

# Consensus on Climate Change Adaptation among Government and Populace

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**Abstract**—Observations and long-term trends indicate that climate change impacts would be significant and affects Taiwan directly and severely. Taiwan engages not only in mitigation, but also in adaptation. However, there are cognitive gaps on adaptation between government and populace. Besides, a vision of zero-carbon and renewable energy 100% will be adopted in future. Therefore, the objectives of this article are to 1) hold a National Forum for knowing differences between the strategies of zero-carbon and renewable energy 100% and cognitions of general populace, and 2) plan a clear roadmap for the vision, strategy, and measures. In this forum, we set 5 group topics, 5 presumed themes, and issues mentioned review for concluding the critical issues. Finally, there are 4 strategies and 14 critical issues which correlate with the vision and strategy of government and the cognition of the general populace.

**Keywords**—Cognitive gap, world café, renewable energy, zero-carbon.

## I. INTRODUCTION

THAT extreme weather is becoming more frequent. Across the province we have seen an increase in prolonged heat waves, extreme rain, even drought. The “Science Report of Taiwan Climate Change 2011” showed that the annual mean temperature has increased by 0.8°C over the past century (1909-2008) [1]. In the metropolitan area, the mean temperature increase over the past century has been 1.4°C. Furthermore, days of torrential rain (defined as daily rainfall  $\geq 200$  mm) have exhibited a significant increasing trend over the past fifty years and past thirty years, as well as the number of typhoons with extremely intense rainfall for the past decade. The light rain days (daily rainfall  $< 1.0$  mm), which benefit irrigation and the nation’s water resources, have decreased substantially, with a decreasing trend of -2 days per decade in the past on hundred years and -4 days per decade in the past thirty years. This reflects the extreme decline in light rain days. From 1993 to 2003, the sea level in nearby basins of Taiwan rose by the rate of 5.7 mm/yr, which was twice the rising rate over the past fifty years and was slightly higher than the 5.3 mm/yr rate derived from satellite observation.

The scope, extent and severity of future climate change is difficult to predict. However, using the IPCC-developed scenario of A1B, which is considered by the international science community as the most likely future outcome, the National Science Council has come up with a list of climate

change projections upon the island of Taiwan by spatial downscaling. In terms of Taiwan’s near-surface temperatures, the majority of climate models project that the temperature increased at the end of the 21st century, ranging between 2°C and 3°C. In terms of precipitation, the mean winter precipitation in Taiwan at the end of the 21 century is projected to decrease, between -3% and -22%. The mean summer precipitation is projected to range between +2% and +26% [2].

Since scientists have more understanding of the climate change, the more they believe that the climate change is an inevitable and unstoppable. For climate change impact, mitigation alone is not enough. Adaptation seems to be another necessary way to deal with the situation now. Taiwan government has begun working on the National Adaptation Plan since 2010.

Therefore, numerous times of expert committee meeting were proactively convened by Taiwan CEPD (Council for Economic Planning and Development) for climate change adaptation framework and policies. Consequently, the “Adaptation Strategy to Climate Change in Taiwan (ASCC)” accomplished by CEPD on June 2012 [3], was developed for enforcement of adaptation capacity and abatement of vulnerability in Taiwan. The ASCC coordinates the efforts of 8 Ministries and experts from various fields, and participants of the ASCC, in cooperation, established 8 sector, including disaster, infrastructure, water resources, land use, coastal zone, energy supply & industries, agriculture & biodiversity, and health.

Furthermore, impact of climate change differs across regions, cities, communities, and even households. CEPD is also engaging in local adaptation planning. In addition, Taiwan Environmental Protection Administration (TaiEPA) has made efforts in: 1) set up a climate change adaptation information platform for enhancing the citizen education on reality of climate change, necessity for adaptation and adaptation mechanism, and 2) hold workshops for fostering local governments’ climate change adaptation planning and processing.

In order to understand citizen’s point of view and raise their awareness about climate issue, the National Climate Change Summit was held by TaiEPA in the form of “civil café” on 5-6th June, 2012. There were 580 participants, which included NGOs (non-governmental organizations), academia, industries and governments, were divided into four groups (Fig. 1) [4].

Based on the results of this summit, we recognized that the concepts of majority populace to climate change adaptation are still focusing on prevention of disasters caused by extreme

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weather, despite the efforts of TaiEPA and CEPD on national and local adaptation.

Overall, there are cognitive gaps on adaptation between government and populace [5]. Besides, a vision of zero-carbon and renewable energy 100% will be adopted in future. Therefore, the objectives of this article are to: 1) hold a National Forum for knowing differences between the strategies of zero-carbon and renewable energy 100% and cognitions of general populace, 2) plan a clear roadmap for the vision or strategy, and 3) adopt the proper measures for fostering people climate change adaptation.

