



# Design and Implementation of a Net-Zero Youth Capacity Building Programme: Case of Thailand

## Table of Contents

1. Background	1
2. Framework Design	2
3. Youth Net Zero Capacity Development Programme Implementation	7
3.1 Overview	7
3.2 Pre-learning: Net Zero 101 Course	8
3.3 In-person Lectures	10
3.4 Design Thinking Activities	13
4. Results	16
4.1 Group Project Evaluation Criteria	17
4.2 Group Pitches	18
4.3 Programme Evaluation and Conclusion	20
REFERENCES	22
APPENDIX I: IDEATHON PROGRAMME	23
APPENDIX II: NET ZERO 101 COURSE STRUCTURE	28
APPENDIX III: SURVEY ANALYSIS REPORT	30

**Copyright © 2024 United Nations University. All Rights Reserved.**

### Disclaimer

The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of the United Nations University. The mention of specific companies or products of manufactures, whether these have been patented or not, does not imply that these have been endorsed or recommended by UNU-IAS in preference to others of a similar nature that are not mentioned.

### Authors

Jerome Silla, Jonghwi Park and Sawaros Thanapornsanguth

### Acknowledgements

The project and research described in this report received funding from the Korea Environment Corporation, the Government of the Republic of Korea.

## **1. Background**

The 27th Conference of the Parties (COP27) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2022 made significant strides with the first-ever Children and Youth Pavilion (UNDP, 2023), a youth-led climate forum that emphasized the role of younger generations in bringing the fight against climate change to the forefront of public attention. In support of the overarching goal of the Action for Climate Empowerment (ACE), the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS) developed a competency framework for youth capacity development programme on net zero that is universally applicable to any country of implementation. The framework was designed to enhance the young generation's competencies, i.e., knowledge, skills and attitudes, for climate action and to empower them to design and implement net zero projects in their community.

UNU-IAS piloted the implementation of the framework in Thailand in August 2023, building on its successful delivery of a net zero training among Thai national government officials in March 2023. Both trainings were part of the K-eco Global Net Zero Partnership (K-GNP) Project, a two-year cooperative project between UNU-IAS and Korea Environment Corporation (K-eco). The project was co-organized with the Royal Thai Government's Department of Climate Change and Environment (CCE) under the Ministry of Natural Resources and Environment and funded by K-eco.

Training modules were developed using the competency framework. The modules consist of a prerequisite e-learning course, in-person training lectures and ideathon-style activities with a Design Thinking approach.

The purpose of this report is twofold. First, it describes the design, modality and target competencies of the youth capacity development programme. Second, it recounts the programme's pilot implementation project entitled 'Net Zero Thailand: ACE Youth Ideathon Camp' and details key information of the training modules and the programme evaluation by the participants.

This report is intended to provide useful information to any institution, group or individual intending to develop and implement capacity building programmes for youth focusing on net zero.

## 2. Framework Design

One of the key issues in climate change education lies in its overemphasis on cognitive aspects or knowledge (i.e., what to know) and less focus on behavioral (i.e., actions and skills — how to do) and social and emotional aspects (i.e., attitudes — why to do) (UNESCO, 2019). In other words, learners may still gain understanding of the climate issues through traditional education programmes and pedagogies, but they may not necessarily acquire the ability to apply their knowledge in an actual context and translate them into real actions. Therefore, it is critical to create a competency framework which can guide a systematic design of an education programme with a balanced consideration of knowledge, skills and attitudes.

The competency framework for the youth net zero capacity development programme has been developed through three major steps (see Table 1):

1. An extensive literature review, through which three major domains were identified: what is net zero, why net zero and how to net zero, which were in turn translated into three modules.
2. Adapting and mapping out UNESCO's eight competencies for education for sustainable development (UNESCO, 2018) throughout the three modules, which include i) systems thinking (ST); ii) anticipatory competency (AC); iii) normative competency (NC); iv) strategic competency (SC); v) collaborative competency (CC); vi) critical thinking (CT); vii) self-awareness (SW); and viii) integrated problem-solving (IPS). For example, 'Module 1: What is Net Zero' targets to cover systems thinking, anticipatory competency and critical thinking.
3. Dividing the learning into three pedagogical approaches:
  - a. Online pre-learning for the competencies that can be acquired through self-paced e-learning and universally applicable to other countries and contexts beyond Thailand (e.g. scientific knowledge behind climate change, international treaties, etc.);
  - b. on-site lecture for the contents that need to be tailored to the country of implementation; and
  - c. ideathon activities for the content that requires active engagement, collaboration, discussion and creation.

The implications of the systematic framework are threefold in developing a net zero capacity development programme for youth. First, it comprehensively and systematically addresses foundational competencies for net zero, including cognitive, social-emotional and behavioural aspects. Second, learners can equip themselves with foundational knowledge, skills and attitudes and prepare for active participation, collaboration and problem solving during the on-site workshop and ideathon. Third, the e-learning can be disseminated independently to wider audience who wish to learn about basic principles of net zero.

Table 1: The Competency Framework for the Youth Net Zero Capacity Development Programme

Modality	Online pre-learning (All modules to be 15 min, 20 slides max)	On-site lecture (Best case/practice presentations)	Hackathon activities (Design Thinking)
Justification of modality	Contents that are universally applicable to other countries and contexts	Contents that need to be tailored to the country of implementation	Contents that require collaboration, discussion and creation
Module 1: What is Net Zero?  (Target competencies: STC, AC, CTC)	<p>Scientific evidence of climate change</p> <ul style="list-style-type: none"> <li>• IPCC reports</li> <li>• GHG and global warming</li> <li>• Major sources of GHG and carbon sink</li> </ul> <p>Key international climate politics and governance to remember:</p> <ul style="list-style-type: none"> <li>• UNFCCC, COP and IPCC</li> <li>• Key milestones: Kyoto Protocol (1997) and Paris Agreement (2015)</li> </ul>	<p>(Country of implementation: Thailand)</p> <p>Country-specific knowledge:</p> <ul style="list-style-type: none"> <li>• Policy and governance (e.g. NDCs)</li> <li>• National trends, challenges and opportunities</li> </ul>	Net zero actors role play

\* IPCC = Intergovernmental Panel on Climate Change; GHG = greenhouse gas; UNFCCC = United Nations Framework Convention on Climate Change; COP = Conference of the Parties; NDC = Nationally Determined Contributions

Modality	Online pre-learning (All modules to be 15 min, 20 slides max)	On-site lecture (Best case/practice presentations)	Hackathon activities (Design Thinking)
<p>Module 2: Why Net Zero?</p> <p>(Target competencies: STC, AC, NC, CTC)</p>	<p>Environmental impacts</p> <ul style="list-style-type: none"> <li>• Rapid onsets (e.g. extreme weather, landslides, floods)</li> <li>• Slow onsets (sea level rise, heat, drought, etc.)</li> </ul> <p>Social-economic impacts</p> <ul style="list-style-type: none"> <li>• Affecting most vulnerable populations</li> <li>• Displacement and human right</li> <li>• Climate justice: developing vs. developed countries</li> <li>• Politics in world economy</li> </ul> <p>Hyperconnected world</p> <ul style="list-style-type: none"> <li>• Why we cannot achieve net zero without international solidarity</li> </ul>	<p>National cases of social and economic impacts of climate change</p>	<p>Design Thinking:</p> <ul style="list-style-type: none"> <li>• Empathize: Mapping key stakeholders</li> <li>• Define problems</li> </ul>

Modality	Online pre-learning (All modules to be 15 min, 20 slides max)	On-site lecture (Best case/practice presentations)	Hackathon activities (Design Thinking)
<p>Module 3: How to Net Zero?</p> <p>(Target competencies: CC, SAC, IPSC)</p>	<p>Which sectors are the biggest CO<sub>2</sub> contributors and what can we do?</p> <ul style="list-style-type: none"> <li>• Transportation</li> <li>• Housing and building (heating and electricity)</li> <li>• Agriculture and forestry</li> <li>• Waste (consumption)</li> <li>• Industry (factories)</li> </ul> <p>Calculating carbon footprint</p> <ul style="list-style-type: none"> <li>• Plastic bag vs. reusable bags</li> <li>• Paper cup (11gCO<sub>2eq</sub>) vs. long haul (10-11 hours) flight (1M CO<sub>2eq</sub>)</li> <li>• NOAA's CarbonTracker</li> </ul> <p>Renewable energy: pros and cons</p> <ul style="list-style-type: none"> <li>• Hydro</li> <li>• Wind</li> <li>• Solar</li> <li>• Bio</li> </ul>	<p>Cases from Thailand and other countries (that can inspire youth to develop their prototypes)</p> <ul style="list-style-type: none"> <li>• Transportation</li> <li>• Eco-tourism</li> <li>• Nature-based solutions</li> <li>• Public education</li> </ul> <p>Tips for resource mobilization</p>	<p>Design Thinking</p> <ul style="list-style-type: none"> <li>• Ideate solutions</li> <li>• Prototype</li> <li>• Plan for test</li> </ul>

\* CO<sub>2eq</sub> = Carbon dioxide equivalent; NOAA = National Oceanic and Atmospheric Administration



### **3. Youth Net Zero Capacity Development Programme Implementation**

In Thailand, youth between 15 and 29 years of age comprise 20% of the population (UNDP, 2020). Youth participation in climate movements have been gaining momentum, particularly on social media platforms (UN ESCAP, 2023). As the country's Nationally Determined Contribution (NDC) targets have become more ambitious than ever — elevating its greenhouse gas reduction target of 30–40% in 2030 from the previous 20–25% (Government of Thailand, 2022) — ensuring that the voices of youths are heard and reflected in both dialogues and decisions will be crucial for Thailand's net zero transition (UNESCO, 2021).

