

APEC STI Strategic Foresight PPSTI 05 2023S

*23rd APEC Policy Partnership on Science, Technology
and Innovation (PPSTI) Meeting
28 February 2024
Lima Convention Center*

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Office of National Higher Education Science Research
and Innovation Policy Council (NXPO)



**Asia-Pacific
Economic Cooperation**
APEC Center for Technology Foresight



APEC Center for Technology Foresight (APEC CTF)



**Asia-Pacific
Economic Cooperation**

APEC Center for Technology Foresight

- Established in 1998
- Science and Technology Working Group (ISTWG) → PPSTI
- The Center was set up through the support of the Thai government and is currently hosted by the Office of National Higher Education Science Research and Innovation Policy Council (NXPO).

www.apecctf.org

Publications

Our Work & Services > Publications

Current and past publications including reports and policy papers that APEC CTF examined as a result of our works with partners can be explored in this section.

All APEC Strategic Foresight Report Climate Change Health an

The Future of APEC Megacities: A Foresight Approach, November 2000
Published Date: Sep 2022
Type: Reports

Technology Foresight (Second Edition): Proceedings of the APEC Symposium on "Technology Foresight", Chiang Mai, Thailand, July 1997
Published Date: Sep 2022
Type: Reports

Technology Foresight on IT for Education, June 2002
Published Date: Sep 2022
Type: Reports

Projects

Our Work & Services > Projects

APEC CTF conducts various foresight projects for the benefit of APEC. Besides, APEC CTF provides professional services related to foresight activities and strategic planning. We have a range of resources and networks to fulfill client demands

APEC CTF AND ENGINEERING KU – BANGKHEN TEAM UP FOR 2nd WORKSHOP ON SCENARIO PLANNING USING MONT FLEUR
Posted September 6, 2023
[See more](#)

APEC CTF COLLABORATES WITH EGAT FOR A PIONEERING WORKSHOP ON THAILAND'S POST-COAL AND NET ZERO
Posted August 31, 2023
[See more](#)

Consulting

Our Work & Services > Consulting

As requested by clients, APEC CTF offers consultation on foresight activities. We employ innovative tools suitable for particular context per request. Our experienced foresight experts and policy makers work collaboratively with clients to address issues they are facing.

Innovation Roadmap for Industrial Decarbonization
Posted October 2, 2022
[See more](#)

Ten Year Strategic Plan of Thai Health Promotion Foundation (ThaiHealth)
Posted September 29, 2022
[See more](#)

ASIAN CITY INNOVATION SYSTEMS INITIATIVE (CIS-ASIA)

risk foresight and im on Thailand

Background

Project Name:
APEC STI Strategic Foresight
PPSTI 05 2023S

Proposing Economy
THAILAND

Co-sponsors
Japan, Peru

Project Duration:
July 2023 – Jan 2024

Self-funded Project endorsed by
Policy Partnership on Science, Technology
and Innovation (PPSTI)

Objective

- To identify key agendas and relevant enabling technologies as an input for a new PPSTI's strategic plan using foresight tools