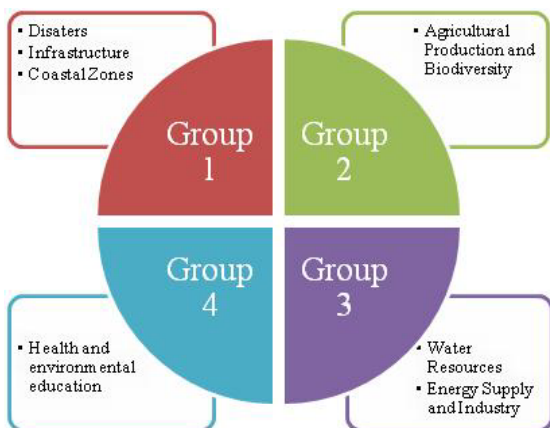


Fig. 1 Four discussion group of “civil café”

II. CONSENSUS CONFERENCE

The general populace participates in decision-making process through various ways that emphasize on the equality, transparency, respect, and participation.

TaiEPA held a forum on 18th May, 2013, which combined the concepts of consensus conference and world café. There are three steps designed for this forum (shown as Fig. 2).

TaiEPA expects that this forum could promote the public’s understanding in basic energy knowledge, decision-making process, trade-off between risk and benefit, and consensus achievement on Taiwan’s energy development direction.

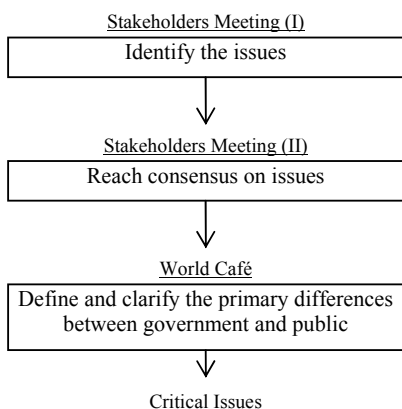


Fig. 2 Framework of the forum

A. Step 1: Stakeholders Meeting (I)

In this step, we organized an executive committee, which is composed of experts in various fields. The task of executive committee is to identify the draft issues during the initial phase. These draft issues should be concerns of public, and need to be further made decision and/or response by government.

B. Step 2: Stakeholders Meeting (II)

To address suitability of the issues for the forum, stakeholders meeting were held twice so that all kinds of issues were sufficiently considered and discussed. Also, stakeholders in various fields were invited, including NGO parties, businesses, scholar experts and the general public.

Moreover, TaiEPA expects that the general populace understand necessary of reforming the energy structure and raising the energy price. Therefore, four selection principles for the draft issues were set in 2nd stakeholders meeting as following:

Identify the gap between government and public

Communicate with public effectively

Understand the public’s concern to policy

Collect the public’s opinions and recognize the need for altering policy or measurement

C. Step 3: World Café

In order to collect comments in various fields, we invited and picked up appreciate participants by reviewing their backgrounds. It was expected that participants’ backgrounds should be comprehensively contained in ages, sexual, educations, locations and careers.

With regarding World Café working, the draft issues were divided into five major groups in this forum. The set five group topics are shown as following:

Identify the information and basic assumptions

Improve the engagement and communication with public

Identify scenario and critical controversial

Discuss the scenario contents and social-economic rules

Illustrate the development progress on energy technology and the cost analysis of power generation

During the World Café, each group had three rounds, switched tables and started new discussion. The step was expected to find out the gap between facts and studies, public and government’s opinion.

After this World Café, various opinions and comments were appeared and debated. Based on these comments, we found the difference between facts and science studies, and the viewpoint of government and public. Hence, we set up a process to highlight critical issues, which were mentioned or debated actively during the forum. There are three steps to conclude the critical issues (shown as Fig. 3), as following:

1. Presume the Critical Issues by Executive Committee

The executive committee presumed five themes at first to facilitate the discussion, including:

Does Taiwan have enough resources to develop self-sufficient renewable energy?

Does renewable energy could be built and distributed

rapidly?

- Is nuclear energy an option to reduce climate risk?
- Are the costs of nuclear and renewable energy low or high?
- Is the energy demand-side management in Taiwan effective?

2. Review the Issues Discussed during the Forum

The discussion and opinions in each table during the forum have been recorded. And comparison with presumed themes and the draft issues, all issues mentioned during the forum could be divided into presumed issues or increased issues.

The increased issues were further compared whether it fit in with vision and policy. The vision means that the issue is probably to altering the development of renewable energy or nuclear energy, and the policy means that the issue has to be accomplished or executed by decision-maker.

Furthermore, all issues were categorized into four strategies, including technology and cost, policy and accompanying measure, education and propagation, and environmental protection.