Recognizing the key role of Thailand's emerging leaders, UNU-IAS designed a pilot capacity development programme and training modules based on the competency framework. The programme was composed of three learning components: a pre-learning course, in-person (on-site) lectures and ideathon-style activities based on Design Thinking. The overview of the programme and the details of the three learning components are described in the following sections.

#### **3.1 Overview**

Forty Thai youths (ages 18 to 25) across Thailand participated in a three-day capacity development programme Net Zero Thailand: ACE Youth Ideathon Camp. The training was held in Bangkok, Thailand on 30 August – 1 September 2023 and aimed to achieve the following objectives:

- Harness youth knowledge and skills on net zero through the delivery of training modules tackling climate change and its implications on net zero; and
- Empower Thai youths to take an active role in climate action in their community and foster a network of youth ambassadors for Thailand's net zero transition.

Equipped with the knowledge gained from the pre-learning course, the youth participants advanced their training through the in-person lectures and the ideathon-style activities during the first two days. From the beginning, six groups of six to seven members were formed and tasked to design sustainable solutions based on two design challenges:

1. Design a whole-of-society approach solution to incentivize reduced carbon footprint in the local community (households, schools, industries, government, etc); and
2. Design a cooperation mechanism between the local community and the provincial government to scale up your solution in (1).

On the final day, the groups pitched their project ideas to a panel of experts in various fields including sustainability, project management, human-centred innovation and social entrepreneurship. The overview of the three-day programme is included in **APPENDIX I**.

### **3.2 Pre-learning: Net Zero 101 Course**

Pre-learning involves establishing a knowledge foundation of concepts before learners encounter them in learning environments. It helps learners develop curiosity and interest in the subject area and serves as preparation for learners to grasp advanced concepts through actively engaging in the learning activities with other learners.

In the case of Net Zero Thailand: ACE Youth Ideathon Camp, UNU-IAS developed an e-learning course “Net Zero 101”, drawn from the competency framework described in Table 1. The youth participants took this e-learning course prior to the three-day training (hence, pre-learning). Net Zero 101 is a free and self-paced e-learning course designed for students who want to learn the foundational principles of net zero, including the causes and implications of climate change, the basics of international climate bodies and treaties and a whole-of-society approach to achieve net zero. Completable within two hours, the course consists of three modules.

#### **Module 1: What is Net Zero?**

This first module explains the underlying concepts of climate change such as greenhouse gas emissions, global warming, carbon neutrality and net zero according to the latest UN climate data and reports. It also explains international climate change bodies such as UNFCCC and Intergovernmental Panel on Climate Change (IPCC), the key milestones in global climate agreements and the relevant international treaties such as the Kyoto Protocol and the Paris Agreement. The learning objectives of Module 1 are:

- Identify the underlying science behind the various phenomena that cause climate change;
- Explain what is net zero and the importance of net zero emission initiatives; and
- Understand international governance and cooperation related to climate change.

### **Module 2: Why Net Zero?**

This module discusses the environmental and socio-economic costs of climate change, detailing its compounded impacts and tackling both local and global issues such as human mobility. It also introduces the different actors and their roles relevant to net zero and will prompt learners to think about the importance of international cooperation in achieving the climate goals of the Paris Agreement.

The learning objectives of Module 2 are:

- Understand the environmental and socio-economic impacts of climate change; and
- Explain the importance of a whole-of-society approach in achieving net zero in a hyperconnected world.

### **Module 3: How to Net Zero?**

The third and last module covers a whole-of-society approach on how net zero transition can be achieved by different sectors. Ways to realize a carbon-neutral and climate-resistant society are discussed, covering large-scale solutions such as renewable energy usage to individual-level approaches such as web-based carbon footprint-tracking. The module also examines daily lifestyle choices by comparing the usage of plastic bags versus reusable fabric bags and different transport systems using buses, trains and cars. The learning objectives of Module 3 are:

- Understand the importance of contextualized measures to achieve net zero;
- Identify appropriate, sustainable and feasible ways to reduce carbon footprint in our daily lives; and
- Differentiate the advantages and disadvantages of renewable energy sources.

Contents of each module are organized in several sections and subsections outlined in **APPENDIX II**. Each module concludes with open-ended questions to

challenge learners to apply what they have learned into their daily lives and prompt critical thinking among them to identify net zero issues and solutions in their community.

### **3.3 In-person Lectures**

The in-person lectures are to complement the pre-learning materials, mainly to provide learners with contextualized and country-specific knowledge on net zero in the country of implementation. In case of Thailand, a series of lectures delivered by experts in their fields delve into the multifaceted issues surrounding climate change and net zero transition at the country-, community- and household and individual-levels. The five lectures were:

- Country-level
  - Thailand’s Road to Net Zero
  - Human Mobility in the Context of Climate Change
- Community-level
  - Phayao Learning City
- Household- and individual-level
  - Carbon Neutrality Practices in Our Daily Lives — The C-Point System
  - Resource Mobilization Panel Discussion

The lectures provided valuable insights into the successful implementation of needs-based solutions affecting various levels of society while emphasizing the importance of whole-of-society approach in shaping a net zero future in Thailand. Key points of the lectures are summarized below:

#### **Thailand’s Road to Net Zero**

*Presented by Mr. Sivach Kaewcharoen (Environmentalist from the Department of Climate Change and Environment, Ministry of Natural Resources and Environment, Royal Thai Government)*

Thailand is highly vulnerable to climate change impacts, ranking ninth in the countries most affected by extreme weather events (2000–2019) according to the Global Climate Risk Index. Aiming to increase its adaptive capacity, Thailand formulated the National Adaptation Plan as implementation framework to integrate climate change adaptation strategies into sectoral and local government

planning. The framework covers six priority sectors, including water resources management, agriculture and food security, tourism, public health, natural resources management and human settlements and security.

The government updated and submitted the country's second version of its Nationally Determined Contributions to the UNFCCC at COP27. The revisions placed focus on mitigation measures, just transition and optimization of socio-economic impacts. In the second updated NDC, the Thai government elevated the contribution level to 40%, with 30% from its domestic effort and 10% from international support. Thailand aims to achieve carbon neutrality by 2050 and net zero greenhouse gas (GHG) emissions by 2065.

### **Human Mobility in the Context of Climate Change**

*Presented by Ms. Debora Gonzalez (Head of the Migration Data and Research Unit of International Organization for Migration (IOM) Thailand)*

Ms. Gonzales provided an overview of the human mobility situation in Thailand where there are 4.9 million migrants as of 2019 – 2.5 million of which are registered as labor migrants and 22,000 are internally displaced due to disasters. In 2020, the Myanmar-Thailand migration corridor was the fifteenth highest in the world and is the highest in the region according to the World Migration Report. Floods pose the greatest hazard risk to Thailand, driving migration. Other migration drivers in the country include political instability in neighboring countries, socio-economic disparities in the region, impacts of development projects such as hydropower dams and labor migration as an adaptation strategy to climate change.

IOM proposes the use of 'environmental migration' as a broad term to cover all types of movement — whether forced or voluntary, temporary or permanent, or international or internal. Ms. Gonzales also emphasized that human mobility linked to climate change is not just about displacement per se; migration can also support climate change adaptation.