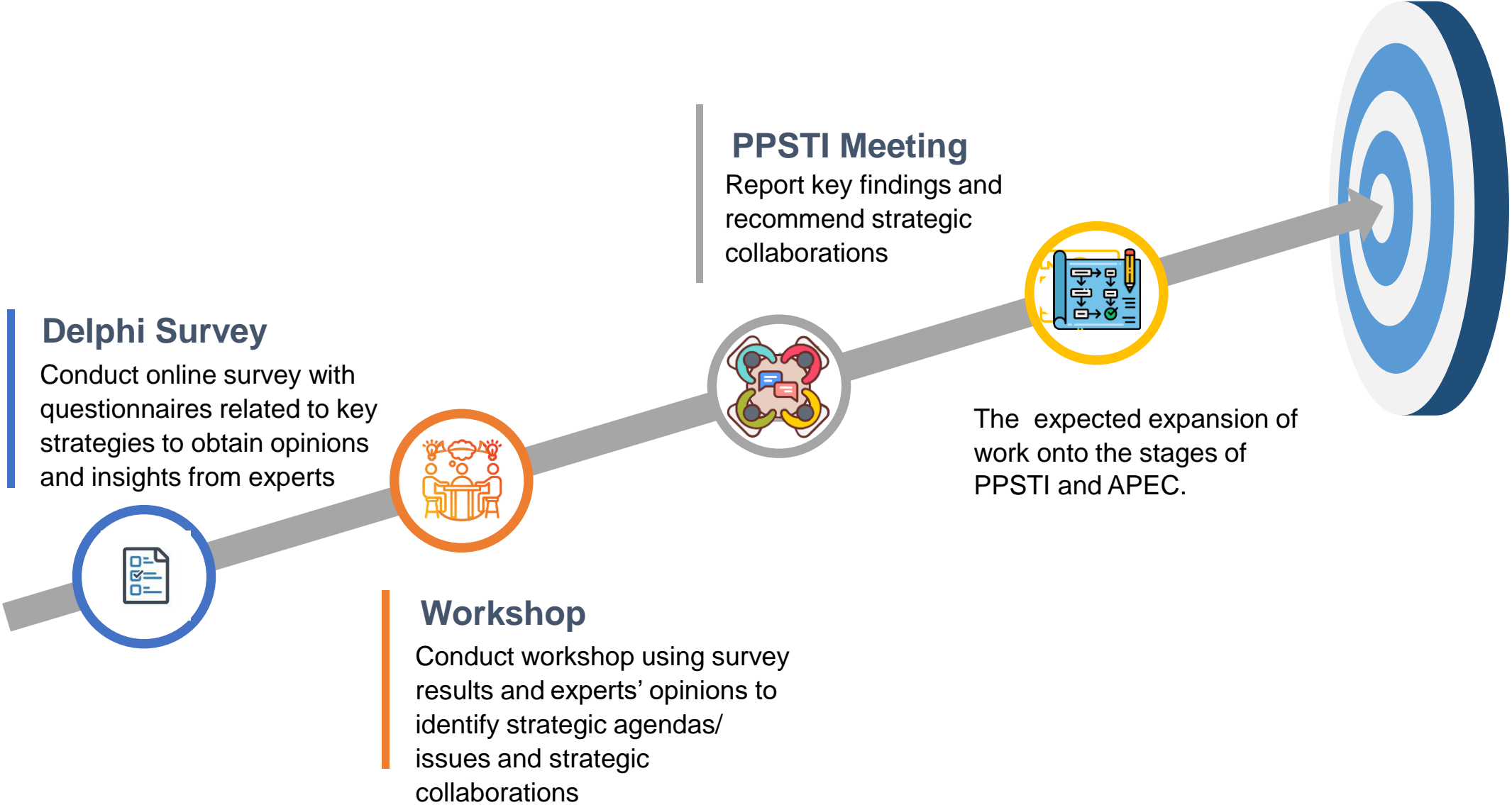
Theme

- Net-zero Emissions

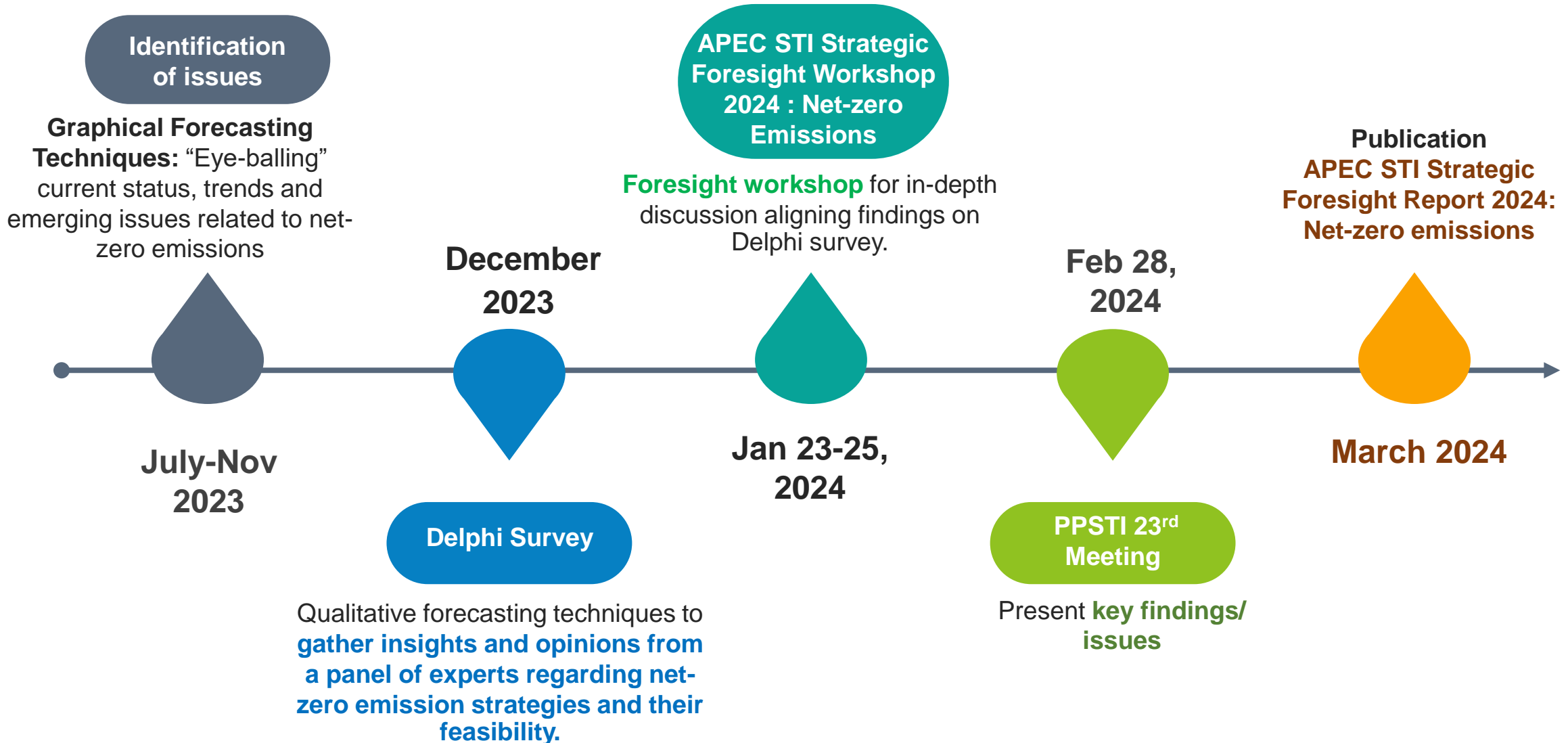
- ❖ Ties to PPSTI Priorities:
- ❖ a. Addressing challenges and barriers for those with untapped economic potential to participate in the science, technology, innovation, and digital ecosystems, as appropriate, to advance enabling environments for a sustainable and inclusive technological future; and
- ❖ b. Exploring emerging technologies and more broadly STI for the role that they play in supporting sustainable resilience and recovery solutions.

