Yoshitsugu Hayashi
Executive Committee Member, The Club of Rome
Ex-President, World Conference on Transport Research Society
Distinguished Professor, Chubu University, Japan

QOL-MaaS: Transformation of Asian Mobility & Lifestyle Towards Decarbonization and Disaster - Pandemic Resilience with Quality of Life in the SDGs Era

15th Regional EST

2023, 24 October, Kuala Lumpur

Extreme Life in a City of “8hrs Commuting a Day”
- Bangkok 1993 -

A School Boy waiting for Bus at 20km Suburb at 4:30 am (1993)

Extracted by Hayashi from “Bangkok Post 4 Sept 1993“

Understanding "The Limits to Motorization" along Economic Development Stages

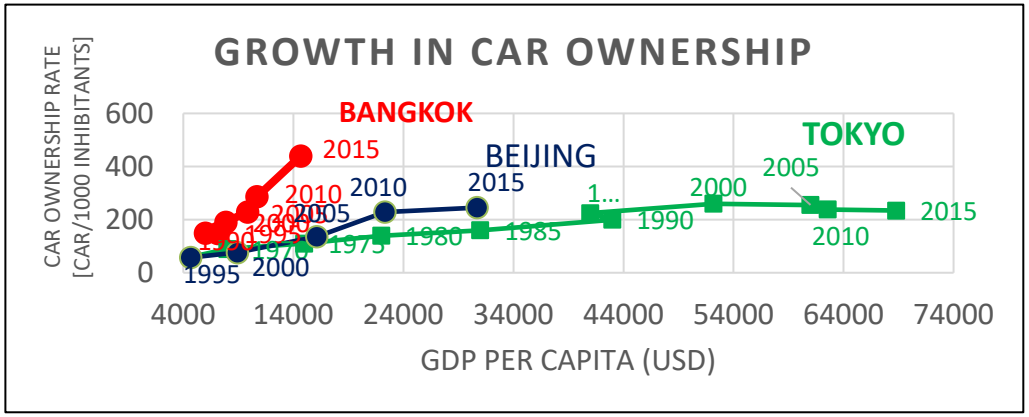


Photo by Hayashi(1993)

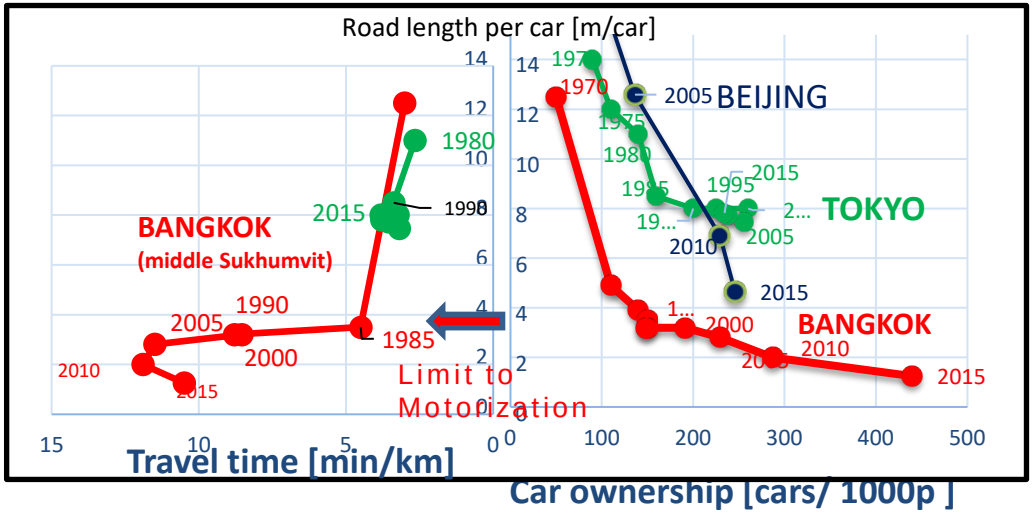


Photo by Hayashi(2018)

Damages caused by Mobility (World, Thailand)
- Effects on Mortality, Health & Well-Being -

1. Traffic Congestion

Average Travel Speed

Thailand **15** km/hr.