## **Phayao Learning City**

*Presented by Dr. Phanintra Teeranon (Associate Professor, University of Phayao)*

Phayao is a province in Thailand whose 76% of its 460,000 population are informal laborers while less than half of the population are college graduates. Between 2012 and 2022, Phayao has experienced a 33% decline in its birth rate, a 50% surge in the number of the elderly and a 5% increase in the number of people with disabilities.

Dr. Teeranon shared her experience of creating local wisdom learning spaces surrounding Phayao Lake. The learning spaces that include temples, garden houses, seniors club and an eco-printing park, are used to promote inclusive lifelong learning by offering classes to out-of-school youths. The many projects of the city include the creation of a net zero learning route to promote local wildlife and practices. Local products sold by learning spaces also include information on the amount of carbon emission reduced from their sustainable production.

## **Carbon Neutrality Practices in Our Daily Lives — The C-Point System**

*Presented by Mr. Lee Young Min (Manager, Carbon Neutral Practice Support Department, Korea Environment Corporation)*

The lecture highlighted a GHG reduction initiative to incentivize businesses and individuals through carbon neutrality practices in various sectors. Also known as the C-Point System, this program was initiated by the Korean Ministry of Environment.

C-Points are awarded to households and businesses for GHG reductions in electricity, water and gas, and in the transport sector, C-Points are awarded for GHG reductions by vehicle mileage savings. Furthermore, private businesses can earn C-Points for their green living practices. Such practices and their equivalent points include using electronic receipts instead of paper receipts (100 KRW per/time, equivalent to 0.77USD), using tumblers or multi-use cups (300 KRW/time) and hiring pollution-free cars (100 KRW/kilometer).

## **Resource Mobilization Panel Discussion**

*Facilitated by Dr. Jonghwi Park (Academic Programme Head for Innovation and Education, UNU-IAS)*

This session was designed to help youth be able to mobilize funds and potential partners to materialize their project ideas. The session invited three panel members from different organizations known for active youth empowering activities. The panelists included Ms. Ada Chirapaisarnkul, Founder of taejai.com; Ms. Siree Jongdee, Deputy Director of Equitable Education Research Institute; and Ms. Phonchan Kraiwatnutsorn, Founder and Managing Director of School of Changemakers.

The discussion revolved around the various opportunities, tools and resources available to promising youth-led initiatives in the areas of climate action, renewable energy and net zero. Exemplary youth-led ventures that the three organizations partnered with for funding were also showcased. At the end, the guest panelists gave advice regarding preparations and key skills to help young social entrepreneurs in finding funding partners.

### **3.4 Design Thinking Activities**

During the ideathon, the six groups were tasked to design a project by solving a user's problem(s) while addressing the net zero challenges in the user's environment or community. To do so, the concepts of design thinking were introduced to the participants through a series of ideathon-style activities for the first two days of the training. On the third day, the groups showcased their project proposals including prototypes anchored in two design challenges:

1. Design a whole-of-society approach solution to incentivize reduced carbon footprint in the local community (households, schools, industries, government, etc.); and
2. Design a cooperation mechanism between the local community and the provincial government to scale up your solution in (1).

Design Thinking is a human-centered approach to problem-solving that emphasizes empathy, collaboration and iteration. It is a cyclical process that involves five stages: empathize, define, ideate, prototype and test. Key information on the design thinking activities carried out are described below:

### **Carbon Auditing**

Youth engaged in a hands-on experience by calculating and auditing their individual carbon footprints through a user-friendly platform provided by [Carbon Footprint](#). This tool enables users to assess the environmental impact of their daily choices, prompting reflection on carbon usage in key areas such as transportation, food consumption, utility bills and shopping expenses. Following the calculations, participants engage in collaborative discussions with their team members, fostering a collective awareness and understanding of the interconnectedness of personal lifestyle choices and overall carbon emissions. This exercise serves as a foundational step in empowering the youth to make informed decisions and collectively work towards a net zero future.

### **Mind Mapping**

Mind maps encourage participants to explore complex problems or ideas by visually organizing their thoughts and generating new insights. During the activity, the youth participants started by defining the problem they wanted to explore and placing it at the center of the mind map. They then brainstormed and added related elements, ideas and concepts around it, connecting them with lines to illustrate the relationships. The output of this activity was a well-structured mind map that served as a visual representation of the problem space or concept being addressed by the groups. This activity encouraged collaboration, as participants can collectively contribute to the mind map and benefit from diverse viewpoints.

### **Introduction to Design Thinking and Empathy**

The Introduction to Design Thinking session provided the youth participants with a foundational knowledge on human-centered design. Participants dived into the design thinking process, exploring popular innovations known for prioritizing user needs, identifying critical pain points and adopting solution-driven approaches. This exploration served as an introduction for the subsequent Empathy session, where students actively engaged in understanding the end-users affected by their chosen net zero issues. During this session, students learned about the techniques on empathy work and learned about good interviewing habits to gather insights from their selected user groups. They also developed interview protocols,



setting the stage for a thoughtful approach to addressing environmental challenges. The participants interviewed their selected user as homework.

### **Design Thinking: Define Group Activity: User Journey & Persona**

Teams were given the task to interview one to two users as part of their overnight homework. Equipped with the insights they gathered, they identified the pain points of their target users, forming thorough problem statements. They then sought feedback from both experts and classmates and redefined their problem statement. In the subsequent session, the focus shifted to introducing the concept of “user journeys” and the development of “user personas”. Students learned to construct stories and identify the pain points of their users, applying this knowledge by actively creating personalized user personas. This hands-on approach, combined with feedback from experts and peers, provided a solid foundation for the teams for the ideation stage.

### **Activity: User Persona and Problem Statement Presentation**

During the presentation on User Persona and Problem Statements, the six youth teams shared insights with the class about their chosen users and the associated challenges, using user personas. For example, Group 3 highlighted a fishing community in the east of Thailand, addressing their specific issues, such as the problem of sea garbage. Their presentation explored the complexities of problems in the community, including issues like polluted beaches, trash in the ocean and the impact of garbage on marine animals. This sharing of diverse perspectives helped build a comprehensive understanding of the distinct environmental challenges faced by the users, encouraging a collaborative and well-informed approach to finding solutions for each team.

### **Design Thinking: Ideate**

The youth were introduced to the concept of ideation through [IDEO U's Rules of Brainstorming](#). Emphasizing a judgment-free space, youth participants were encouraged to defer judgment and build upon each other's ideas. The session promoted the embrace of unusual and out-of-the-box notions, highlighting the thin line between seemingly outrageous and brilliant ideas. Guided to use "and"

instead of "but" for inclusivity, the youth participants stayed focused on the topic while allowing divergence. Visual aids, such as colored markers and sticky notes, were used to enhance idea visualization and the importance of generating a large quantity of ideas quickly was emphasized. Following these principles, the youth participants were engaged in a dynamic brainstorming session, applying creativity and collaboration to address their team problem statements on net zero challenges.

### **Activity: Prototyping and Storytelling**

Following a collaborative brainstorming session where youth members agreed on a solution, teams engaged in discussions about the sketches of their prototypes. Emphasis was placed on the understanding that prototypes can take diverse forms, including products, services and conceptual processes. To support their prototype creations, teams were introduced to digital tools such as Figma for wireframe building and video editing software. Working overnight, the youth members dedicated themselves to bringing their projects to life, ensuring completeness and coherence. As a crucial final step, they prepared compelling storytelling narratives to present their innovative solutions addressing the challenges of achieving net zero to their target users. This combination of hands-on prototyping and impactful storytelling aimed to convey not just the solutions but also the ethos and potential impact of their net zero initiatives.

Through the in-person lectures and design thinking activities, the participants were guided to view global issues from a local lens, to apply their knowledge and skills in identifying pertinent issues in their community, and to present innovative solutions in contribution to realizing a net zero Thailand. The principle of whole-of-society approach to climate action was emphasized throughout the training.

## **4. Results**

On the third and last day of the training, the participants pitched their innovative net zero projects to a panel of juries. The group project evaluation criteria, the group pitches and the participants' evaluation of the programme are described in the following.

#### **4.1 Group Project Evaluation Criteria**

Based on the project objectives and the programme design, four criteria were selected to ensure a fair and effective assessment of the group projects. The four criteria were project sustainability, project feasibility, innovation, and creativity and social impact. Each criterion was to be assessed by a designated jury member, whom are experts in their respective fields such as sustainability, project management, human-centred innovation and social entrepreneurship. Each criterion was to be rated from 1 to 10, with 1 being poor and 10 being excellent. The evaluation rubric including the definition of each criterion and the assessment process was explained to the participants from the beginning of the programme. The four evaluation criteria are described below.