Key Activities Toward Ultimate Goal

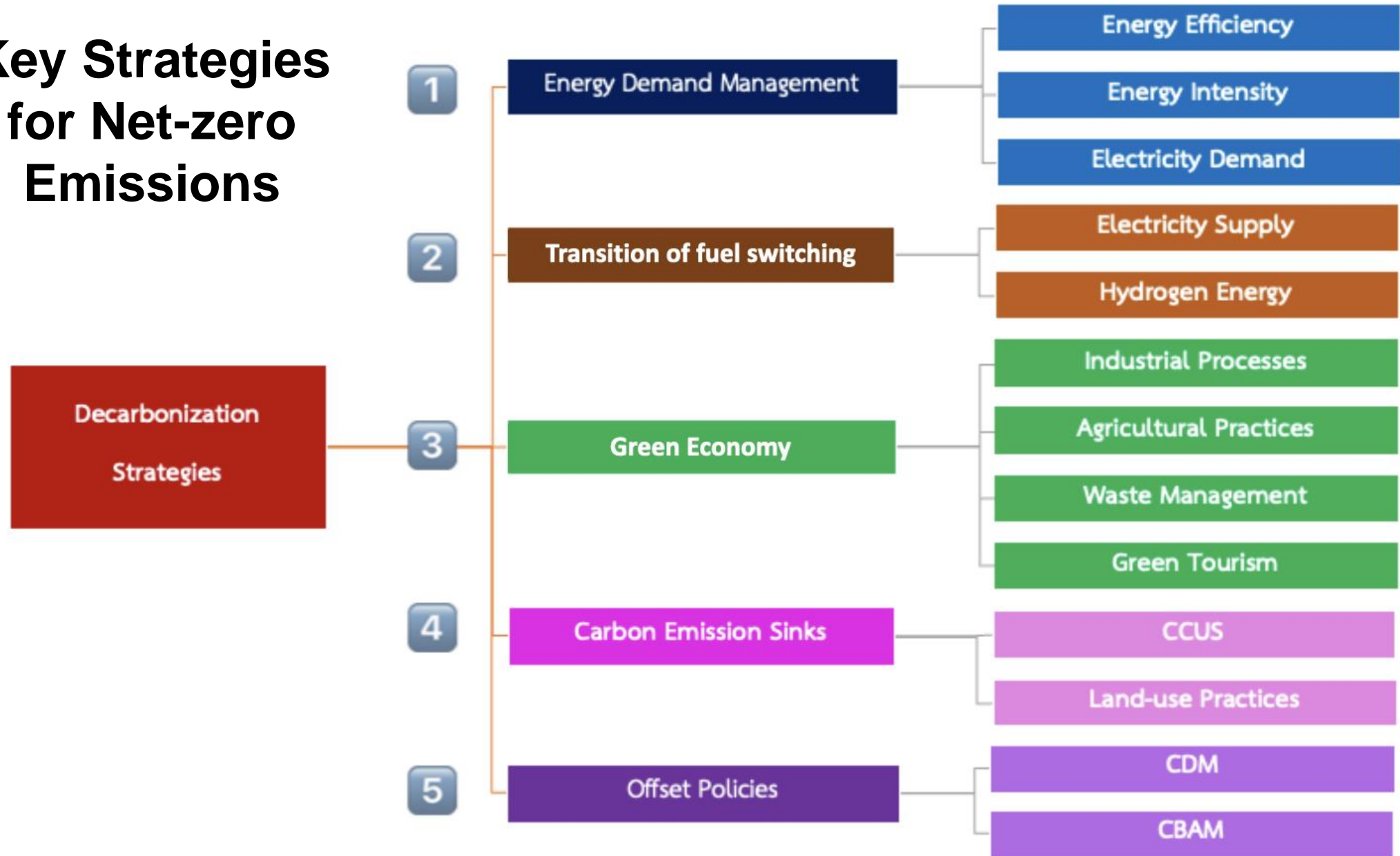
GHG Reductions



Project Timeline



Key Strategies for Net-zero Emissions



Delphi Survey

Introduction

Global warming is one of the greatest challenges for mankind. In 2018, the Intergovernmental Panel on Climate Change (IPCC) set a target of limiting global warming to 1.5°C. The term 'net zero' refers to the target of reducing the greenhouse gas released into the atmosphere with the amount of greenhouse gas removed and stored by carbon sinks.

