5. Evaluation and Discussions through Workshops

We held the final workshops on March 6-7, 2007 in Bandung to present, discuss, and evaluate the alternative plans. On the first day, a general explanation of global environmental issues and the purpose and result of this research in Indonesia, were followed by the presentation of the 4 alternative plans for Gunung district in Cirebon city. On the second day, reports on the approaches taken in Malaysia, Singapore and Thailand, were followed by presentations and discussions of the 4 alternative plans for Sarijadi district in Bandung city, then by wider more general discussions.

Representatives of the study areas and officials of the two local governments attended the workshops. Also, in addition to the resource persons in the building and city planning fields, representatives of forestry participated in the workshop.

(1) Presentation and Discussion

After a general explanation of global warming issues and a survey of housing complexes, architects and city planners who designed the alternative plans presented them to the workshop. They were requested to explain the concept of the plans, and then, the contents of their design in three-dimensional presentations so that non-engineers could understand them.

Usually planning and designing is undertaken in preparation for actual development and construction. However this presentation, which dealt with rather conceptual works for the distant future, utilized 2 districts as examples of model plans. The participants seemed quite confused at first, however they finally understood and appreciated the real meaning of this research.

They accepted and supported the greenery aspects of the plans. The natural wind and ventilation were also accepted. However discussions of quantities (degree of emissions reductions) appeared to still be difficult, due to the lack of data and established methods. Research activities on thermal comfort, that is classified in "building science" in this country is still in its infancy. Various thematic researches on thermal environments around human settlements must be undertaken to permit quantitative discussions.

Opinions on building materials are very diverse. Many participants view theusage of timber as an evil which destroys natural forests. Some forestry experts are promoting artificial sustainable forestry as a new business that requires a timber market and needs industries to produce durable timber products to absorb and fix CO_2 from the atmosphere faster than natural forests. However, it is also recognized that there is a risk of fire or rapid deterioration of timber in tropical climates. Even though traditional houses in all provinces are all made of timber, governmental promotion of permanent houses since the 1970s has made masonry houses a part of the culture of the Indonesian people.

High-rise and dense apartments, still a new life style in this country, are promoted by some architects as a way to provide greater open space for more urban greenery and to make cities more compact. However, not enough comparisons of alternatives within complex have been made to discuss this issue, but larger scale studies covering the total spatial plan of a city including its mass transportation infrastructure will be needed.

Opinions and questions from the floor were contributed as follows:

a. On Overall Activities

- The two planned target areas provide examples of simulation and optimization, but do not hypothesize actual development projects. Simulation means the systematic calculation of values (CO_2 emission, in this case). Optimization is a method of selecting and deciding one solution from among plural alternatives.
- The purpose of this research is to obtain an appropriate prototype.
- The target fields are city, district, housing environment and buildings.
- This research focuses on building materials, transportation and everyday life.
- Limits of indexes can be clarified.
- After the limit to every index has been set, analysis can be performed at the house, district, area and city scales.

b. On the Design

- Orientation of buildings should be north to south.
- Trees should be planted on the west side of buildings to block the heat from sunshine
- A roof garden effectively blocks the heat from sunshine: a principle also applicable to the side walls.
- Cul-de-sac type site planning is not efficient for pedestrians, causing more distant approaches. Also, they restrict access by public transportation. Supplementary short-cut footpaths (passages) should be provided.
- Grid-type site planning is more efficient, however it is more difficult to recognize its orientation. Introduction of a hierarchy of streets can aid orientation. Minor modifications can be added through parking spaces and greenery created by flowerpots along the streets (case of Sarijadi district in Bandung).
- Planners should consider the dominant direction of the wind. Even though the velocity of wind is low in a tropical climate,it can be effective.
- If we consider the eco-system, self-sufficient design is impossible, because physical conditions, land conditions and landscapesvary.
- On the urban scale, houses and housing areas are diverse, so approaches taken will not be stereotypical.
- Planning should account for such aspects as:
  >Cultural landscape
  >Participatory design
  >Economic capacity of the government and citizens
  >Feasibility of high-rise buildings considering earthquakes
- The explanation of concepts should cover aspects such as:
  >Changes from current common understanding
  >Provision of guidelines
  >Ideas from small communities like Kampung Naga

>Introduction of regulations for achievement

- It is difficult to introduce new basic thinking of ways to enhance the amount of timber used, as a replacement for the conventional philosophy,"keep and preserve forests, reducing the usage of timbers". A wood town is difficult in Indonesia.
- Quality-based designs are presented, and further calculations of quantitative indexes should be carried out.
- Needs of the inhabitants that should be consideredare:

>Safety and security from criminals and animals etc.