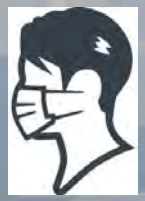
2. Road Accident

3 people die every hour

66 people die everyday from accidents

World ***1.35 mil.*** *died (2020)*

3. Air Pollution & health

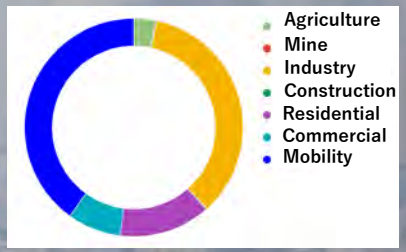


Asthma rate reaches **15-20%**

c.f. 5% in 1980

6.5 mil. *died (2020)*

4. Energy & GHG

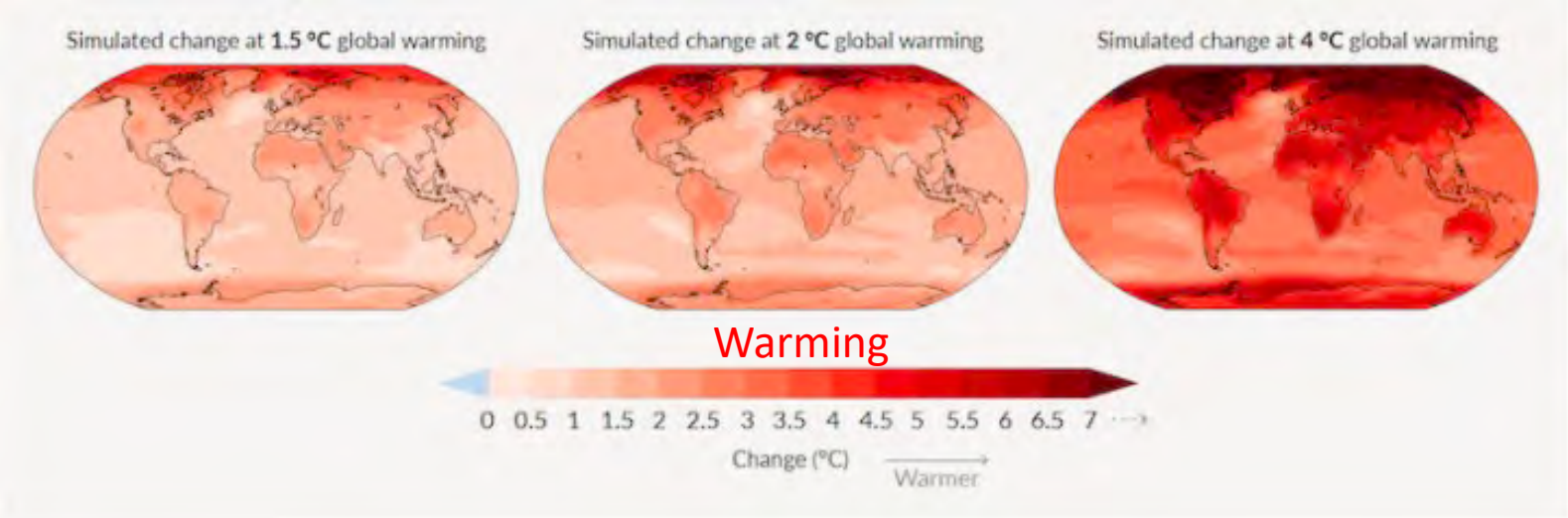


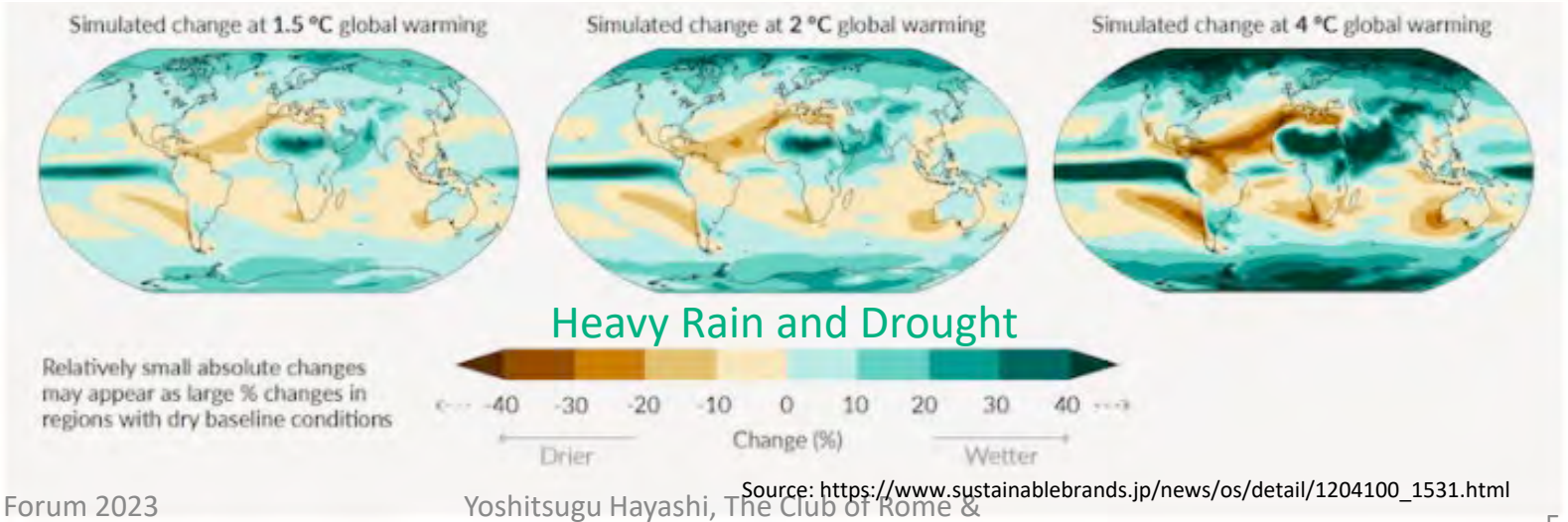
Transport Energy Consumption **40%**

35%

Courtesy by Pawinee Iamtrakul

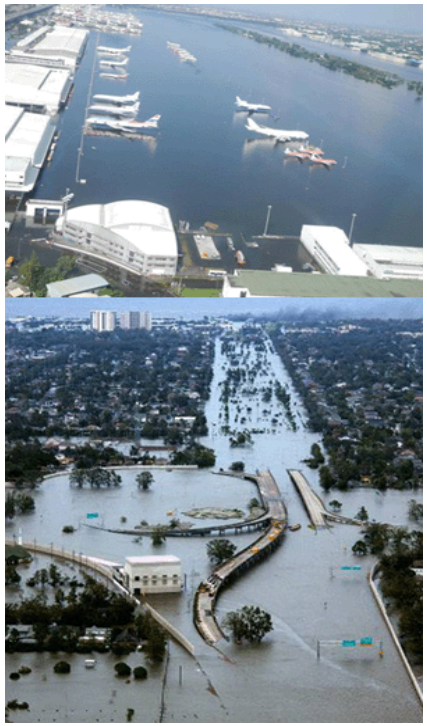
Change in Temperature resulting in damages as Heat Wave, Heavy Rainfall, Drought

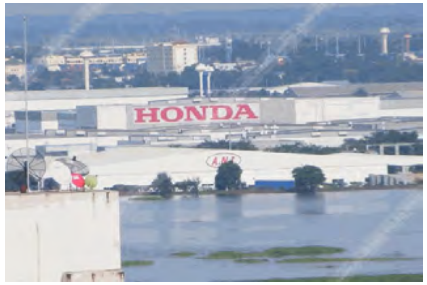




Source: https://www.sustainablebrands.jp/news/os/detail/1204100_1531.html

2011 Bangkok Flood
Central Region and Industries Submerged for Months

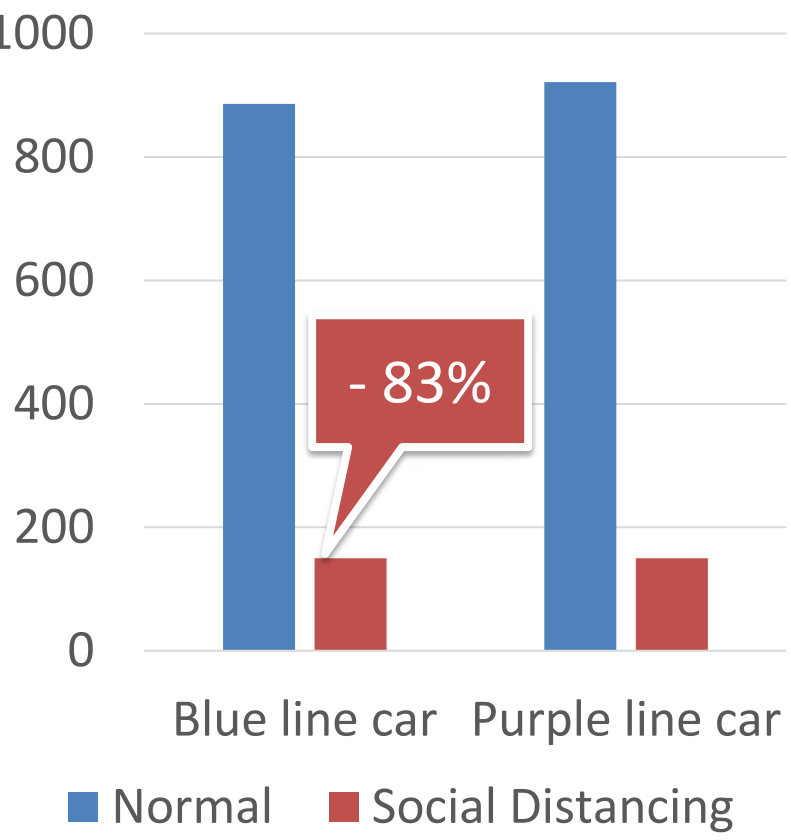




Duration: 149 days
Life Loss: 813 deaths
Economic Loss: 48,185 mil US$
Elevated/Underground Rails are Resilient