- **Project sustainability**

Project sustainability will be assessed considering the project's outcomes to endure and provide value over the long term; the holistic impact on the environment, the economy and the society; and the implementation of a whole-of-society approach considering the stakeholders involved.

- **Project feasibility**

Project feasibility involves scientific and practical workability such that the project activities could be realistically implemented in practice backed by scientific data and in alignment with the Thailand and/or the community's net zero transition goals.

- **Innovation and creativity**

Innovation and creativity will be assessed based on originality and relevance in contrast with existing net zero solutions, putting ideas together into action and creation of tangible results.

- **Social impact**

Social impact involves value in the community and project scalability, and will be assessed based on the project's potential to mobilize various resources (human, financial, etc.) and how impacts can be measured, achieved and scaled up.

## **4.2 Group Pitches**

The six groups were given fifteen minutes each to present their net zero solutions followed by a question-and-answer portion with the four jury members. A short description of the problem statement and the net zero solutions of the six projects are described below.

### **Group 1: COCONNECT**

Thailand has recently surged to become the thirteenth largest global exporter of agricultural products, attributed to a remarkable 20% increase in agricultural trade during the first 11 months of 2022. This growth has brought about shifts in land use, leading to a decrease in forested areas. Consequently, it resulted in a rise in agricultural waste production, prompting many to opt for the seemingly convenient and cost-effective method of burning agricultural residues. Over the period from 2001 to 2022, Thailand lost 2.41 million hectares of tree cover, marking a 12% decline since 2000, and emitted 1.36 gigatons of CO<sub>2</sub> equivalent. Farmers often resort to burning maize fields to cut down on waste management expenses, although this practice contributes to local pollution and degrades soil quality for farming.

Solution: Coconnect is a comprehensive waste management system that assists in collecting agricultural waste from farmers, storing the collected materials in a warehouse, and subsequently making these resources available for sale to partners such as landscaping or furniture production industries. Coconnect's primary objective is two-fold: to augment farmers' income by enabling them to sell their agricultural waste and to make a meaningful contribution to mitigating the environmental impact of such waste, particularly within agricultural areas.

### **Group 2: Food Waste Segregated Machine**

Food waste is both a social and an environmental issue. When food is wasted, resources such as the water and energy it took to grow, harvest, process, package and transport the food are also wasted. Reducing food waste can cut human-caused greenhouse gas emissions by 6 to 8%.

Solution: A machine that automatically sorts and disposes of food waste. The machine can segregate the waste according to size, making waste disposal

effortless and efficient. It also incorporates an effective odor control system with sealed compartments and carbon fabric in the bottom shelf to help absorb the food smell. The segregated waste can be used for composting, promoting sustainable lifestyle practices.

### **Group 3: Mywastechanger**

In Phang nga Province in Thailand, the amount of waste that enters landfills is 30 tons per day. These wastes eventually end up in coastal waters, polluting the coastal area and causing detrimental impacts on marine life.

Solution: Mywastechanger is a platform where coastal community residents can bring and sell collected wastes and convert them into waste credits. The collected wastes are then shipped to upcycling factories and eventually sold as upcycled products. It aims to reduce marine waste pollution and keep a clean environment for marine biodiversity while at the same time help generate income for the community members.

### **Group 4: TRAVECO**

An all-in-one eco-tourism application is rare to find and often, tourists who wish to support eco-tourism trips may have to use several applications for booking, finding local activities and calculating carbon footprint.

Solution: TRAVECO is an eco-tourism smartphone app that helps users create travel itineraries showcasing local goods and local wisdom of the community, book eco-friendly transportation services and calculate total carbon footprint.

### **Group 5: WayOfWaste**

Leftover restaurant food is often disposed of in the trash, causing an odor and clogging the water pipes. This unsustainable habit poses several detrimental impacts to the environment especially when organic and solid wastes are mixed in landfills.

Solution: WayOfWaste provides a platform for restaurant owners to sell their leftover food wastes to potential buyers such as livestock owners. It provides a

sustainable solution to deal with daily food wastes produced by restaurateurs while also providing lower cost feed and raw materials in livestock businesses.

### **Group 6: MY FOOTPRINT**

The energy sector in Thailand comprises the highest contributor to total GHG emissions in the country at 69.96% in 2019. A large proportion is attributable to individuals commuting with their private vehicles despite the availability of various public transportation. A lack of public awareness on carbon footprint and ways to reduce emissions may be attributed to the popularity of private vehicle use during commute.

Solution: MY FOOTPRINT is a smartphone application that informs vehicle drivers about their carbon footprint every time they purchase fuel. It informs the users the GHG emission per purchase and provides reward points for those whose fuel purchase is lower than their average historical purchase.

Following the final pitch and the Q&A of the six groups, the two groups that received the highest tallied scores were announced as ideathon winners.

### **4.3 Programme Evaluation and Conclusion**

A pre- and a post-survey were administered to the participants with the two objectives: (i) to assess their learning gains before and after the training; and (ii) to evaluate the various aspects of satisfaction related to the programme. The pre-survey was conducted on 12–15 August 2023 before the training commenced while the post-survey was conducted at the end of the training day on 1 September 2023. A cloud-based survey platform called Survey Monkey was used to carry out the survey. All 40 participants responded to the survey.

The survey analysis report is provided in detail in **APPENDIX III**. Conclusions derived from the survey analysis results are summarized below.

1. Successful programme design: Ninety-eight per cent of the participants expressed overall satisfaction with the programme, and every session of the programme was individually rated as highly satisfactory. These results indicate that the program content and delivery were well-received by the participants.

2. Enhanced participants' net zero knowledge and skills: The statistical analysis using paired t-test demonstrated a statistically significant increase in the level of expertise between before and after the programme for all subject matters covered in the training. These gains reflect the effectiveness of the training in enhancing participants' knowledge and skills.
3. Raised awareness of the Sustainable Development Goals (SDGs): The analysis also revealed a statistically significant increase in participants' knowledge of all 17 SDGs, indicating perceived improvements in the participants' understanding of these goals. This suggests that the programme had a positive impact on participants' awareness and comprehension of the SDGs.
4. Inspired a sense of commitment and action in response to climate change: The open-ended responses from participants underscore the positive impact of the ideathon on their academic and everyday life. The knowledge on net zero and climate change, team collaboration and idea sharing were noted as the most valuable components gained during the ideathon. Many youth participants also expressed a commitment to start making changes within themselves and contribute to raising awareness about climate change.

It was evident that the programme positively influenced youth participants from various regions in Thailand. The UNU-IAS's designed programme, i.e., the innovative combination of e-learning, design thinking and residential ideathon, contributed to synergizing youth energy, interest, knowledge and leadership in net zero initiatives. The successful implementation of Net Zero Thailand: ACE Youth Ideathon Camp proved its potential to empower youth to be a change agent as well as its applicability to other countries with similar levels of economic and social development.

## REFERENCES

Brown, T. 2008. “Design Thinking.” *Harvard Business Review* 86 (6): 84. <https://hbr.org/2008/06/design-thinking>

Government of Thailand. 2022. “Thailand’s 2nd Updated Nationally Determined Contribution 2023.” <https://unfccc.int/documents/620602>

UNDP. 2020. “UNDP Thailand Youth Strategy.” <https://www.undp.org/thailand/publications/undp-thailand-youth-strategy>

UNDP. 2023. “Celebrating COP27 Wins for Young People.” <https://www.undp.org/blog/celebrating-cop27-wins-young-people>

UNESCAP. 2023. “Engaging Youth in Climate Action: Hope for the Region’s Sustainable Future.” <https://www.unescap.org/blog/engaging-youthclimate-action-hope-regions-sustainable-future#>

UNESCO. 2018. “Issues and Trends in Education for Sustainable Development.” <https://unesdoc.unesco.org/ark:/48223/pf0000261954>

UNESCO. 2019. “Country Progress on Climate Change Education, Training and Public Awareness: An Analysis of Country Submissions under the United Nations Framework Convention on Climate Change.” <https://unesdoc.unesco.org/ark:/48223/pf0000372164>

UNESCO. 2021. “Greening the Mekong: Action for a Greener Economy with Children and Youth.” <https://unesdoc.unesco.org/ark:/48223/pf0000377085>