>Comfort

>Accessibility and mobility

- Housing districts can be classified from the following perspectives:

>Geographical conditions (flat, ocean, coast, hill, mountain)

>Local infrastructure and facilities (market, medical) that relate to the inhabitants

>Culture etc.

- Population increase will increase the consumption of building materials. Open green space should be enhanced through vertical development. Apartment houses of the kind now constructed are not appropriate.
- Direction of wind was not analyzed through this research.
- Greenery functions as sunshade and umbrellas.
- How to reduce poisonous gases?
- What is the purpose of urban renewal? Is town planning also included?
- Is this research intended to disturb environment plan 1996 (Holler)?
- Garden city by Howard has a park in the center.
- Designs lack landmarks, nodes, and a maintenance concept .
- In a normal development, profit is considered. How about cost and benefits?
- Does the reduction of CO_2 emissions lead to reasonable prices?
- To what degree will the reduction of CO_2 emission be achieved through each alternative model?
- Is it easy move between stories in the designed apartments?
- It seems to be assumed that land will be provided for the development plan. What about districts where individual landowners already exist?
- In Bandung, housing area is dense, so it is difficult to find new land for housing development.
- In general, land for new development is inadequate, and not appropriate for selection as a development site.

c. Open Green Space (RTH: Ruang Terbuka Hijau)

- Designing RTH should be included in house unit and district plans.
- Designing RTH should be based on types, structure and form of the city and its cultural landscape.

- Regulations stipulating the optimal % of RTH will be needed.
- Trees will reduce the risk of landslide, and also they are related to CDM. They, therefore, enhance the value of houses.
- Planning should consider not only building coverage ratio (KDB), but also the green coverage ratio (KDH). Local governments should urge citizens to plant trees.
- CO_2 also comes from oceans, therefore the system is not closed.
- Not only RTH, but the kinds of trees are also related to the reduction of CO_2 emissions. Considering the rate of absorption per hectare per year, Acacia Mangis shows very high performance.
- It is difficult to measure the actual amount of CO_2 in the field, however it is possible to apply an estimation formula. If dynamic informatics is established, it can be used for this calculation.
- A forestry research institute in Bogor is measuring the amount of CO_2 absorbed by 50 kinds of trees. It measures the amount absorbed by sample leaves and twigs during 10 hour periods.
- There is software to estimate the consumption of gas by the population.
- Trees that emit poisonous gases are harmful. Research on short useful kinds of trees is needed.
- Greenery on the top of buildings effectively isolates heat from sunshine.
- Local governments should establish adequate regulations. In Indonesia, trees are being grown and cut without clear reasons.
- Research on the total amount of absorption of CO_2 by unit area of forest should be undertaken. Trees absorb CO_2 during the daytime, but emit CO_2 at night.
- Is the absorption of CO_2 by RTH in urban areas significant? How about the mechanism? How about in cities with different characteristics?
- Planting trees is cheap and effective. Therefore, it is promoted.
- RTH plays significant roles in reducing CO_2 emission, catching and holding surface water, and contributing to beautiful landscapes.
- The concept of "one tree for each house" is easy to understand.

d. Building Materials

- Timber fixes carbon. On the global scale, construction of timber houses will be effective. The production of timber should be done in forests on mountains.
- Bamboo grows everywhere in Indonesia where it isutilized for buildings. However, the absorption of CO_2 by bamboo has not been evaluated. Bamboo is deemed effective for protection from strong winds and from earthquakes (by strengthening soil).
- It has long been known that bamboo grows rapidly. It is utilized as cheap building material. In order to enhance its value, new related technologies must be developed.
- Bamboo houses with performance better than brick houses must be designed.
- The concept of "Wood Town" will help reduce CO_2 emissions. Timber houses and bamboo houses can be developed in Indonesia, however, we must consider the fact that they are not still not sufficiently

safe from fire.