Courtesy by Varameth Vichiensan

Social Distancing
Reduced Train Capacity



Courtesy of Varameth Vichiansen

Policy/Technology Solution Options for De-Carbon & Anti-Pollution

(CUTE Matrix)

Strategies / Means	AVOID	SHIFT	IMPROVE
Technologies	• Transport oriented development (TOD) • **Poly-centric development** • Efficient freight distribution	• Railways and BRT • Interchange improvement among railway, BRT, bus and para-transit modes • **Small mobility and pedestrian walkability**	• HB,PHB vehicle • E-Vehicle (EV) • Fuel Cell/Hydrogen Vehicle (FCV) • Biomass fuel • Autonomous driving
Regulations	• Land-use control	• Separation of trunk and feeder routes by bus/para-transit • Local circulating service • Control on driving and parking	• Emissions standards • “Top-runner" approach
Information	• **Teleworking** • Online shopping • Lifestyle change	• **MaaS**	• "Eco-driving" • ITS traffic-flow management • Vehicle performance labeling
Economy	• Subsidies and taxation to location	• Park & ride • Cooperative fare systems between modes	• Fuel tax/carbon tax • Subsidies and taxation to low-emissions vehicles

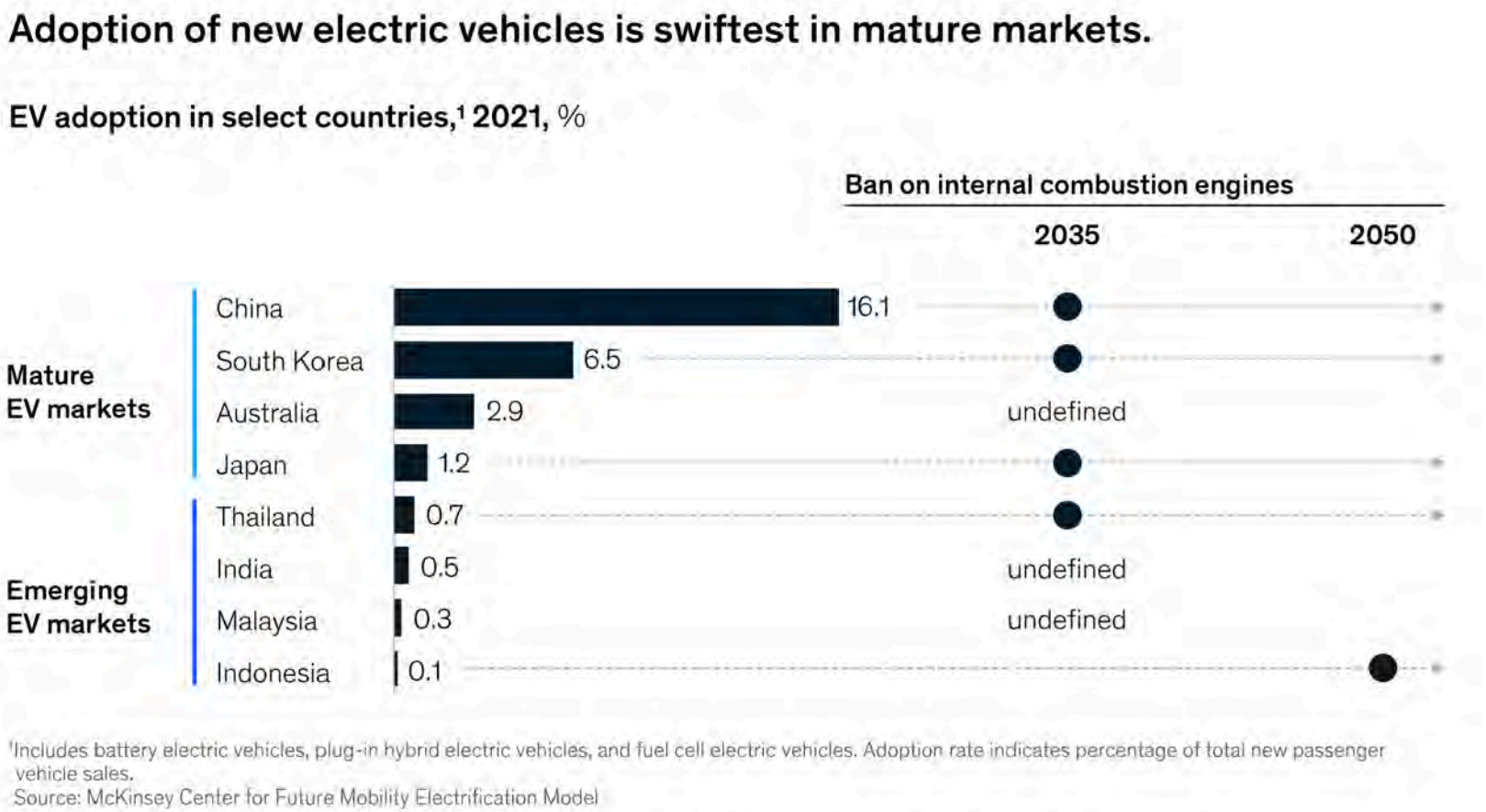
Hideo Nakamura, Yoshitsugu Hayashi and Anthony D. May eds (2004)
Urban Transport and The Environment – An International Perspective, Elsevier

Goals for EV-PHV-FCV Car Sales

	Target year	Goal	FCV	EV	PHEV	HEV	ICE
Japan	2030	HV: 30 to 40% EV/PHV: 20 to 30% FCV: Up to 3%	Up to 3%	20-30%		30 to 40%	30 to 50%
	2035	Electrified vehicles (EV/PHV/FCV/HV)100%	100%				N/A
EU	2035	EV/FCV: 100% (Note) However, there are regulations of intermediate review, etc.	100%		N/A		
U.S.	2030	EV/PHV/FCV: 50%	50%			50%	
California	2035	EV/PHV/FCV: 100%	100%				
China	2025	EV/PHV/FCV: 20%	20%				
	2035	HEV50% EV/PHV/FCV: 50% (Note) Announced in China-SAE	50%			50%	N/A
UK	2030	Gasoline-powered vehicles: Sales prohibited EV: 50 to 70%		50-70%			N/A
	2035	EV/FCV: 100%	100%		N/A		
France	2040	Internal combustion vehicles: Sales prohibited	100%		N/A		
Geramany	2030	EV: Stock 15 million		Stock 15 million			