## APPENDIX I: IDEATHON PROGRAMME

START	END	TIME	ACTIVITY	TOPIC	SPEAKER / FACILITATOR
[Day 1] Wednesday, 30 August 2023 (Facilitated by Jerome Silla)					
9:00	9:30	30 min	Registration		
9:30	9:40	5 min + Buffer	Welcoming Remarks		Shinobu Yume Yamaguchi UNU-IAS
9:40	9:50	5 min + Buffer			Youn Young-Bong KOREA ENVIRONMENT CORPORATION
9:50	10:00	5 min + Buffer			Pavish Kesavawong DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT
10:00	10:30	30 min	Icebreaker Session		Jerome Silla UNU-IAS
10:30	11:00	30 min	Programme Orientation		Jerome Silla UNU-IAS
11:00	12:00	60 min	Module	Carbon Auditing	Sawaros Thanapornsangsuth & Paricha Duangtaweesub UNU-IAS & CHULALONGKORN UNIVERSITY
12:00	12:30	30 min	Module	Mind mapping	Sawaros Thanapornsangsuth & Paricha Duangtaweesub UNU-IAS & CHULALONGKORN UNIVERSITY
12:30	13:30	60 min	Lunch Break		
13:30	14:30	60 min	Scene-setting Presentation	Thailand's Road to Net Zero	Sivach Kaewcharoen OFFICE OF NATURAL RESOURCES AND ENVIRONMENTAL POLICY

14:30	15:15	45min	Module	Human Mobility in the Context of Climate Change	Debora Gonzalez INTERNATIONAL ORGANIZATION FOR MIGRATION
15:15	15:30	15min	Recess		
15:30	16:30	60 min	Module	Introduction to Design Thinking and Empathy	Sawaros Thanapornsangsuth & Paricha Duangtaweesub UNU-IAS & CHULALONGKORN UNIVERSITY
16:30	17:30	60 min	Module	Design Thinking: Define Group Activity: User Journey & Persona	Sawaros Thanapornsangsuth & Paricha Duangtaweesub UNU-IAS & CHULALONGKORN UNIVERSITY
17:30	17:45	15 min	Reminders		Jerome Silla UNU-IAS
Night			Homework: Carbon Auditing, Empathize and Define		

**[Day 2] Thursday, 31 August 2023 (Facilitated by Jonghwi Park)**

9:00	9:30	30min	Recap & Warm-up		Jerome Silla UNU-IAS
9:30	10:30	60 min	Module	Net Zero Community Efforts: Case of Phayao	Phanintra Teeranon PHAYAO LEARNING CITY

				Learning City	
10:30	11:00	30 min	Recess		
11:00	12:00	60 min	Module	Resouce Mobilization Panel Discussion	Jonghwi Park UNU-IAS Ada Chirapaisarnkul TAEJAI.COM Siree Jongdee EQUITABLE EDUCATION FUND Phonchan Kraiwatnutsorn SCHOOL OF CHANGEMAKERS
12:00	13:00	60min	Lunch Break		
13:00	15:15	135 min	Module	Activity: User Persona and Problem Statement Presentation Design Thinking: Ideate	Sawaros Thanapornsangsuth & Paricha Duangtaweesub UNU-IAS & CHULALONGKORN UNIVERSITY
15:15	15:30	15 min	Recess		
15:30	16:00	30 min	Module	Net zero lifestyle	Lee Young Min KOREA ENVIRONMENT CORPORATION
16:00	16:30	30 min	Module	Storytelling	Sawaros Thanapornsangsuth & Paricha Duangtaweesub UNU-IAS & CHULALONGKORN UNIVERSITY
16:30	17:30	60 min	Module	Activity: Prototyping	Sawaros Thanapornsangsuth & Paricha Duangtaweesub UNU-IAS & CHULALONGKORN UNIVERSITY

17:30	17:45	15 min	Reminders		Jerome Silla UNU-IAS
Night			Homework: Prototyping		

**[Day 3] Friday, 01 September 2023 (Facilitated by Jerome Silla)**

9:00	10:00	60 min	Group Presentation Final Preparations	Sawaros Thanapornsangsuth UNU-IAS
10:00	10:15	15 min	Group 1 Presentation	<p>FACILITATOR: Jerome Silla UNU-IAS Sawaros Thanapornsangsuth UNU-IAS</p> <p>EVALUATORS: Jonghwi Park UNU-IAS Chongrak Thinagul DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT  Ada Chirapaisarnkul TAEJAI.COM  Paricha Duangtaweesub CHULALONGKORN UNIVERSITY</p>
10:15	10:25	10 min	Group 1 Feedback	
10:25	10:40	15 min	Group 2 Presentation	
10:40	10:50	10 min	Group 2 Feedback	
10:50	11:05	15 min	Group 3 Presentation	
11:05	11:15	10 min	Group 3 Feedback	
11:15	11:30	15 min	Group 4 Presentation	
11:30	11:40	10 min	Group 4 Feedback	
11:40	11:55	15 min	Group 5 Presentation	
11:55	12:05	10 min	Group 5 Feedback	
12:05	12:20	15 min	Group 6 Presentation	

12:20	12:30	10 min	Group 6 Feedback	
12:30	13:30	60min	Lunch Break	
13:30	13:50	20 min	Post-survey	Jerome Silla UNU-IAS
13:50	14:10	20 min	Certificate Awarding	
14:10	14:15	5 min	Awarding Ceremony	Dr Jonghwi Park UNU-IAS
14:15	14:25	5min +Buffer	Closing Remarks	Pavish Kesavawong DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT
14:25	14:35	5min +Buffer		Jonghwi Park UNU-IAS
14:35	14:45	10 min	Group photo	
14:45	15:00	15 min	Dismissal	

## **APPENDIX II: NET ZERO 101 COURSE STRUCTURE**

Sections and sub-sections of the three modules of Net Zero 101 course are outlined below:

### **Module 1: What is Net Zero?**

- 1.1 Scientific Evidence of Climate Change
  - 1.1.1 What causes climate change?
  - 1.1.2 GHGs and global warming
- 1.2 Carbon Sinks
  - 1.2.1 Natural carbon sinks: forest and ocean
  - 1.2.2 Technology-based approach
- 1.3 What is Net Zero?
  - 1.3.1 Carbon neutrality
  - 1.3.2 Net zero
- 1.4 UN Climate Change Bodies and Treaties
  - 1.4.1 UNFCCC, COP and IPCC
  - 1.4.2 Key milestones in global climate agreements
  - 1.4.3 Kyoto Protocol
  - 1.4.4 Paris Agreement

### **Module 2: Why Net Zero?**

- 2.1 Environmental Impacts of Climate Change
- 2.2 Socio-economic Impacts of Climate Change
- 2.3 A Hyperconnected World
  - 2.3.1 State parties
  - 2.3.2 Non-state parties
  - 2.3.3 Household and individuals

### **Module 3: How to Net Zero?**

- 3.1 Biggest GHG Contributors
  - 3.1.1 GHG emission by sector in different countries
  - 3.1.2 How to achieve net zero starts with understanding your community
  - 3.1.3 Different sector, Different solution
- 3.2 Carbon Footprint Calculation
  - 3.2.1 What is carbon footprint?
  - 3.2.2 How to calculate carbon footprint?

3.2.3 Carbon footprint for daily lifestyle options

### 3.3 Renewable Energy

3.3.1 What is renewable energy?

3.3.2 Four major renewable energy sources: Pros and Cons

## **APPENDIX III: SURVEY ANALYSIS REPORT**

### **Part I. Introduction**

The United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS), together with the Royal Thai Government's Department of Climate Change and Environment, organized a capacity building programme entitled "Net Zero Thailand: ACE Youth Ideathon Camp" on 30 August – 1 September 2023 under the Korea Global Net Zero Partnership Project funded by the Korea Environment Corporation.

A pre- and a post-survey were administered to the participants to assess their learning gains before and after the training and to evaluate the various aspects of satisfaction related to the programme. The pre-survey was conducted on 12–15 August before the ideathon commenced while the post-survey was conducted on the last day of the ideathon on 1 September. Both surveys were carried out online using a cloud-based survey platform called Survey Monkey. All the participants responded to the survey (N=40).



## Part II. Participant demographics

The cohort is composed of 40 participants consisting of 26 (65%) female and 14 (35%) male. Those who are aged between 20 and 25 compose 85% of the total participants and the remaining 15% are less than the age of 20. University students make up most of the cohort with 35 (87%) individuals, followed by 3 (8%) high school students and 2 (5%) working professionals. Figures 1, 2 and 3 below illustrate the distribution of gender, age and student/non-student proportion of the participants.