- The price of timber is high. It is now difficult for people to build timber houses. However, if the price of cement goes up and cement-related products become more expensive, market demand will shift to timber.
- It is impossible to immediately popularize timber and bamboo. Technologies, energy and funds are needed to develop and produce cheap timber and bamboo members and components ready to be assembled at construction sites. Research on optimal safety is needed, hence, "value engineering".
- To what degree can bamboo absorb CO_2? For engineering reasons, it is important to make RTH well balanced between house lot and district planning, to establish housing areas as green belts.
- Brick houses are already part of the culture of Indonesia.
- It is important to develop prototypes of housing areas.
- From the architectural perspective, it is important to enhance the lifetime of timber buildings and to make them more beautiful. In principle consumers seek lower prices.
- Bamboo can be utilized for either primary structures or as additional finishing.
- The question is "how to make it possible to use teak trees that are 8 years old or younger,".
- Constructing high-rise buildings using timber is now limited to a maximum of 3 stories.
- Discussions of applicable technologiesshould consider the locality. For example, local building materials are easier to purchase, and using them will contribute to the local economy.

e. Social and legal aspects

- Populariization activities are needed to arouse consciousness of citizens.
- In order to put new concepts into practice, local governments should take the lead to stimulate the desires of the the wider society. However, the difficulty in Indonesia lies in the weakness and lack of continuity of local governments.
- In order to reflect strategies in regulations, management budgets should be clear.
- In order to manage building regulations, rules must come from the community level and be strictly enforced.
- Media must help spread rules in society.
- Mailing lists are useful tools to start networking.
- The results of this research seem to be fruitful, however, will actions to put them into practice be taken continuously?
- At this moment, results of research and development are abundant. However, popularization is still insufficient, and they have not been put into practice.
- Are the results of this research "proposed models" and "evaluation of impact"? Are the outputs technical guidelines?
- Popularization of life styles led at multiple levels in three-dimensional cities will be needed.
- It is also significant to popularize organic building materials (timber), natural wind (direction), and

greenery on the top and side of buildings.

- Proposals are difficult to execute, and concepts should be clearer.
- In order to popularize socialize the result of the workshops, and promote their realization, concerned authorities must cooperate.
- It is difficult to spread local consciousness to large cities or some districts in large cities where ethnic groups vary. We have to translate our local consciousness into more logical language.
- The ways that Indonesians think should be changed.
- Special local regulations are needed to establish the legal foundations within societies.
- Proposals and planning are valuable. Efficiently providing quantitative indexes will result in the establishmenbt of technical guidelines.

f. Transportation

- Research on mass-transportation will help reduce CO_2 emissions. What about the efficiency of fuels (km / liter)? This index is still low in Indonesia.
- What are the shares of emissions by transportation by domestic energy consumption?
- "Walking on foot" must be encouraged.
- How can a living environment whose inhabitants desire to walk on foot be created? How to socialize this among urban governments?
- Motorcycles contribute 73% of air pollution in Bandung.
- Transportation contributing to CO_2 emissions consists of not only local public buses and individual vehicles, but also vehicles that pass through the Sarijadi district to visit Lemban (mountain resort) and Cimahi (a western satellite city next to Bandung).

(2) Evaluation by Non-engineer Participants

Questionnaires were provided to workshop participants. They asked participants about the presentation and contents of each alternative plan, elaborated for two districts in Cirebon and Bandung cities.

Because presenting this kind of questionnaire at seminars and workshops is not usual in this country, the questions were simple and the choice of answer was also only "yes or no".

The educational backgrounds of participants in this workshop was high, and most of the participants already knew about "Global Warming".

Presentation of alternative plans using 3D models seems to be effective, and most of the participants could understand the contents of design.