The APEC Center for Technology Foresight (APEC CTF), a center under APEC's Policy Partnership for Science, Technology, and Innovation, is conducting a Delphi survey, titled "Decarbonization Strategies to Achieve Net Zero in APEC Economies". The survey aims to gather opinions and insights from experts. Subsequently, a workshop will be conducted to gain a deeper understanding of the strategies and technologies related to decarbonization in APEC.

The results obtained from this project can be used as a reference for the next PPSTI's strategic plan, as appropriate. The survey is an oriented policy approach to address challenges in APEC.

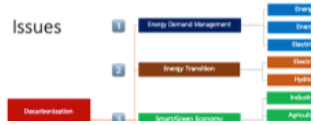
We sincerely thank you for participating in this Delphi study on Net Zero in Decarbonization Strategies to Achieve Net Zero in APEC. We hope you will gain a deeper understanding of the strategies and technologies related to decarbonization in APEC.

Investigation areas for Delphi survey

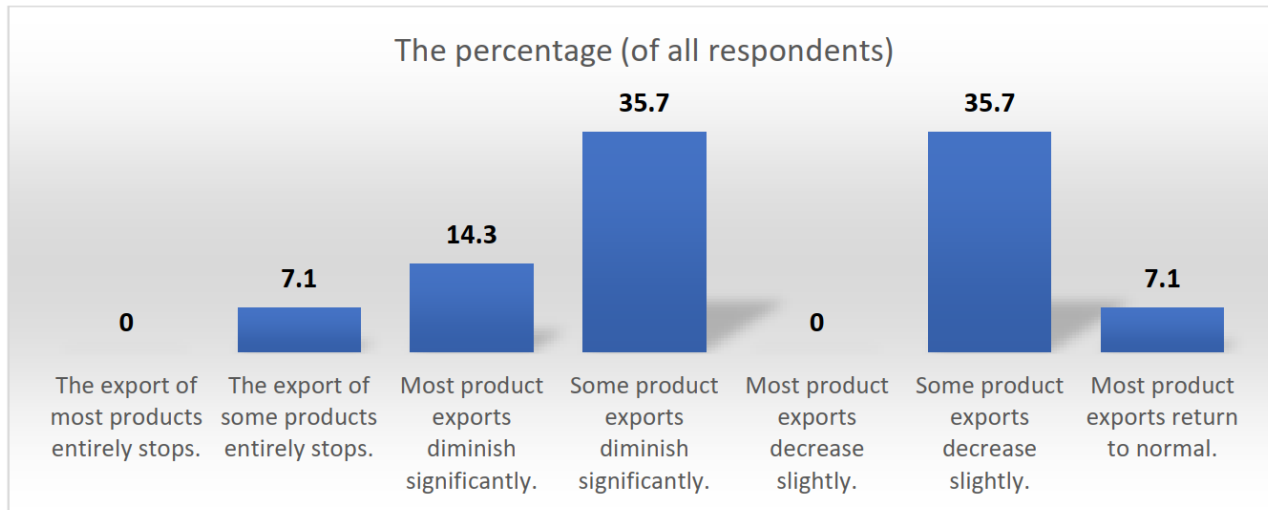
There are 5 issues, namely:

1. Energy demand management
2. Transition of fuel switching
3. Green economy
4. Carbon emission sinks
5. Offset policies

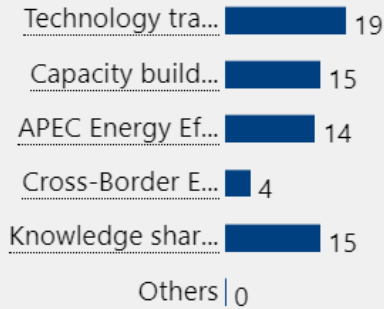
Each of these issues is further classified into sub-issues, as shown in the picture below. You can choose any of these time to complete each round is 10 – 15 minutes. Please feel free to provide any additional comments you may have.