3. Sum up the Frequency of Issues Appeared in Each Table and Group

The issues recorded or discussed frequently, which means that the issue is seriously concerned by public. To response the public's concern, we defined these issues as critical issues. The critical issues will be analyzed more detailed and communicated more deeply with public.

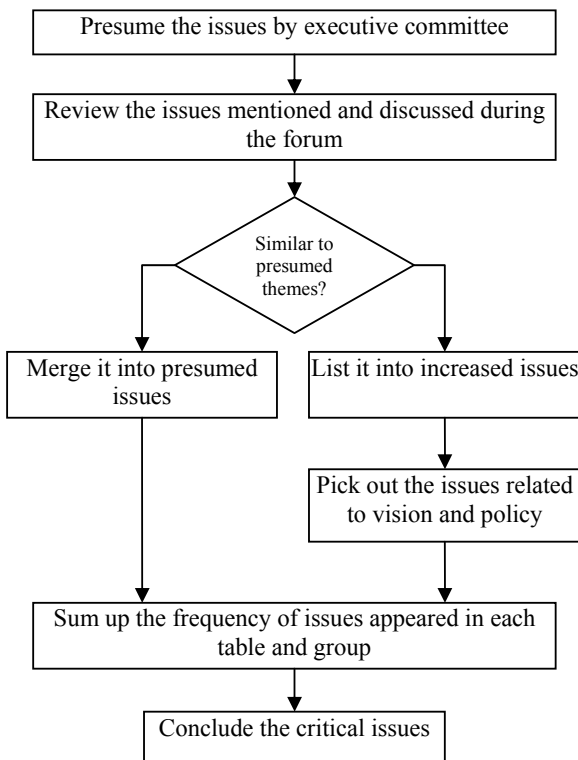


Fig. 3 Procedure of generating critical issues

III. RESULT AND DISCUSSION

All issues mentioned during the forum were compared with five themes for each group.

A. Identify the Information and Basic Assumptions

Comparison with vision and policy, we found that there are 4 issues in first group topic correspond with vision and policy; six issues fit in with policy; eleven issues accord with vision; fourteen issues do not consistent.

With regard to comparison with five themes, 29% of all issues in group topic 1 are correspond with themes. Fig. 4 shows the ratio of themes-to-issues. 50% of issues correlate with presumed theme d “Are the costs of nuclear and renewable energy low or high?”. 20% is presumed theme e “Is the energy demand-side management in Taiwan effective?”. The other themes are 10%.

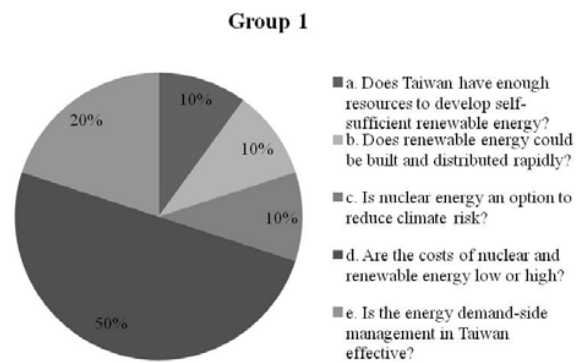


Fig. 4 Ratio of themes-to-issues in group topic 1

B. Improve the Engagement and Communication with Public

Comparison with vision and policy, we found that there are 18 issues in second group topic correspond with vision and policy; five issues fit in with policy; four issues accord with vision; twelve issues do not consistent.

With regard to comparison with five themes, 26% of all issues in group topic 1 are correspond with themes. Fig. 5 shows the ratio of themes-to-issues. 40% of issues correlate with presumed theme e “Is the energy demand-side management in Taiwan effective?”. 20% is presumed theme d “Are the costs of nuclear and renewable energy low or high?”. The other themes are 10%.

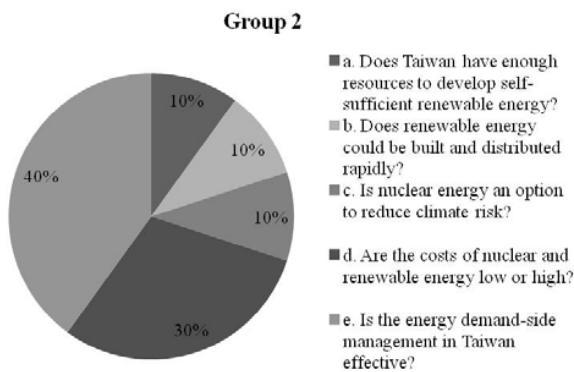


Fig. 5 Ratio of themes-to-issues in group topic 2

*C. Identify Scenario and Critical Controversial*

Comparison with vision and policy, we found that there are 14 issues in first group topic correspond with vision and policy; five issues fit in with policy; eighteen issues accord with vision; four issues do not consistent.