For both districts in the two cities, in general, the most support was given to maisonette type (two storied) houses for many reasons. .

a. "Gunung" District in Cirebon City

a-1. Attributes of Respondents

Table 30: Address

NA (No Answer)	Bandung city	Cirebon city	Others
1	16	5	5

Table 31: Sex

NA	Male	Female
1	20	6

Table 32: Age

NA	-29	30-39	40-49	50-59	60-
1	2	5	11	7	1

Table 33: Education

NA	High School	University	Master	Doctor
1	3	9	10	4

a-2. Evaluation of Each Alternative Plan

Table 34: Presentation

	NA	Clear	Insufficient
Plan 1	2	24	1
Plan 2	7	18	2
Plan 3	8	19	0
Plan 4	11	15	1

Table 35: Explanation of Concept

	NA	Clear	Insufficient
Plan 1	3	23	1
Plan 2	8	15	4
Plan 3	9	16	2
Plan 4	12	12	3

Table 36: Explanation of Design

	NA	Clear	Insufficient
Plan 1	6	17	3
Plan 2	10	13	4
Plan 3	8	18	1
Plan 4	11	14	2

Table 37: Transportation

	NA	Good	Insufficient
Plan 1	4	17	6
Plan 2	7	9	11
Plan 3	8	15	4
Plan 4	11	12	4

Table 38: Domestic Energy Consumption

	NA	Good	Insufficient
Plan 1	3	14	10
Plan 2	7	11	9
Plan 3	8	13	6
Plan 4	10	9	7

Table 39: Building Material

	NA	Good	Insufficient
Plan 1	4	18	5
Plan 2	7	15	5
Plan 3	9	12	6
Plan 4	11	8	8

Table 40: Greenery

	NA	Good	Insufficient
Plan 1	5	14	8
Plan 2	6	14	7
Plan 3	8	14	4
Plan 4	12	12	3

Table 41: Daily Life

	NA	Good	Insufficient
Plan 1	6	20	1
Plan 2	7	15	5
Plan 3	10	16	1
Plan 4	14	13	0

Table 42: Feasibility

	NA	Good	Insufficient
Plan 1	4	21	2
Plan 2	7	15	5
Plan 3	11	15	1
Plan 4	13	14	0

Table 43: Free Comments

	NA	Answered
Plan 1	18	9
Plan 2	18	9
Plan 3	21	6
Plan 4	21	6

Table 44: Understanding of Global Warming

NA	I knew.	I newly learned now.
10	14	3

b. "Sarijadi" District in Bandung City

b-1. Attributes of Respondents

Table 45: Address

NA	Bandung city	Cirebon city	Others
2	14	6	2

Table 46: Sex

NA	Male	Female
4	18	2

Table 47: Age

NA	-29	30-39	40-49	50-59	60-
3	1	4	9	6	1

Table 48: Education

NA	High School	University	Master	Doctor
4	4	9	4	3

b-2. Evaluation of Each Alternative Plan

Table 49: Presentation

	NA	Clear	Insufficient
Plan 1	0	24	0
Plan 2	2	19	3
Plan 3	2	21	1
Plan 4	10	14	0

Table 50: Explanation of Concept

	NA	Clear	Insufficient
Plan 1	1	23	0
Plan 2	3	21	0
Plan 3	3	21	0
Plan 4	11	13	0

Table 51: Explanation of Design

	NA	Clear	Insufficient
Plan 1	4	20	0
Plan 2	6	18	0
Plan 3	5	19	0
Plan 4	15	9	0

Table 52: Transportation

	NA	Good	Insufficient
Plan 1	1	18	5
Plan 2	3	16	5
Plan 3	2	17	5
Plan 4	10	11	3

Table 53: Domestic Energy Consumption

	NA	Good	Insufficient
Plan 1	1	18	5
Plan 2	3	16	5
Plan 3	2	19	3
Plan 4	10	10	4

Table 54: Building Material

	NA	Good	Insufficient
Plan 1	1	14	9
Plan 2	2	16	6
Plan 3	2	16	6
Plan 4	10	11	3

Table 55: Greenery

	NA	Good	Insufficient
Plan 1	1	19	4
Plan 2	3	19	2
Plan 3	2	19	3
Plan 4	10	12	2

Table 56: Daily Life

	NA	Good	Insufficient
Plan 1	2	21	1
Plan 2	3	20	1
Plan 3	3	19	2
Plan 4	10	13	1

Table 57: Feasibility

	NA	Good	Insufficient
Plan 1	2	22	0
Plan 2	2	20	2
Plan 3	3	19	2
Plan 4	10	13	1

Table 58: Free Comments

	NA	Answered
Plan 1	14	10
Plan 2	17	7
Plan 3	16	8
Plan 4	23	1

Table 59: Understanding of Global Warming

NA	I knew.	I newly learned now
12	12	0

6. Conclusion

(1) Summary

The first half of this research was a survey of existing conditions at planned housing complexes and building material factories related to CO_2 performed in order to establish the foundations for future evaluations. In order to evaluate plans intended to lower total emission while also considering indirect emissions caused by activities in the housing complex the system boundary was defined. Thus, data concerning building material factories and power plants were also surveyed and collected.