1. At what level would CBAM affect APEC economies when it comes to full implementation?

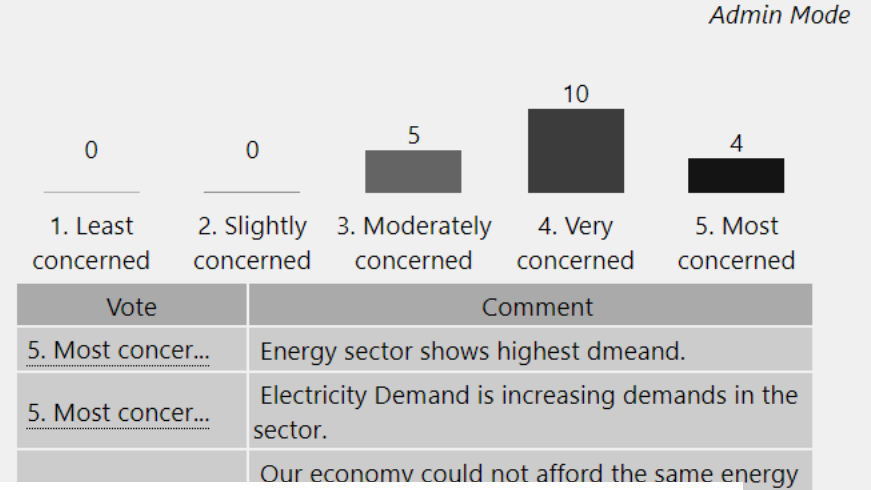


6. Please identify the collaboration among APEC economies regarding energy efficiency are driving progress towards net-zero emissions.

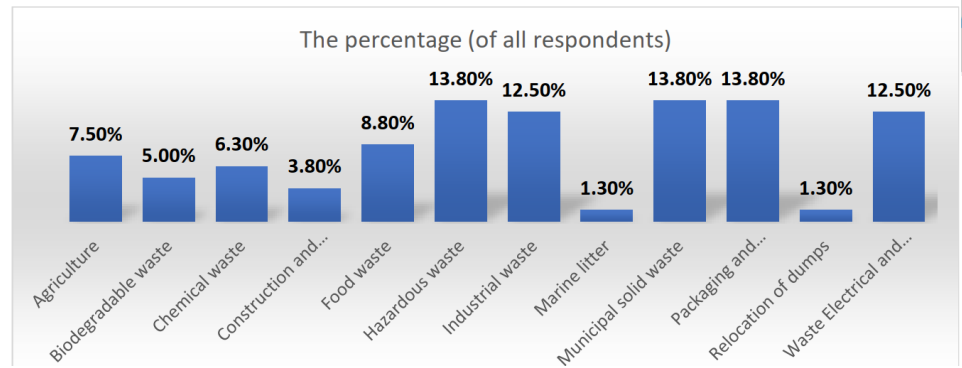


Vote	Comment
Technology tra...	Sometimes a country is lacking in tech be developed and deployed
Capacity build...	Lack of capacity

1. On a scale of 1 to 5, how concerned are you on the potential increase in electricity demand as the dominant form of energy in which APEC economies are working towards achieving net-zero emissions?



3. From the choices below, please select five sources of waste in terms of environmental impact urgency in APEC economies.



Distribution of Participants in Delphi Survey

Total Invites

337

Total Responses

45

(13.35%)