Source: Prepared based on information disclosed by the Ministry of Economy, Trade and Industry

EV Adoption in Asian countries



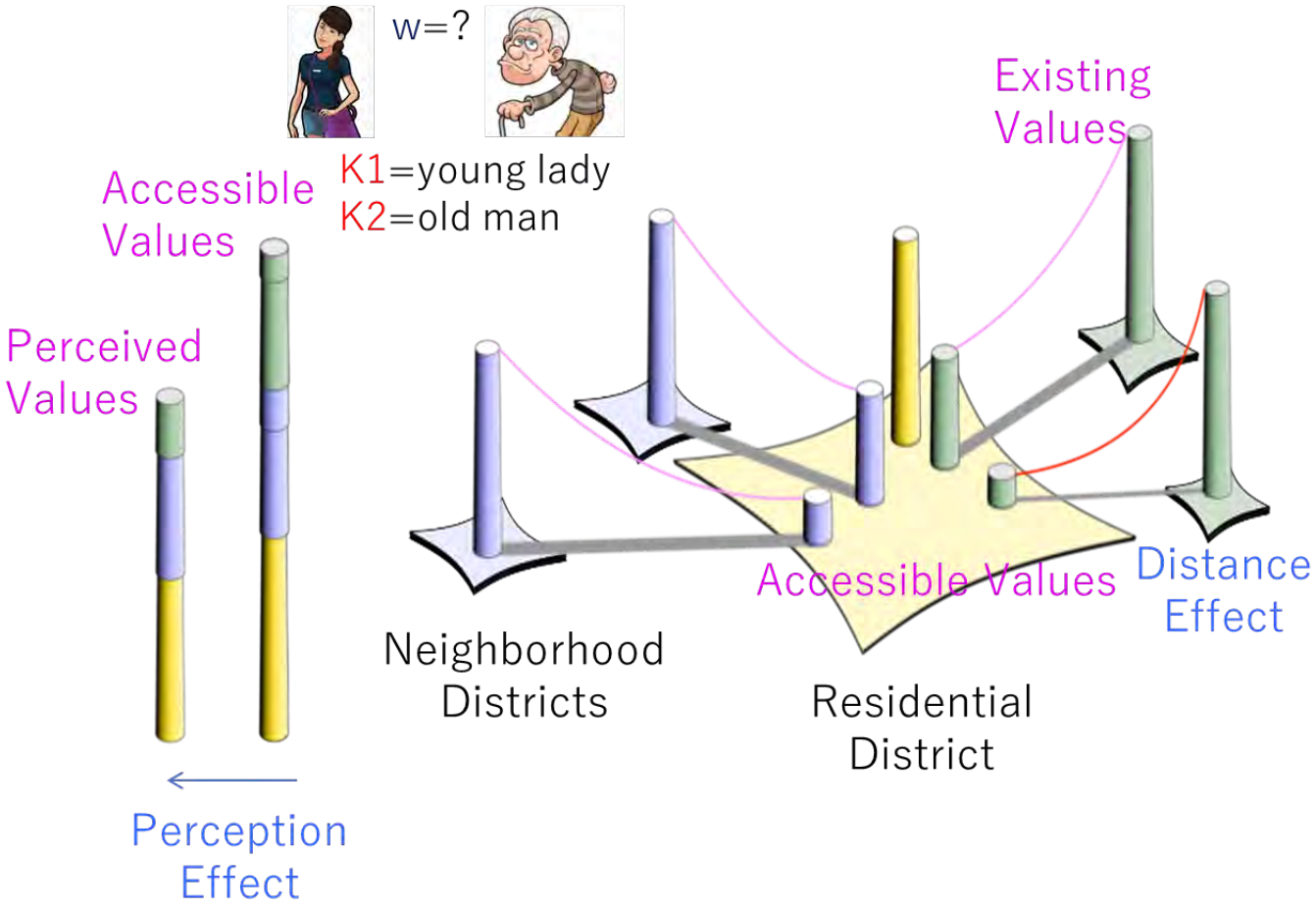
Importance of Shift to EV but The Barriers

- EV shift is important for decarbonization of road transport that shares 50% of world Oil consumption, 170EJ (exajoule=10^{18}J).
- Is EV the best solution?
- EV emit more emission till water, solar, wind electric generations will be dominant → From Well to Wheel Life-cycle Energy management
- 50% more total Electricity Demand if all vehicles are replaced by EV
- Can we build many more electricity generation, power storage and transmission systems?
- Competitor：Electricity demand for Data Center is estimated to be 100% more total electricity in 2030
- Waste of lithium-ion battery contains chemical and nuclear matters

→CO2/km Fuel Efficiency based Regulation + Top Runner System

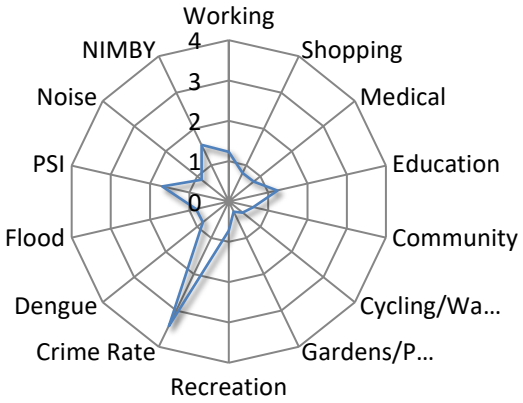
Beyond Carbon Neutral
Well-being for
Resilience and Sustainability

Hayashi's QOL Accessibility Model (Living-QOL)

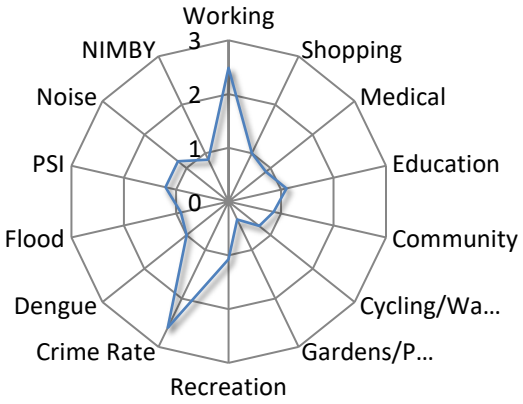


Weights between QOL Factors (Singapore)