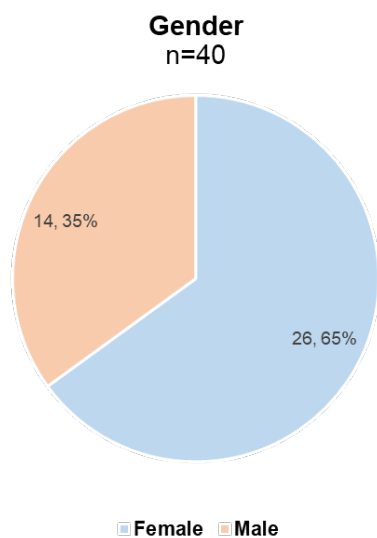


Figure 1. Gender distribution of participants

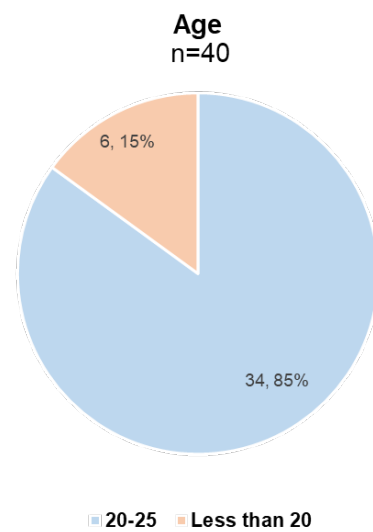


Figure 2. Age distribution of participants

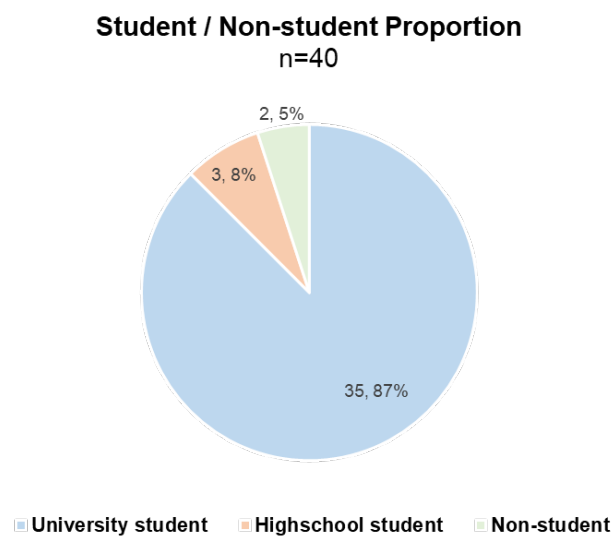


Figure 1. Student and Non-student proportion of participants

The cohort comes from a diverse academic background where the majority (19 out of 40 youths) has environmental science or environmental engineering background while the rest comes from the field of civil engineering, biology, economics, hospitality and tourism, aviation industry, chemistry, chemical engineering, education, international relations, law, political science, science for industry and soil conservation. Figure 4 below shows the distribution of participants' academic background.

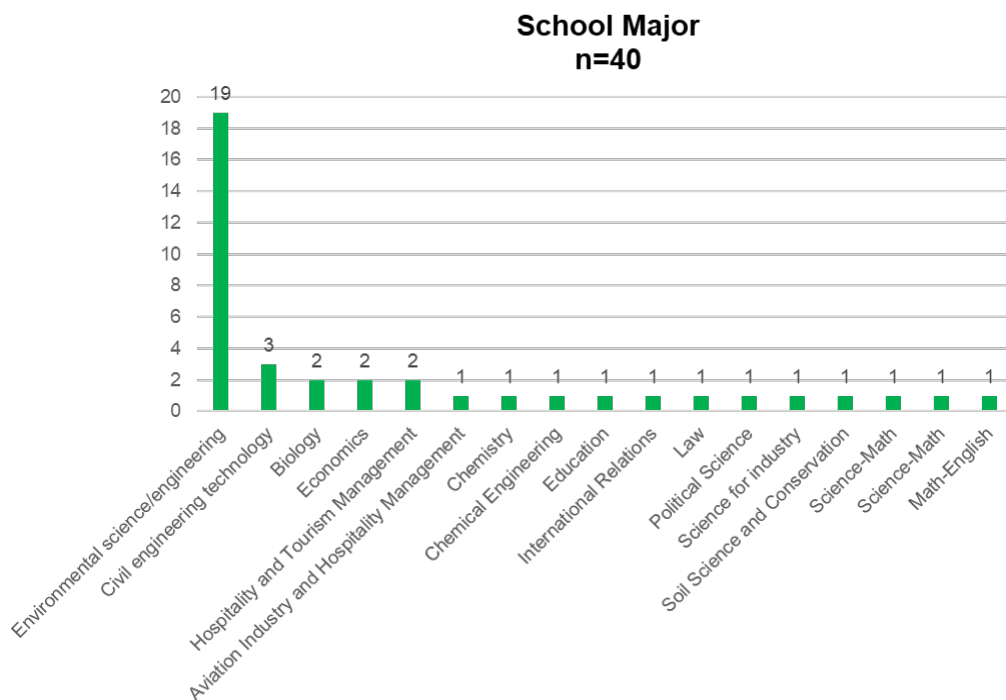


Figure 2. School major distribution of participants

The forty participants came from 16 different provinces of Thailand. Bangkok is the most represented area with 16 participants, followed by Chiang Mai province with four students. The provinces of Chonburi, Pathum Thani, Phuket, Ratchaburi, Samut Prakan and Ubon Ratchathani have two participants each while Khon Kaen, Maha Sarakham, Nakhom Pathom, Nakhon Phanom, Rayong, Sakon Nakhon, Saraburi and Songkhla have one student each. Figure 5 below shows the distribution of participants' current province of residence.

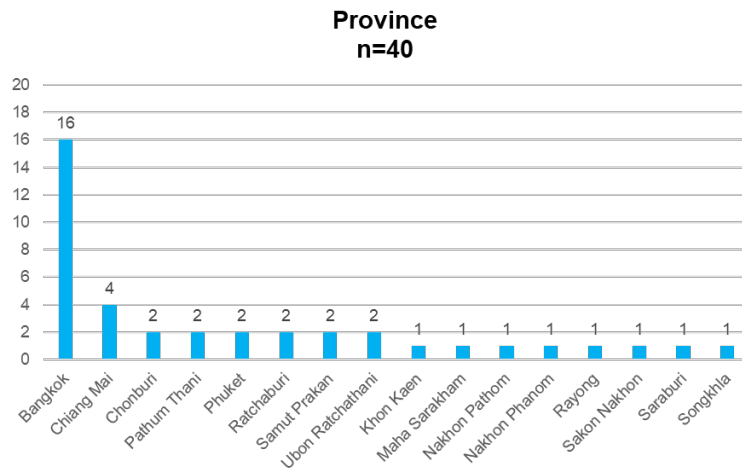


Figure 3. Current province of residence of participants

### Part III. Satisfaction level

The participants were asked to rate their level of satisfaction using a five-point Likert-scale: extremely dissatisfied, somewhat dissatisfied, neither dissatisfied nor satisfied, somewhat satisfied and extremely satisfied.

Ninety-five per cent of the participants gave a positive response regarding their overall expectations of the programme and more than half of the participants (57.5%) provided the highest rating of “extremely satisfied”. While five per cent of them or two individuals were neither dissatisfied nor satisfied, none of the participants provided a negative response to this question. Figure 6 below illustrates the distribution of participants’ overall level of satisfaction vis-à-vis their expectations.

Overall, my expectations of the programme were met.

n=40

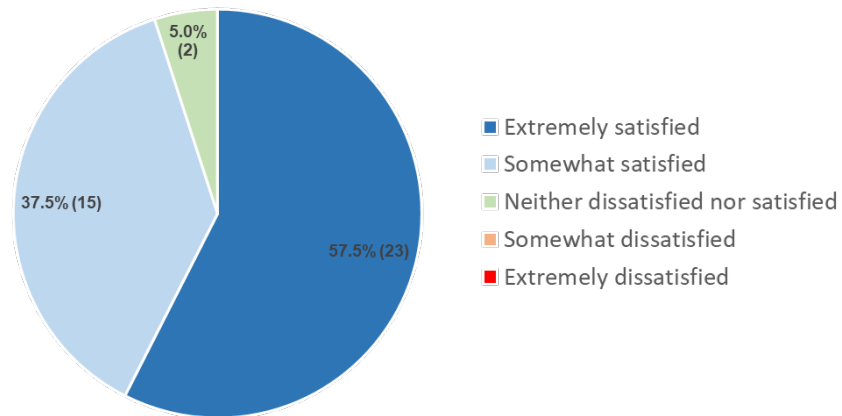


Figure 4. Participants' overall level of satisfaction vis-à-vis their expectations

Regarding the question “How was your experience in the overall logistical organisation of the programme?”, 97% of the participants provided a positive response, in which 73% felt that they were extremely satisfied. Despite this, one individual which represents 3% of the cohort answered somewhat dissatisfied. Figure 7 below shows the distribution of participants' satisfaction level vis-à-vis the ideathon's logistical organization.