Total Responsive Economies

16

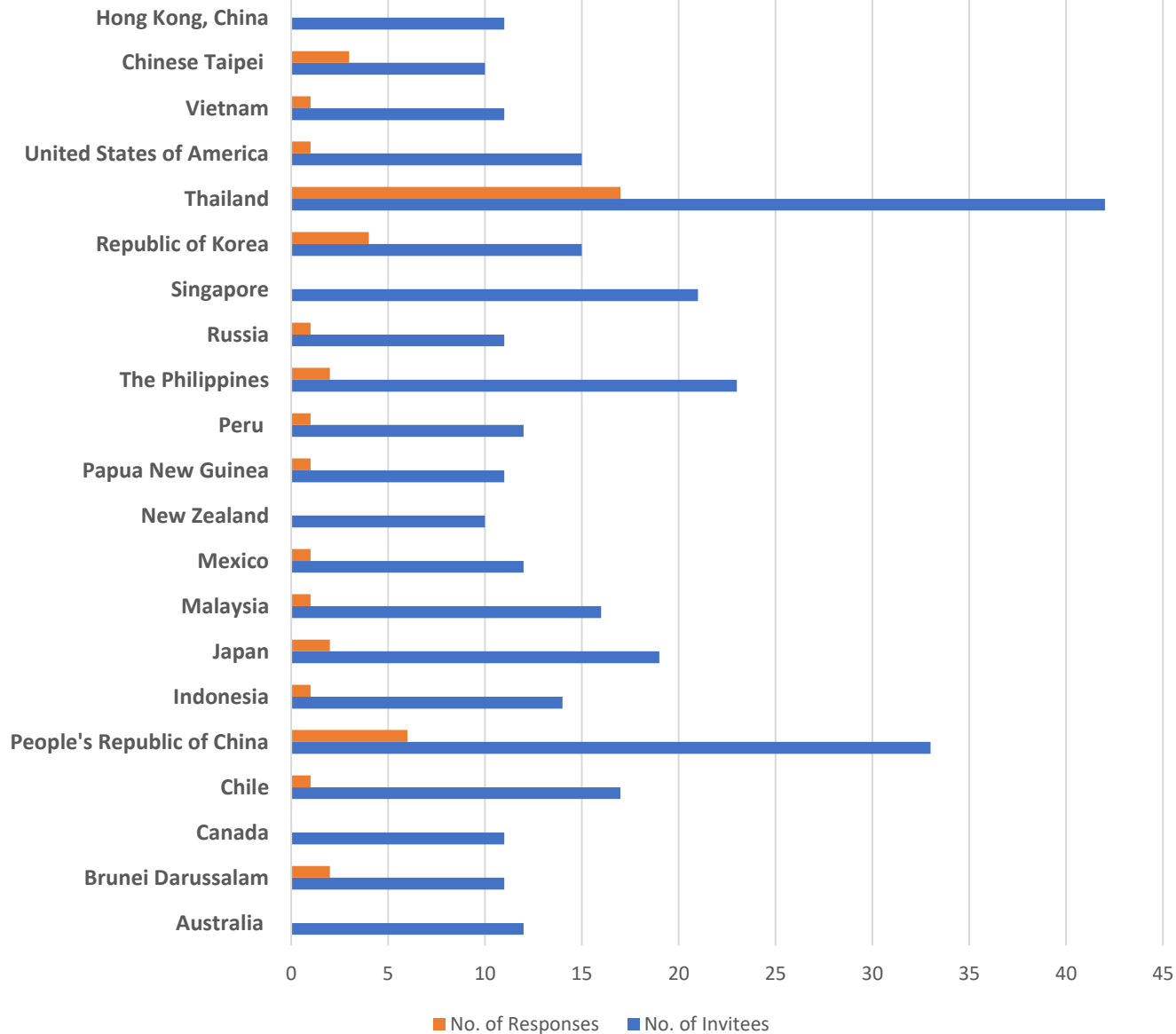
Gender

70%

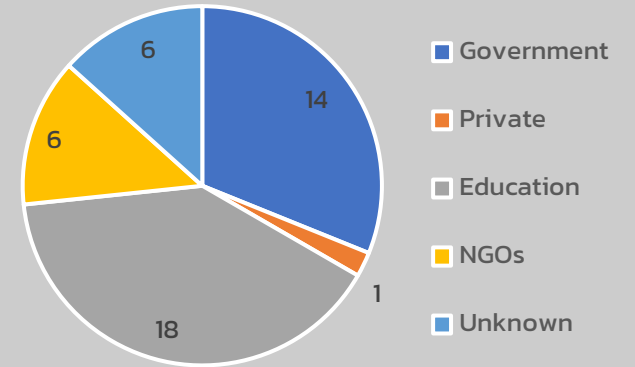
Male

30%

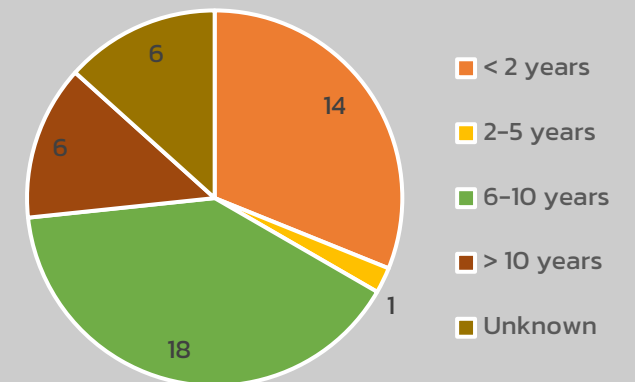
Female



Affiliation Type



Years of Experience



Foresight Workshop



23-25 January 2024

3 days
5 key strategies
13 sub-group issues



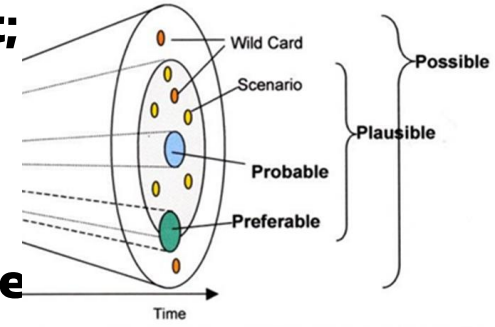
Tools:
Future Triangle
World Café



The total carbon emitted is **21 tons**
Offset with biomass power plant

Pulls, we got;

- **Possible**
- **Plausible**
- **Probable**
- **Preferable**



Pushes are directed more towards reinforcing the significance of the subject.

Future Triangle

Weights are identified and prioritized, leading to additional projects or collaborations.

Distribution of Participants in Workshop

Participating Economies

9

Total Participants (Including Facilitators)

48

Gender

62.5% 37.5%
Male Female

Brunei Darussalam
People's Republic of China
Japan
Republic of Korea
Malaysia
Peru
Chinese Taipei
Thailand
The United States

 @APECCTF1998

Recording and Highlights

<https://www.youtube.com/watch?v=y6bO06Kfr3w&t=3s>



Key Findings



1) Energy demand management

Energy Efficiency

Key findings: This issue demands immediate action due to the maturity of technologies available, offering impactful solutions. Further discussions are regarding **human behavior and AI technology for energy efficiency**, as human behavior is increasingly acknowledged as key for driving significant improvements.