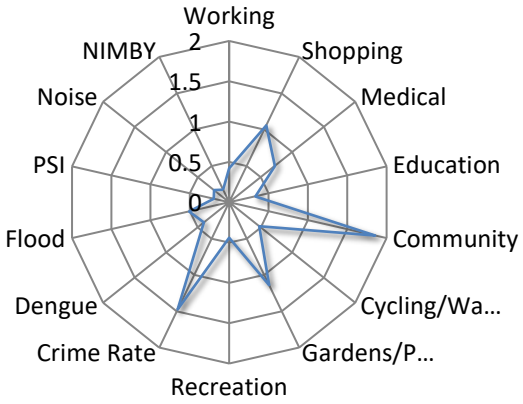
Young / Female



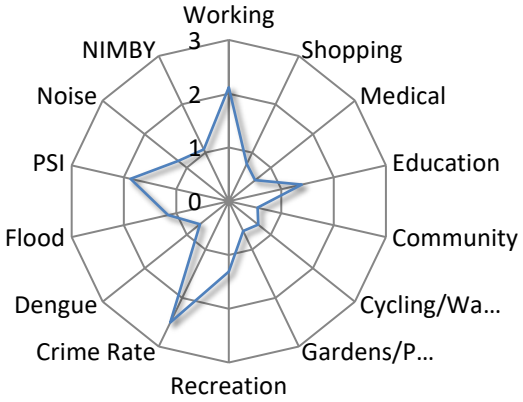
Middle-aged / Female



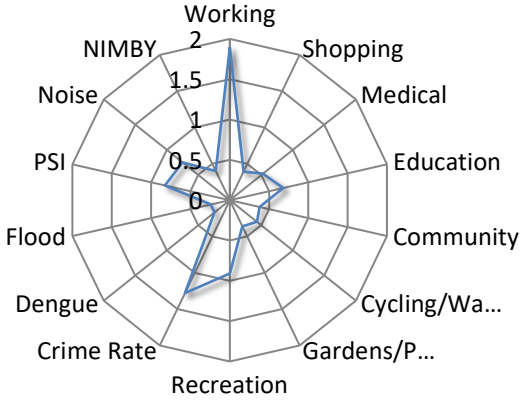
Aged / Female



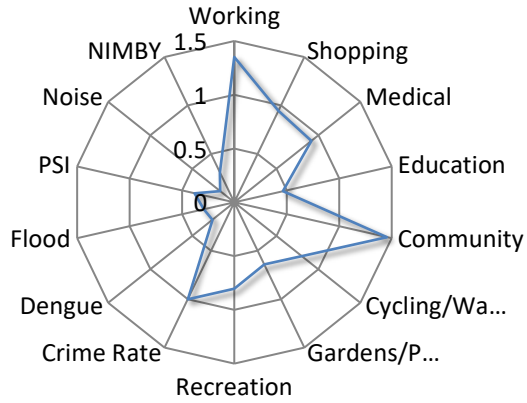
Young / Male



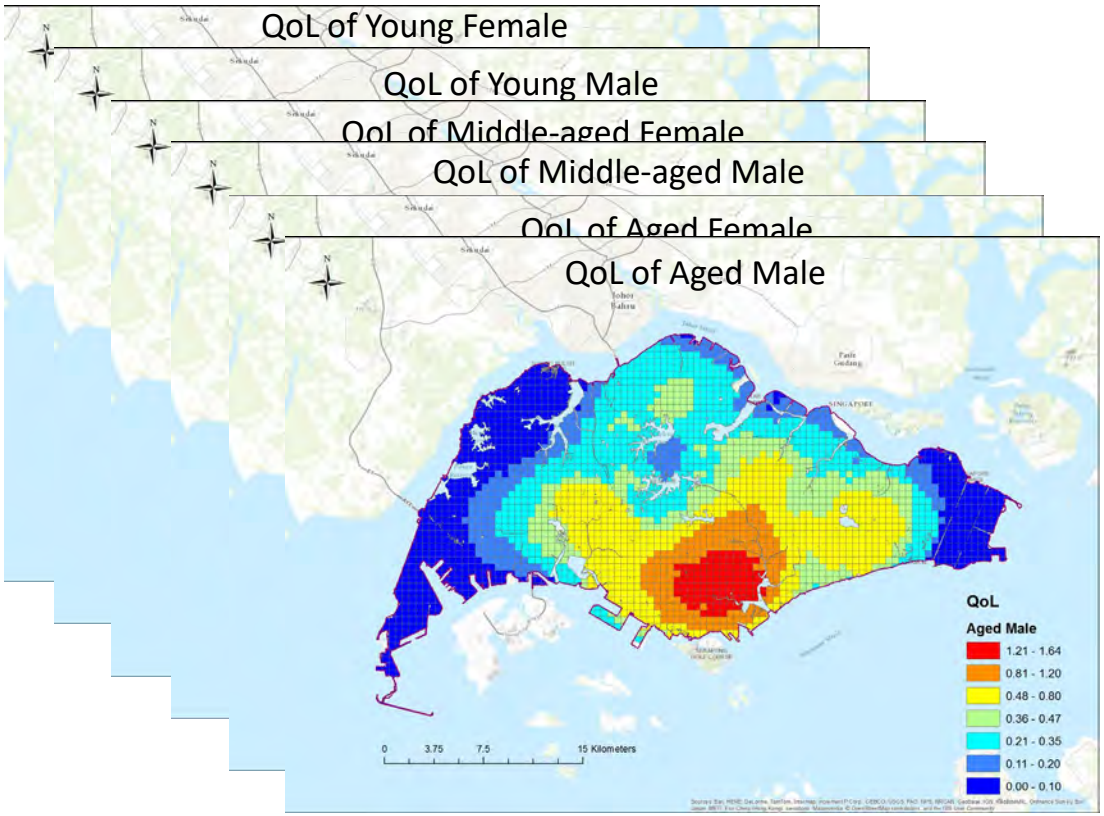