How was your experience in the overall logistical organisation of the programme

n=40

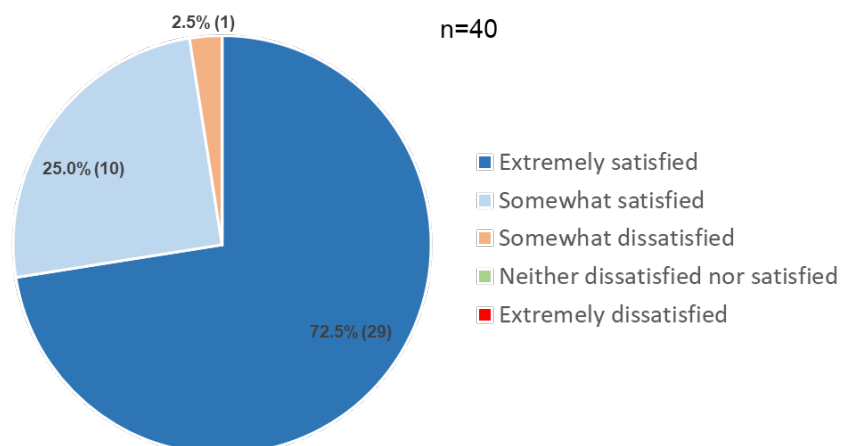


Figure 5. Participants' level of satisfaction vis-à-vis the ideathon's logistical organisation

Five additional questions detailing the participants' satisfaction level were asked. The questions are illustrated in Figure 8 below. For all five questions, two trends can be deduced. First, for all five satisfaction questions, the majority of the participants (92–100%) answered with a positive response and none provided a negative response. Second, for all five satisfaction questions, majority of the participants (50–83%) answered “extremely satisfied.” The statement “The speakers were very knowledgeable about the subject matter” received the most favorable response where 83% of the participants felt extremely satisfied.

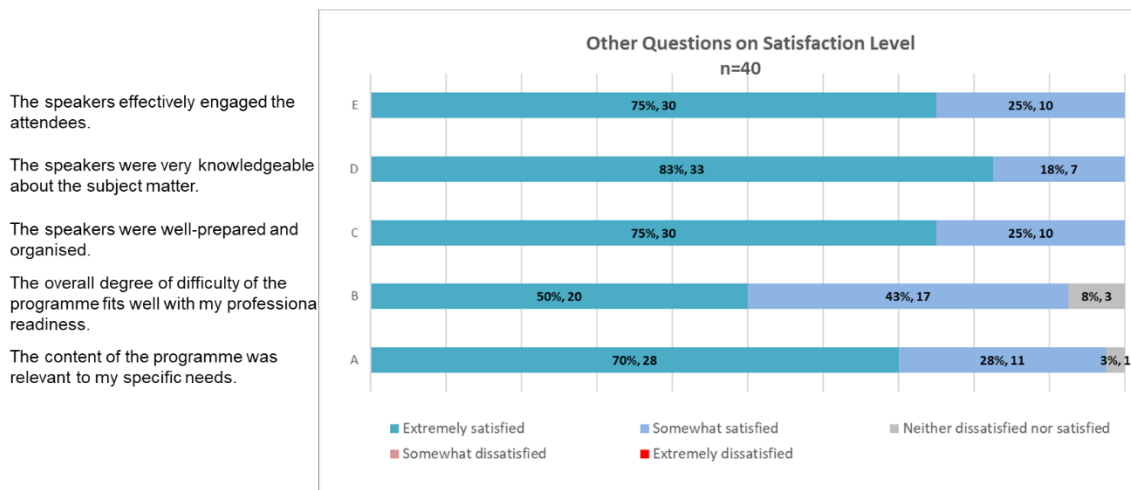


Figure 6. Participants' response distribution to other five questions on their satisfaction level

## Part IV. Session rating

Participants were asked to rate each of the 12 modules of the ideathon in addition to the final presentation session and the Net Zero 101 course. In total, 14 “sessions” were evaluated in which two trends can be deduced from the collected responses. First, 82-95% of the participants provided positive feedback to all sessions. Second, more than half of the cohort (between 53–73%) rated all 14 sessions as excellent. Considering the weighted average scores, the sessions that received the highest ratings are Introduction to Design Thinking and Empathy, Final Group Presentations, Carbon Auditing and Mind mapping. Details of the session ratings are provided in Figure 9 below.

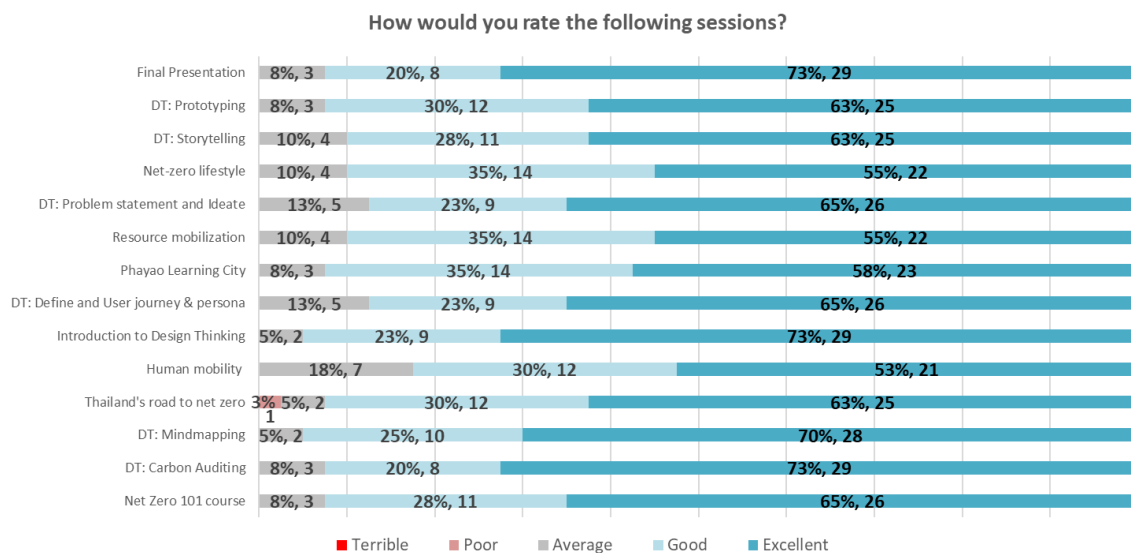


Figure 7. Distribution of participants' rating of each ideathon session

## Part V. Learning gains on ideathon subject

The participants were asked to rate their expertise in the subject matters covered in the programme using a five-point Likert-type scale. Details of the mean pre-scores, mean post-scores, difference of mean post- and post-scores and the p-values are summarized in Table 1 below.

Please rate your current expertise in the following fields.				
t-test, 2-tailed, paired, n=39				
Subject/Topic	Mean (Pre)	Mean (Post)	Mean (Post-Pre)	p-value
Causes of climate change	3.67	4.26	0.59	0.000
Concept of carbon sink	3.00	4.08	1.08	0.000
Concept of net zero	3.51	4.26	0.74	0.000
UN climate change bodies and treaties	3.10	4.00	0.90	0.000
Environmental impacts of climate change	4.03	4.41	0.38	0.003
Socio-economic impacts of climate change	3.59	4.23	0.64	0.000
Whole-society approach to achieve net zero	3.23	4.15	0.92	0.000
GHG emission by sector in different countries	3.05	4.00	0.95	0.000
Calculating carbon footprint and sustainable lifestyle	3.08	4.03	0.95	0.000
Pros and cons of different types of renewable energy	3.26	4.10	0.85	0.000
Design Thinking framework	3.08	4.18	1.10	0.000
Status of net zero in Thailand	3.08	4.08	1.00	0.000
Climate change displacement	2.92	3.92	1.00	0.000
Net-zero community efforts in Thailand	3.03	4.21	1.18	0.000
Mobilizing resources for project funding	2.46	3.92	1.46	0.000

Value	Label
1	I do not know anything about this field
2	I have heard about the field, but I cannot explain what it is
3	I have heard about the field, and I can explain the broad principles only
4	I know a lot about the field, and I can explain it well
5	I know a lot about the field, I can explain it well, and I can take actions on it

Table 1. Summary table of paired t-test results of the participants' self-reported expertise in various subject matter of the ideathon

The top three subjects that have the highest post-test mean scores are:

- i. Environmental impacts of climate change (4.41)
- ii. Causes of climate change (4.26)
- iii. Concept of net zero (4.26)

In contrast, the top three subjects that have the lowest post-test mean scores are:

- i. Climate change displacement (3.92)
- ii. Mobilizing resources for project funding (3.92)
- iii. UN climate bodies and treaties and GHG emission by sector in different countries (tied at 4.00)

Moreover, the mean post-test and pre-test scores were compared. Analysis was performed using 2-tailed, paired samples t-test. The result shows statistically significant difference (p-values are below 0.05) in the level of expertise for all subject matters covered in the training. This means that the

participants demonstrated perceived learning gains for all subject matters of the ideathon.