Recommendations: **Establishing regulations and incentives for energy efficiency across each sector is crucial. Incentives such as technology transfer, R&D tax credits**, and investment tax credits play a role in encouraging adoption. Initiatives like the **APEC labeling** of energy-efficient appliances is key to ensuring compliance with standards and are integral to addressing this issue.

Electricity Demand

Key findings: A majority express **high concern about the rising electricity demand** as the primary energy source in APEC economies' efforts to achieve net-zero emissions. This concern is focused on three key sectors: Industry, Transport, and Building, chosen for their substantial contributions to electricity demand.

Recommendations: **Solar** energy emerges as the most influential alternative electricity source to accelerate progress towards achieving net-zero emissions in APEC economies, endorsing its potential impact. This is followed by nuclear energy, wind energy, and hydroelectric power.

Energy Intensity

Key findings: **A revised APEC Energy Intensity target is imperative**, necessitating a more aggressive approach than the Honolulu declaration, given the current global trend towards heightened ambition.

Recommendations: The Emission Intensity initiative is gaining traction in discussions, as traditional energy intensity metrics encompass all energy types used to generate output, while **emission intensity** provides a more reliable measure of environmental impacts associated with economic output.

Key Findings



2) Transition of fuel switching

Electricity Supply

Key findings: Findings arise regarding **resource scarcity** for renewable energy (RE) technology, particularly in mineral mining and processing. Additionally, there is a need for advancements in technology for Smart Grids to accommodate the growing demand for green electricity and facilitate the integration of renewable energy sources into the grid system.

Recommendations: APEC necessitates transition policies with effective governance and capacity building for governments, including **the establishment of common institutions or intermediaries to connect APEC economies.**

Hydrogen Economy

Key findings: A significant of respondents express a desire to enhance the role of hydrogen energy in decarbonizing the hard-to-abate sectors, such as fuel cell, power generation and industry applications, in APEC. The majority of concerns revolve around **hydrogen production costs**, the establishment of hydrogen infrastructure, and a preference for green hydrogen over other hydrogen colors.

Recommendations: Further discussions are underway regarding market demand and public awareness to drive the hydrogen economy forward. An initiative has been proposed for the establishment of **APEC carbon emission standards for hydrogen production**, aiming to create a common policy framework for trading hydrogen energy within the APEC region.

Key Findings



3) Green economy

Industrial Processes

Key findings: There is a global shift in industrial processes towards sustainability and innovation, driven by higher carbon pricing, technological advancements, and an increasing demand for green products. Despite facing economic and governance challenges, this shift underscores the need for global cooperation, legal modernization, and strategies focused on green funding, intellectual property protection, and technology investment. These efforts, along with collaborative initiatives in knowledge sharing and research, are essential for navigating the transition to a more sustainable industrial landscape.

Recommendations: Emphasizing financial reforms to support SMEs, transitioning away from fossil fuels, enhancing governance, and updating laws for green practices are critical. Key strategies should include raising awareness about sustainability, fostering innovation, enhancing economic incentives such as carbon pricing, and advancing technology. Strengthening supply chain resilience, ensuring inclusive development, promoting global R&D collaboration, and supporting education in green technologies and carbon reduction efforts are crucial for overcoming existing challenges and seizing emerging opportunities.

Agricultural Practices

Key findings: Agricultural practices are confronting significant challenges from economic volatility, environmental impacts, and food security issues, further complicated by urbanization, regulatory hurdles, and societal changes. The sector is also contending with pressures of global population dynamics and climate change, necessitating agile adaptations like “**Agrivoltaics**”. Nevertheless, promising advances in biotechnology, precision agriculture, AI, and efforts to improve information accessibility and education present opportunities to mitigate these concerns, highlighting the importance of innovation and adaptability in agriculture.

Recommendations: Advocating for diverse R&D efforts such as agroforestry and supporting farmers with technical assistance tailored to local needs are necessary. Also, improving market access, optimizing supply chains, and enforcing sustainable policies and regulations are crucial. Moreover, promoting trade development, facilitating information sharing, and implementing guidelines for sustainable conduct are recommended. Encouraging cross-sectoral and cross-border collaborations and investing in education and capacity building for farmers through networks and grants are vital steps towards a sustainable agricultural evolution.

Key Findings



3) Green economy

Waste Management

Key findings: Most waste management policies in APEC are moderately effective **citing plastic pollution as the biggest obstacles** in achieving net-zero emissions. Additionally, there is a need for sustainable material from alternative sources such as agricultural waste, timbre, and recycled materials. Thus, reverse logistics system needs to be in place to accelerate waste collection process.