With regard to comparison with five themes, 36% of all issues in group topic 1 are correspond with themes. Fig. 6 shows the ratio of themes-to-issues. 37% of issues correlate with presumed theme b “Does Taiwan have enough resources to develop self-sufficient renewable energy?”. 25% is presumed theme e “Is the energy demand-side management in Taiwan effective?”. The other themes are less than 19%.

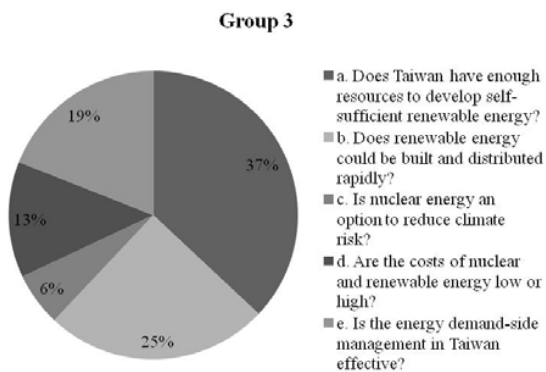


Fig. 6 Ratio of themes-to-issues in group topic 3

*D. Discuss the Scenario Contents and Social-Economic Rules*

Comparison with vision and policy, we found that there are 8 issues in first group topic correspond with vision and policy; five issues fit in with policy; five issues accord with vision; one issue do not consistent.

This group topic focuses on tools of socio-economy, law, and tax. Hence, there is no correlation with presumed themes.

*E. Illustrate the Development Progress on Energy Technology and the Cost Analysis of Power Generation*

Comparison with vision and policy, we found that there are 5 issues in first group topic correspond with vision and policy;

two issues fit in with policy; five issues accord with vision; seven issues do not consistent.

This group topic focuses on technology and cost. Hence, there is no correlation with presumed themes.

After the world café, we reviewed the issues discussed in the forum, and judged the issue is similar with presumed five themes or not. If the issue can't be grouped into the five presumed themes, it was regarded as increased issues. However, the increased issues are might too vague for government to response, we then summarized the increased issues into several critical issues by determining whether the issue is related to vision and policy or not. If the issue is related to vision and policy, we then regarded as critical issues.

At last, based on the principles of top priority concern, directions of strategies, and strong linkage between vision and policy, we drafted 14 critical issues (shown as Fig.7).

Nowadays, the 14 critical issues are initially drafted. After, expert meeting should be held for discussing these critical issues and confirming the key factor which would be used in scenario analysis.

Also, in order to address the question and concern raised by public, numerical model would be used to analyze the development trend for renewable energy under different settings, including different kinds of scenarios, and numerous key factors.

**Vision: 100% Renewable Energy**

<u>Directions of strategies</u>	<u>Critical issues</u>
Technology and cost	<ul style="list-style-type: none"> <li>The barriers to develop renewable energy</li> <li>The possibility of self-sufficient renewable energy</li> <li>The possibility of building up renewable energy rapidly</li> <li>The cost of nuclear power and renewable energy</li> </ul>
Policy and accompanying measures	<ul style="list-style-type: none"> <li>The accompanying measures to develop renewable energy</li> <li>Efficiently manage energy demand-side</li> <li>The objective of renewable energy development</li> <li>Renewable energy development and economic growth</li> </ul>
Education and propagation	<ul style="list-style-type: none"> <li>Increase the public's environment literacy through education measurements</li> <li>Propagate correct energy information</li> </ul>
Environmental protection	<ul style="list-style-type: none"> <li>The public's expectation of nuclear safety</li> <li>The environment impacts brought from renewable energy development</li> <li>The effect on lowering climate risk by using nuclear power</li> <li>The relationship between business, family, social development and energy safety</li> </ul>

Fig. 7 The drafted critical issues from the forum

Before executing the model, numerous factors have to be discussed and confirmed by experts, such as the cost of different kinds of energy resources, the prospects prediction of different kinds of energy technologies, and the supply-demand

analysis in the future. And the output will contain the change of energy structure, the ratio of renewable energy, the cost of carbon reduction technologies, the impacts of economic, and the employed population etc.

The scenarios will be designed based on different social and economic development scenario, the progress of developing renewable energies.

After accomplishing the previous steps, the results simulated by the model could be announced.

#### ACKNOWLEDGMENT

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#### REFERENCES

- [1] National Science Council, The Science Report of Taiwan Climate Change 2011, November 2011.
- [2] <http://tccip.ncdr.nat.gov.tw/NCDR/main/index.aspx>, access 2013/09/05.
- [3] Council for Economic Planning and Development, Adaptation Strategy to Climate Change in Taiwan, June 2012.
- [4] <http://unfccc.saveoursky.org.tw/nccs/>, access 2013/07/30.
- [5] <http://ecolife.epa.gov.tw/cooler/project/WorldCafe/>, access 2013/09/05