Furthermore, six subject matters received at least 1.0 mean gain between their post-test and pre-test scores. The gained scores of these six subjects are written in green text in Table 1. The session Mobilization Resources for Project Funding received the highest difference of 1.46 mean score gain.

## Part VI. Learning gains on SDGs

Similarly, the participants were asked to indicate their level of knowledge in the UN 17 SDGs using a five-point Likert-type scale. Details of the mean pre-scores, mean post-scores, difference of mean post- and pre-scores and the p-values are summarized in Table 2 below.

Please indicate your level of knowledge in the UN 17 SDGs.				
t-test, 2-tailed, paired, n=39				
SDG	Mean (Pre)	Mean (Post)	Mean (Post-Pre)	p-value
GOAL 1: No Poverty	3.13	3.92	0.79	0.000
GOAL 2: Zero Hunger	3.10	3.92	0.82	0.000
GOAL 3: Good Health and Well-being	3.31	4.03	0.72	0.000
GOAL 4: Quality Education	3.33	3.92	0.59	0.001
GOAL 5: Gender Equality	3.31	3.90	0.59	0.000
GOAL 6: Clean Water and Sanitation	3.28	3.97	0.69	0.000
GOAL 7: Affordable and Clean Energy	3.13	3.92	0.79	0.000
GOAL 8: Decent Work and Economic Growth	2.87	4.05	1.18	0.000
GOAL 9: Industry, Innovation and Infrastructure	2.79	4.00	1.21	0.000
GOAL 10: Reduced Inequality	2.90	4.08	1.18	0.000
GOAL 11: Sustainable Cities and Communities	3.08	4.10	1.03	0.000
GOAL 12: Responsible Consumption and Production	3.03	4.00	0.97	0.000
GOAL 13: Climate Action	3.49	4.41	0.92	0.000
GOAL 14: Life Below Water	3.23	4.23	1.00	0.000
GOAL 15: Life on Land	3.23	4.23	1.00	0.000
GOAL 16: Peace and Justice Strong Institutions	2.90	3.79	0.90	0.000
GOAL 17: Partnerships to achieve the Goal	3.03	4.10	1.08	0.000

Value	Label
1	I do not know anything about this field
2	I have heard about the field, but I cannot explain what it is
3	I have heard about the field, and I can explain the broad principles only
4	I know a lot about the field, and I can explain it well
5	I know a lot about the field, I can explain it well, and I can take actions on it

Table 2. Summary table of paired t-test results of the participants' self-reported SDGS knowledge



The top five SDGs that have the highest post-test mean scores are:

- i. Goal 13: Climate Action (4.41)
- ii. Goal 14: Life below Water (4.23)
- iii. Goal 15: Life on Land (4.23)
- iv. Goal 11: Sustainable Cities and Communities
- v. Goal 17: Partnerships for the Goals

Moreover, the mean post-test and pre-test scores were compared. Analysis was performed using a two-tailed, paired samples t-test. The result shows statistically significant difference (p-values are below 0.05) in level knowledge of all 17 goals. This means that participants demonstrated perceived gains for all the SDGs.

Furthermore, seven SDG goals received at least 1.0 mean gain between their post-test and pre-test scores. The gained scores for these 17 goals are written in green text in Table 2. Goal 9 (industry, innovation and infrastructure) received the highest difference of 1.21 mean score gain.

## **Part VII. Open-ended questions**

The participants were also asked to respond to seven open-ended questions to explore the details of their insights about their learnings, the ideathon design and net zero in their community and in Thailand. Since the responses received were a mix of English and Thai, those written in Thai have been translated to English to uniform the coding process of the survey data for interpretation.

### **What did you find was the most valuable component of the programme?**

The respondents provided varied answers, but the most common responses can be grouped into four: (i) Knowledge gain on net zero and climate change; (ii) Teamwork and idea sharing; (iii) design thinking; and (iv) Building connections and meeting new people.

One youth answered, *“As a youth advocate who voicing climate change in the southernmost in Thailand, the program (encouraged) working with the team in doing the projects of achieving net zero emissions, which is a crucial foundation to foster teamwork and communication skills. I learned to work with diverse individuals, leveraging each other's strengths for the success of the project.”*

**What is one lesson you want to take back to your work that you have learned during the programme? Why?**

The three most common responses were:

- Solving climate change and realizing net zero cannot be done alone:  
*“Reducing GHG emissions requires the participation of the public, as global warming is not a problem of any one person.”*
- A team with an interdisciplinary background helps:  
*“Everyone is unique. And when we work together to do something and have a team that encourages each other to show their full potential, it results in good results.”*
- Design thinking process:  
*“Before creating an innovation, the needs of users should be considered.”*

**Based on what you gained from the programme, what changes would you like to see in your city/country/region to achieve net zero and how do you want to contribute to it?**

The two most common responses by the participants were:

- Start the change within myself and contribute to raising awareness:

“I learned about the environment in the university so I am familiar with policies and Net Zero. But when you learn so much, sometimes you lose the passion especially when you cannot change the structure. This camp gave me a lot of idea to start now, even without collaborating with the government. So, I think my passion has come back.”

- Changes in daily life/city/Thailand/South-East Asia to achieve net zero:  
“I want to bring existing of knowledge to teach member in my family, such as separation of waste and how to reduce of food waste in my household.”

**If any, please add comments on the overall logistical organization of the programme (i.e. application process, venue logistics, programme coordination).**

Many participants provided positive feedback on the project coordination, emphasizing the programme hosts, speakers and the clear instructions provided during programme preparation. Despite this, a considerable amount of the participants thought that the publicity of the training during the open call could have been improved, noting that utilizing social media more or engaging other institutions may be useful to promote the programme before delivery.

Additionally, a few suggested to use a communication platform that is commonly used in Thailand instead of learning how to use a new platform in a short time such as Slack, which was used during the training implementation.

Lastly, one participant suggested that for overnight camps, it would be helpful if the organizers provided a co-working space that teams can use at night to work on their projects.

Having learned about resource mobilization, do you have a concrete plan for the next steps to make your project ideas a reality?

Varied answers were received, and some of the responses from the participants are provided below:

*“There’s many way to develop our project. At first we have to collaborate with petrol capitalist company.”*

*“I think we have to collaborate with government and business group companies. For help us make our project come true.”*

*“The solid plan of our team project is to make effective planning and distribute the responsibility by the individual ability to create an effective team work. Furthermore, we will make plan B to prepare our team for failure or unexpected situation.”*

*“In the first part, the project must first find its own investment. After that, we will use the money circulating in the project to pay the villagers who bring garbage for sale. We will earn from our sales products We can increase the value of our products from stories. In addition, there are additional membership channels to subsidize products, and in the future, a good network must be built for the cooperation of each sector.”*

**Please suggest issues or topics that you would like us to feature in future programmes.**

Many youth participants answered “waste management”, “successful international case studies of net zero” and “technology and innovation for net zero” as suggested topics for future trainings. Other topics that were mentioned were “ocean and net zero”, “mangrove conservation”, “acceleration program”, “carbon credit”, “policymaking” and “how to make strong partnership”.

**Overall comments and any other things that you would like to tell us.**

One participant mentioned that while the activities were fun, the use of English by some of the speakers may have discouraged some participants to express their thoughts due to poor English skills. The participant's suggestion is to provide the programme activity details in advance in order to give the training participants time to prepare and mitigate the language barrier.

Despite this, many participants that answered the question generally expressed their gratitude and appreciation to the organizing team such as:

*"You're great team. And this is the greatest camp that i ever join until now. So,pls do this project on the next year. I want the younger people gain some of positive energy and a several of knowledge like me. !!!"*

*"Thank you to all the team for organizing this camp, I have received many things from this camp, I will use the knowledge and experience I have gained to further develop in the future. 🙏💕"*