Recommendations: **Platform for cross-border waste management in APEC** becomes prominent to facilitate international collaboration, serving as a platform for digital data for waste management, capacity building in eco-design, and regulation and standards modernization

Green Tourism

Key findings: APEC experts express concerns regarding the effectiveness of local authorities in managing tourist expectations for carrying capacity, waste management, and a lack of green products. **Further investigation identifies logistics and transportation as a bottleneck to bring about green tourism transformation in APEC region.**

Recommendations: Existing arrangement needs to be reviewed and updated to accommodate more green and sustainable tourism establishment such as **registration platform, green finance for MSME, and education for both local and tourist to embrace the notion of 'green spirituality' into their everyday lives.**

Key Findings



4) Carbon emissions sinks

Carbon Capture, Utilization, and Storage (CCUS)

Key findings: CCUS is expected to play a significant role in achieving net-zero emissions in APEC, especially for hard-to-abate industries. Large-scaled CCS plants using green energy are desirable to store gigatons of CO₂ per year. **New businesses would arise from CCS-as-a-Service and utilization of CO₂ in carbon recycling and upcycling.**

However, major challenges include limitation on appropriate storage sites, lack of regulation for transboundary and transparency cooperation among APEC economies, and expensive/ immature technologies.

Recommendations: **A collaboration roadmap for CCUS development in APEC should be drafted to provide a framework, guideline, and timeline for essential collaborations including knowledge sharing such as CCS pilot plant operation, common APEC regulations and standards, R&D collaboration on key research topics such as high storage efficiency and efficient CO₂ conversion, and effective technology transfer mechanism.**

Land-use Practices

Key findings: Majority of APEC experts raise concerns over the effectiveness of land-use practices in APEC and severe biodiversity loss due to land-use changes. Key bottlenecks have been identified including **unattractive incentive schemes and fair compensation for farmers and private landowners**, ineffective carbon market, inability to track land-use changes, and lack of knowledge sharing regarding species of plants and their ability to absorb greenhouse gases as well as new method to restore forest ecosystems such as the **framework species method (FSM).**

Recommendations: **A single APEC carbon market and common APEC emission trading system with reasonable carbon prices and acceptable cost of carbon credit verification are desirable to offer appealing incentive and solve carbon market problem.** To track land-use changes and prevent deforestation, co-developing low-cost surveillant technologies is required. Besides, dynamic knowledge sharing process that integrates modern knowledge and traditional knowledge regarding local plants and their ability to absorb greenhouse gases should be initiated.

Key Findings



5) Off-set policies

Clean Development Mechanism (CDM)

Key findings: A strong push for the ETS stems from the **Paris Agreement, particularly Article 6**. This provision facilitates carbon trading, offering opportunities for both industrial and non-industrial economies to invest in and exchange emissions allowances.

Recommendations: This section underscores the significance of technology, cost, and carbon pricing identification, alongside proposing the Hybrid Market (Trade and Tax) as a strong recommendation. Concerns are raised about the alignment of carbon **prices with international verification standards and APEC region standards**, suggesting a common price or APEC standard as a potential solution to boost carbon trading in the region.

Cross Border Adjustment Mechanism (CBAM)

Key findings: APEC anticipates potential inclusion of all major industries in the EU's CBAM, prompting considerations for countermeasures and focus on "Scope 3" emissions. Similar mechanisms from other economies are expected. An approach aiming for balanced development and enhanced environmental governance is proposed. Challenges such as product shortages and increased commodity prices may arise for the EU. Alternative scenarios for CBAM include operational challenges and economic pressures on the EU. **Effective data collection and sharing systems are vital for monitoring emissions and fostering global transparency.**

Recommendations: Proposed recommendations for APEC in response to CBAM policies include **international cooperation and harmonized environmental regulations, establishing dialogue platforms for policy, legal, and technical discussions, and agreeing upon standardized definitions and terms**. Prioritizing these initiatives is crucial to effectively respond to CBAM policies in a timely manner.



Key Messages

- **Incorporate** decarbonization or accelerate **decarbonization technology strategies as one of the primary mission targets of the PPSTI (in the new PPSTI strategic plan)**. Given its status as a global agenda, it is crucial to recognize the importance of science, technology, and innovation in driving the implementation of emission reduction initiatives.
- **Recommend** drafting crucial **APEC-wide regulations, standards, and incentives, such as the APEC labeling mechanism** used to effectively incentivize energy efficiency measures and sustainable practices across industries. The implementation of labels and common standards will play a pivotal role in guiding and promoting these practices.
- **Establish APEC market mechanisms for an emissions trading system**. This initiative will stimulate innovation in policy frameworks and platforms, encompassing ETS and CBAM, thus facilitating effective progress toward achieving net-zero emissions targets.
- **Establish a technology transfer mechanism for green technology within APEC**. This recommendation aims to harness the potential of technology development and facilitate the exchange of technological knowledge among member economies.
- **Initiate a sharing management platform within APEC, such as a cross-border waste management platform**. This platform will serve to enhance technologies, knowledge sharing, and sustainable industrial/ agricultural processes through collaborative efforts.



Asia-Pacific Economic Cooperation

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