pathways ‘lowering the carbon intensity of steel and cement production,’ ‘enabling universal access to water, education, internet, and health services’, and ‘densifying spatial planning for decreased energy and resource use’. Further work is needed, particularly for these pathways, to support the development and alignment of long-term infrastructure plans to transition goals. This would be supported by an understanding of the ‘transition investment gap’ for infrastructure for each of the infrastructure transition pathways.

6.1.6 Maturity of plans in developed and emerging economies

Analysis of the planning maturity between developed and emerging economies was also undertaken. Across most transition pathways, a significant disparity was observed. The maturity of plans appeared to be lower in the emerging economies of the G20. This indicates that capacity building is needed to further support countries – especially in emerging markets – in the development of long-term infrastructure plans. This support could include a decision-making tool to support countries to develop infrastructure plans that address the infrastructure transition pathways, particularly those with lower maturity and coverage of plans.

6.2 Next steps

The findings from this report have informed the development of the draft G20 / GI Hub Framework on how to best leverage private sector participation to scale up sustainable infrastructure investment.

This report provides a high-level analysis of G20 infrastructure plans for insights on infrastructure transition pathways. A more detailed analysis of long-term investment amounts and other trends across these transition pathways will be completed to provide public information in an online tool for infrastructure practitioners and decision-makers in early 2023. This will coincide with the publication of data analysis from GI Hub’s InfraTracker 2.0.

GI Hub welcomes any IWG member feedback or questions. Please direct them to the Head of External Relations, Katharina Surikow at katharina.surikow@gihub.org.

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Appendix A - Detailed approach

The detailed approach to deriving and using infrastructure transition pathways included:

1. Desktop research
   a. High-level scan of infrastructure plans for all G20 member and guest economies.
   b. Review research from international organisations related to achieving transition goals through infrastructure.
   c. Deriving common infrastructure transition pathways from literature to further refine these pathways through more detailed research into each G20 economy’s strategy and plan and through the review process (as outlined below).

2. Initial validation of the list of plans
   a. Bilateral engagement with each G20 member and guest economy to seek feedback on the preliminary list of national infrastructure plans (as identified by the GI Hub to date) to ensure that the right ones were captured for this analysis. Nine countries responded to the initial call for the validation of the list of plans, representing 40% of the plans reviewed. A follow-up email was also sent in mid-May 2022; however, given the short period for consultation, the GI Hub is proposing to extend the response time for validation until 30 June 2022. An updated report will be circulated to the members in September 2022.

3. Data collection and analysis (together with InfraTracker 2.0):
   a. Detailed scan and analysis
      i. Map strategies, plans, and infrastructure transition pathways to key parameters, including sectors and transformative outcomes 12.
   b. Final review of trends
      i. Bilateral engagement with each G20 member and guest economy to seek feedback on final results, trends, and insights. To avoid duplication, this will be undertaken in conjunction with the validation process of InfraTracker 2.0.
   c. Update of InfraTracker 2.0 tool
      i. Update InfraTracker 2.0 with data on strategies, plans, and infrastructure transition pathways.

4. Under IWG’s Priority 1:
   a. Final report on Infrastructure Transition Pathways
      i. Review trends and insights from InfraTracker 2.0
      ii. Develop the final report on Transition Pathways for the IWG.

This method defines ‘infrastructure plans’ as follows:

- National plans, that are labelled as such and published on official government websites
- Plans that are still operational, generally dated from 2018 onwards (unless otherwise advised by any member)
- Cross-sectoral infrastructure and development plans

12 Transformative outcomes were developed as part of the GI Hub’s 2021 Transformative Outcomes Through Infrastructure initiative. Transformative outcomes are the ways in which infrastructure can address our most pressing global challenges (e.g. the climate crisis, social inequity, and resilience). More detail can be found here: https://transformativeinfatracker.gihub.org/overview/
• Sectoral infrastructure and development plans
• Plans that cover all economic and social infrastructure sectors. Due to the significant prevalence in the literature, the GI Hub also includes ‘buildings’ (public and private) as a sector for this initiative.
Appendix B - Reference list for draft transition pathways