Middle-aged / Male



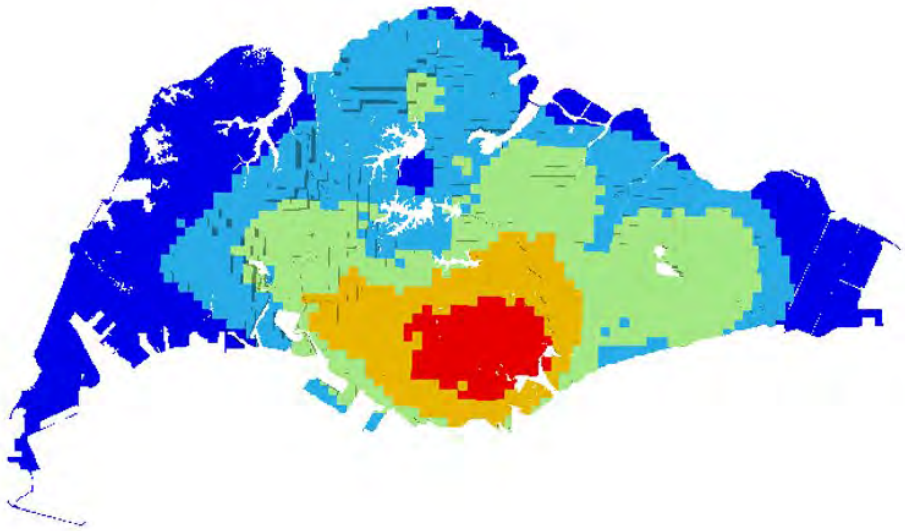
Aged / Male



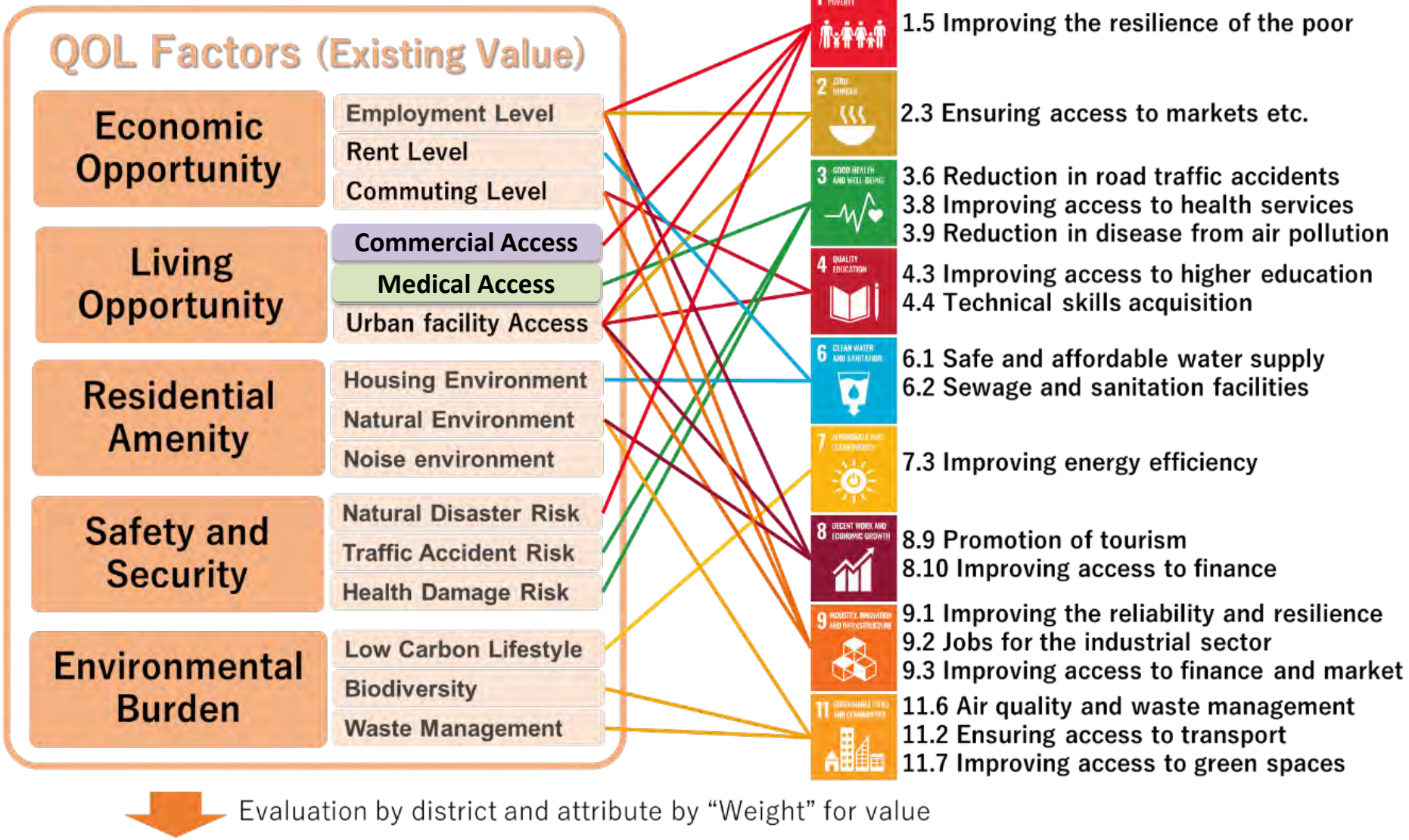
QOL Spatial Distribution in Singapore (by age, gender)



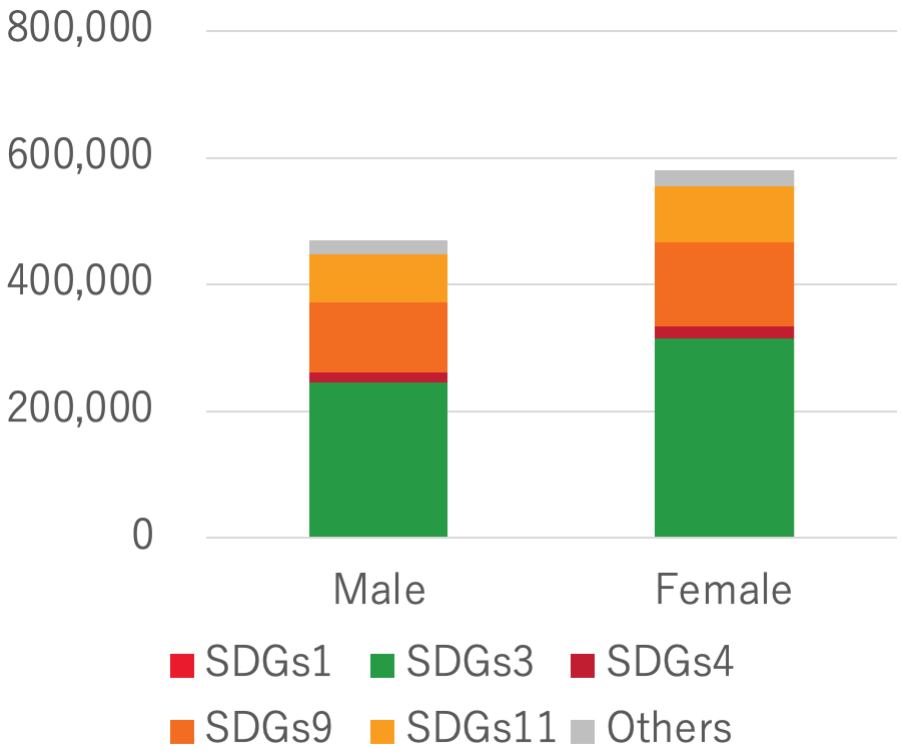
Policy Options
- Transport Network or Compact City –