An average household in the surveyed housing complexes emits a total of 3-4 Tons of CO_2 every year. This value is comparable to the total national emissions of c.a. 200 million tons per year by the entire population of Indonesia that is c.a. 200 million persons.

A comparison of (1) domestic energy consumption, (2) transportation and (3) consumption of building materials shows that the largest emissions are caused by domestic energy consumption. Among various kinds of energy consumption,, the usage of electricity is rapidly increasing, suggesting that in the future,

conditions in this country that will be similar to those during the summer in developed countries.

Emissions by transportation are related to the location of each housing complex and related availability of facilities (market etc.). It is also strongly related to the distance to job opportunities and the popularization of private cars. This aspect should be discussed within the scope of an entire urban structure and the provision of mass transportation.

Emissions by the consumption of building material are relatively low, because even though the lifetime of houses is short, the major material is red brick produced by burning biomass-based rice husks,.

Greenery in the housing complexes which were studied was measured both through field surveys and the through analysis of satellite images. Field surveys listed the kinds of greenery within house lots and neighborhoods, while satellite images permitted the measurement of the total area of green caps of trees. These were compared to grasp the quantitative effect of greenery.

The second half elaborated, 4 alternative plans for each of the 2 districts selected in Cirebon and Bandung cities. Most architects and city planners that participated considered the vertical expansion of the housing complex by providing multi-story houses (maisonettes and apartments). The main purpose was to restore the greenery on the ground that has tended to be decreased by the unexpected private and unplanned expansion of rooms beyond the regulated maximum building coverage rate.

However, a relatively small amount of CO_2 is absorbed by trees within a complex, in comparison with the increase of emissions by the use of cement and steel: materials whose production emits huge amounts. However extending the expected lifetime of building structures will relieve this situation. The contribution of greenery to the reduction of the outdoor temperature, which is very important in developed countries where air conditioning is popular, could not be surveyed quantitatively,; rather it was considered from the viewpoint of good behaviour, experienced comfort or feelings of co-existence with nature. In the future, the measurement of outdoor environments, now simplified by the development and popularization of thermal sensors and related equipment will be carried out.

Fixing carbon by using organic components with long lifetimes in buildings will require lengthy consideration, exploiting timber has been considered to be bad behavior that destroys natural forests, and also lowers the quality of houses(shortening their lifetimes). However, some resource persons from the forestry field have started to gain benefits by promoting artificial productive forests and improving the domestic sustainable timber materials market of. They are studying and testing several kinds of trees that grow very rapidly.

During the period when this research was undertaken, the public's interest in global environmental issues seemed to grow in Indonesia. This is partially a result of extraordinary weather, including the large-scale flood that struck Jakarta in February 2007. The concept of the compact city, especially through the development of high-rise apartments, was presented by the government to the people, as an approach, that will slow the development of fringe areas of large cities: a cause of the destruction of forests and agricultural fields that retain rainwater.

(2) Outputs

The overall results have been reported to the Ministry of Environment and published in three annual reports in the Japanese language with short summaries in English.

As part of the activities related to this research, seminars or workshops were held in Bandung. Papers based on this research and also papers by related resource persons weresubmitted to these events. These can now be seen at the NILIM web site :

http://sim.nilim.go.jp/GE

A paper based on the results of the field survey of existing planned housing complexes waspresented to the City Planning Institute of Japan. in 2005 (Okinawa).

Four pages of posters were presented at the Technical Conference of Ministry of Land, Infrastructure and Transport during November 2007 in Tokyo.

An international symposium based on findings of this research on "Climate Change and Human Settlements" is scheduled for March 18-19, 2008 in Bali, Indonesia.