Low Carbon Transport

Atsushi FUKUDA

Nihon University, Japan
20-30% of GHG from transport sector.
80-90% of GHG in transport sector from road transport.
Automobiles continue to increase.
Many technologies for LCT including low carbon vehicles are available. However,
  - High cost
  - Limit of application
What are the key factors for the successful implementation of low carbon transport and smart urban design?
How to reduce Fuel Consumption/CO2 Emission?

- Use alternative Fuel Such as Bio Fuel (Carbon Neutral)
- Improve Fuel Consumption
- Shift to Mass Transit
- Reduce traffic/driving distance

Total CO2 Emission = Total driving distance
Example of Bottom Up Approach in Japan

Without road infrastructure

With implementing road infrastructure

Development of highway network

Developing and promoting low-emission vehicles
- 20.60 million tons

Traffic flow management
- 8.9 million tons

Promoting modal shifts and more efficient logistics
- 9.1 million tons

Promoting the use of public transport
- 6.7 million tons

Promoting the citizens’ voluntary Action and “eco-driving”
- 1.8 million tons

Low Carbon Transport
Potential measures

Total amount of CO2 emission on Expressway in Japan was estimated 24 million ton/year. We estimated 3.5 thousand ton can be reduced by following measures.

- Eco-driving: - 680 (- 2.80)
- Eco-driving by PC: - 509 (- 2.12)
- Speed Limiter for HT: ~1104 (~4.33)
- Alleviate congestion: - 230 (- 0.96)
- ETC at Toll Plaza: -100 (~0.42)
- Installing ITS: ~120 (~0.50)
- Effective Use: - 17 (- 0.07)
- Related Road Work: - 43 (- 0.18)
- Related Accident: - 220 (- 0.92)
- Traffic Information: - 1050 (- 4.38)
- Pricing measure, etc.
Future energy consumption to cut 70% of CO2 in 2050 (passenger)

Source: [2050 Low Carbon Society] Project
Future energy consumption to cut 70% of CO2 in 2050 (commodity)

Source: [2050 Low Carbon Society] Project

Low Carbon Transport
What is Low Carbon Society?

- Feasibility
- Cost for infrastructure

Low Carbon Transport
Shift to Mass Rapid Transit

15 lines, 509km

Year 2020 Estimation

<table>
<thead>
<tr>
<th></th>
<th>BE\textsubscript{road}</th>
<th>PE\textsubscript{road}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18,251,177</td>
<td>12,736,649</td>
</tr>
<tr>
<td></td>
<td>5,514,528 (-30.2%)</td>
<td></td>
</tr>
</tbody>
</table>

million ton/year
Selection of measures

Å Japan’s MAC curve by a bottom-up model

Low Carbon Transport
Unified strategy

- Fossil Fuel Society
  - Mode
    - Bus: Diesel, CNG
    - Rail: Gasoline
    - MC: Gasoline
    - PC: Gasoline

- Low Carbon Society
  - Mode
    - Bus: Diesel, CNG, Bio
    - Rail: Electricity
    - MC: Gasoline
    - PC: Gasoline

- Comprehensive policy
- Future vision

Low Carbon Transport
Selection as APEC

- Unified strategy as APEC
- How to deal with uniqueness of each countries?

Low Carbon Transport
How are the awareness and implementation of low carbon transport and smart urban designs in developing APEC economies?

- Invisibility of GHG
- Inactivity of market mechanism
  - Benefit (in monetary term) is small
- Common understanding for LCT/LCS
- Visualization of the policy
  - Future Vision, Load Map
Future vision & road map

- Low Carbon Transport
- Base Year
- Target Year
- GHG Emission
- Required huge reduction e.g. 30-50%
- Back casting Approach
- BAU Case
- Reference Case
- Can not Achieve
- Road Map
- Vision for Low Carbon Society
- Vision should be developed to make a huge reduction

低碳运输系统

- 近期-6-5 研究项目
- 实现低碳运输系统在亚洲的措施
- 建立评估中期至长期环境政策选项的评估方法
- 亚洲低碳社会
- 未来愿景与路线图

Research Project on Establishing Methodology to Evaluate Middle to Long Term Environmental Policy Options toward Asian Low-Carbon Society by Ministry of Environment, Japan
What are the key smart urban design options on existing cities?

peripheral communities

the recommended plan for expansion based on radial corridors

satellite new towns

Planned sprawl

a circumferential ring of towns

expansion by independent cities
Future Vision of Smart City

- Wind Power
- Solar Power
- Biomass
- Geothermal
- Electricity Storage
- Smart Grid
- EV Bus
- EV
- Heating
- Eco House

http://e2a.jp/event/100528.shtml
Future Vision for Asia Low Carbon City

- Promotion of utilization of Renewable Energy
- Dissemination of HV
- Improvement of logistic system
- Introduction of EV to delivery truck
- Enhancement of control of urban area expansion
- Utilization of paratransit on feeder
- Introduction of EV for paratransit
- Construction of public transport network on truck route
- Park & ride at suburb
- Dissemination of EV motorcycle
- Production of biofuel using local material
- Promotion of biofuel usage
- Promotion of development of area along railway
- Future Vision for Urban Area in 2030

Typical Image of Future Vision for Urban Area in 2030

Enhancement of control of urban area expansion

Utilization of paratransit on feeder

Introduction of EV for paratransit

Production of biofuel using local material

Promotion of biofuel usage

Promotion of development of area along railway

Construction of public transport network on truck route

Park & ride at suburb

Dissemination of EV motorcycle

Dissemination of HV

Introduction of EV to delivery truck

Improvement of logistic system

Promotion of utilization of Renewable Energy

Future Vision for Asia Low Carbon City
Case Study in Khon Kaen

Without TOD case in 2022
Case Study in Khon Kaen

With TOD case in 2022

- Production of Bio Ethanol
- Conversion to Hybrid Vehicle: 30%
- Conversion to Electric Vehicle: 50%
- Introduction of TOD
- Introduction of Ethanol Bus
- Conversion to EV Motorcycle: 30%
- Production of Bio Ethanol

IMPROVE
AVOID
SHIFT
IMPROVE
Estimated CO2 Emission

We need technological innovation and integration of transportation systems to enhance sustainable transport.
Urban structure might be also essential to set up future strategy for environmental measures in transport sector.

From "Evaluation and Realization of Transport-Origin CO2 Reduction Measures in Asian Developing Countries under S-6 Research Project on Establishing of Methodology to Evaluate Middle to Long Term Environmental Policy Options toward Asian Low-Carbon Society by Ministry of Environment, Japan"
Conclusion

- What are the key initiatives on low carbon transport?
- What are the key smart urban design options on existing cities?
- What are the key factors for the successful implementation of low carbon transport and smart urban design?
  - Social choice & clear vision
  - Coordination between land use and transport