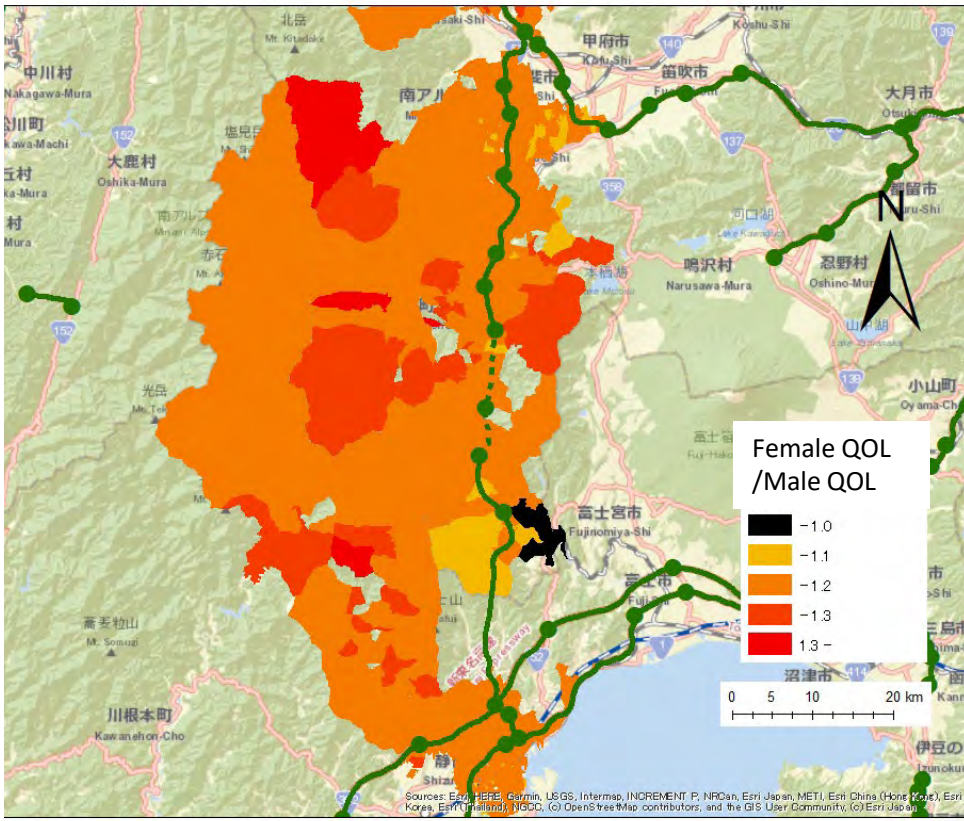


Total Volume = GRH (Gross Regional Happiness)


QOL Factors (Existing Value)
Economic Opportunity
Employment Level
Rent Level
Commuting Level
Living Opportunity
Commercial Access
Medical Access
Urban facility Access
Residential Amenity
Housing Environment
Natural Environment
Noise environment
Safety and Security
Natural Disaster Risk
Traffic Accident Risk
Health Damage Risk
Environmental Burden
Low Carbon Lifestyle
Biodiversity
Waste Management
1.5 Improving the resilience of the poor
2.3 Ensuring access to markets etc.
3.6 Reduction in road traffic accidents
3.8 Improving access to health services
3.9 Reduction in disease from air pollution
4.3 Improving access to higher education
4.4 Technical skills acquisition
6.1 Safe and affordable water supply
6.2 Sewage and sanitation facilities
7.3 Improving energy efficiency
8.9 Promotion of tourism
8.10 Improving access to finance
9.1 Improving the reliability and resilience
9.2 Jobs for the industrial sector
9.3 Improving access to finance and market
11.6 Air quality and waste management
11.2 Ensuring access to transport
11.7 Improving access to green spaces
Evaluation by district and attribute by “Weight” for value
1.4 Improving basic service access
5.1 Eliminating discrimination against women
5.5 Promoting Women’s participation
10.2 Promoting inclusion of all people

QOL Comparison: Female / Male
(Motorway Opening near Mt.Fuji)





Mobility Transformation
- Emergence from 20 Century's Stupid Habits -

20th century Stupid Mobility → for Mass Economy with High Carbon

Fixed time/destination commuting

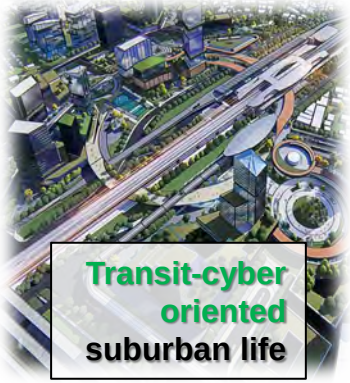
Over **95%** of the time, cars are **parked**

Car-oriented sprawling suburb

Not walkable environment

Flexible workplace/ commuting timing

Cyber-support Sharing and **Hierarchical transport** network



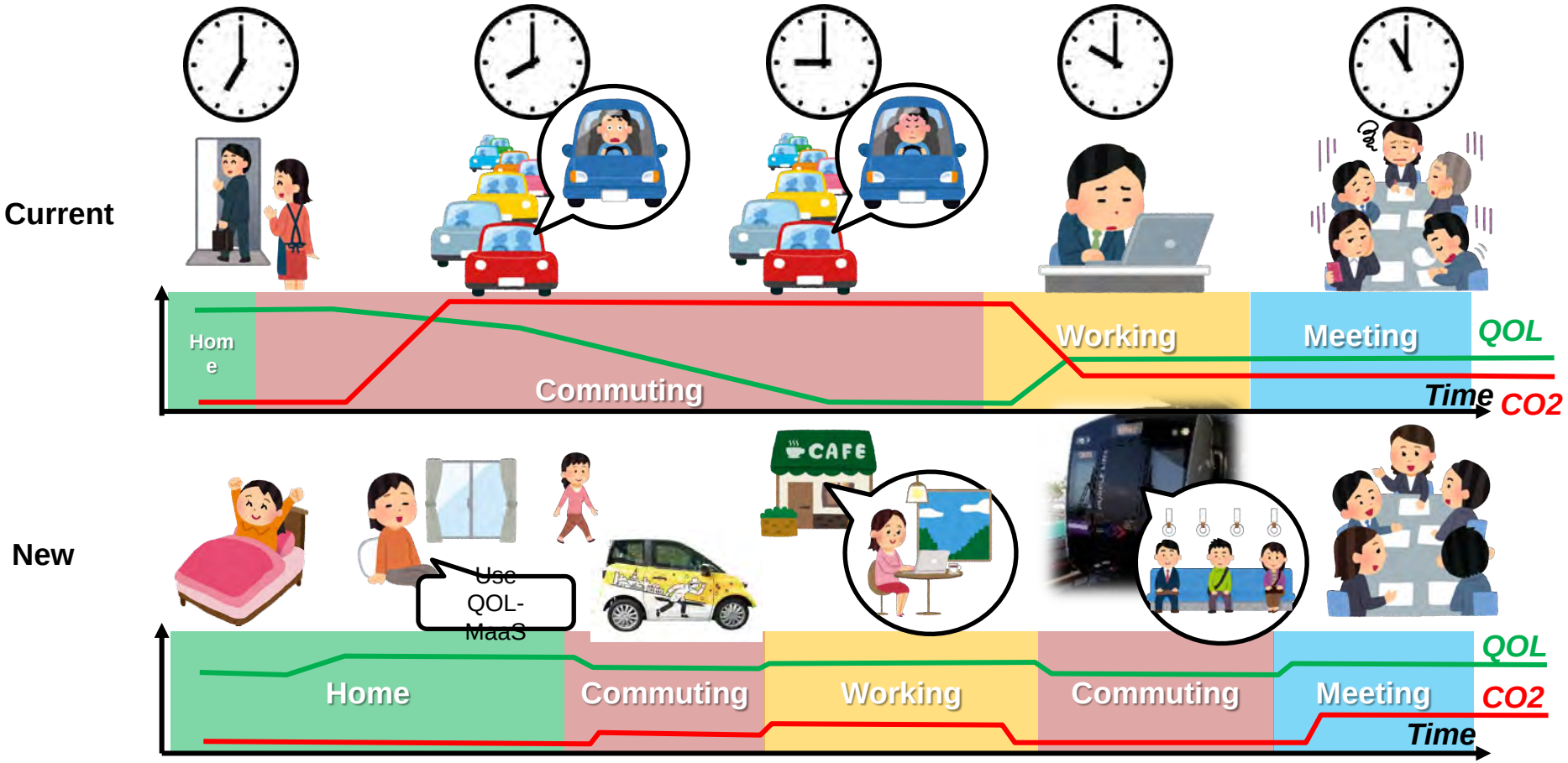
Transit-cyber oriented suburban life

Lively (*Sabai*) street built environment

21st century Smart Mobility → for People with High QOL/Low Carbon

From JICA/JST SATREPS Project 2018-2024"Smart Transport for Thailand 4.0"(Leader: Yoshitsugu Hayashi)

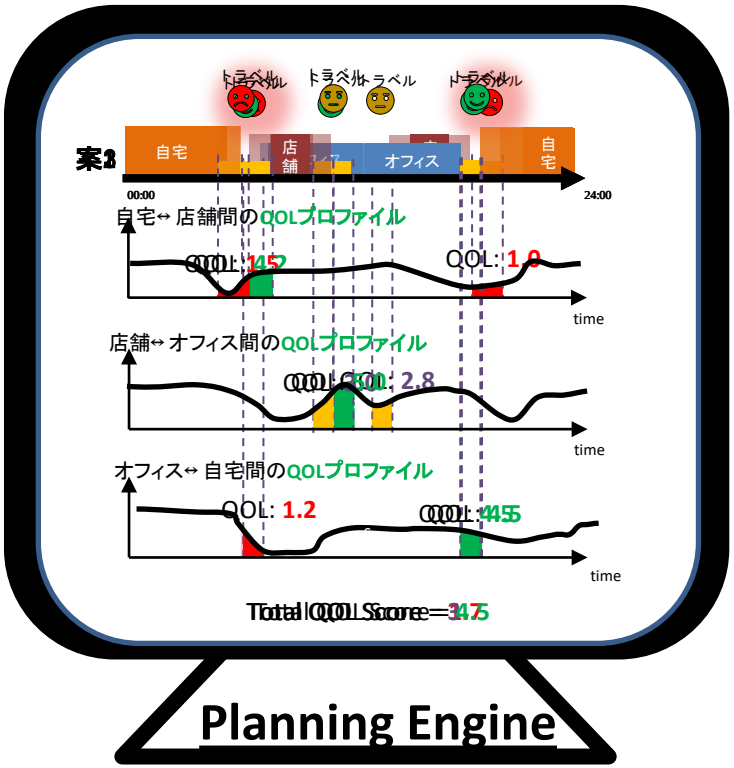
QOL-MaaS:
Work-Life Style Changer for 21st Century



From JICA/JST SATREPS Project 2018-2024"Smart Transport for Thailand 4.0"(Leader: Yoshitsugu Hayashi)

DX → “QOL MaaS”

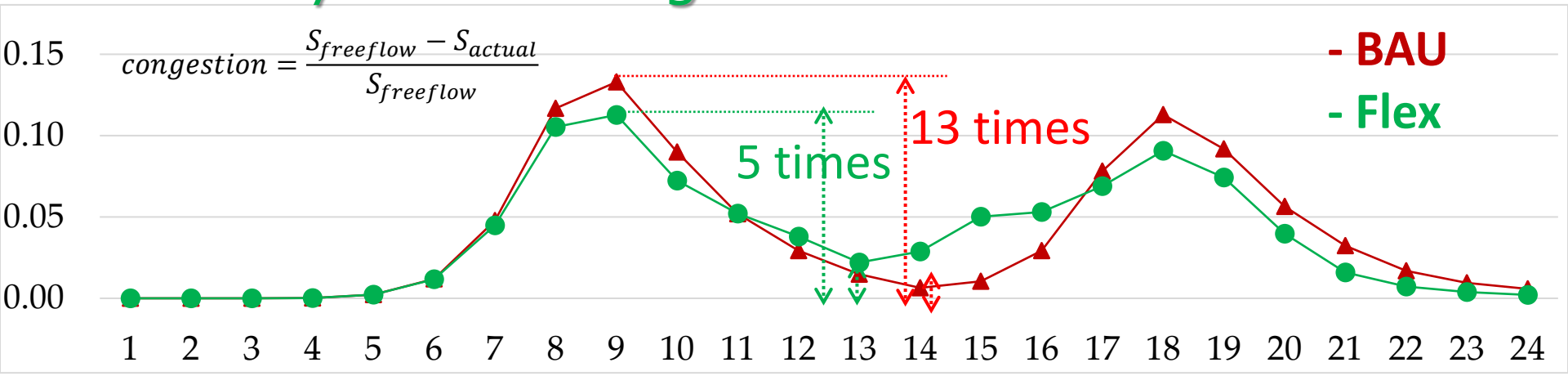
Guiding to QOL-Max Sequence Plan of Activity + Travel



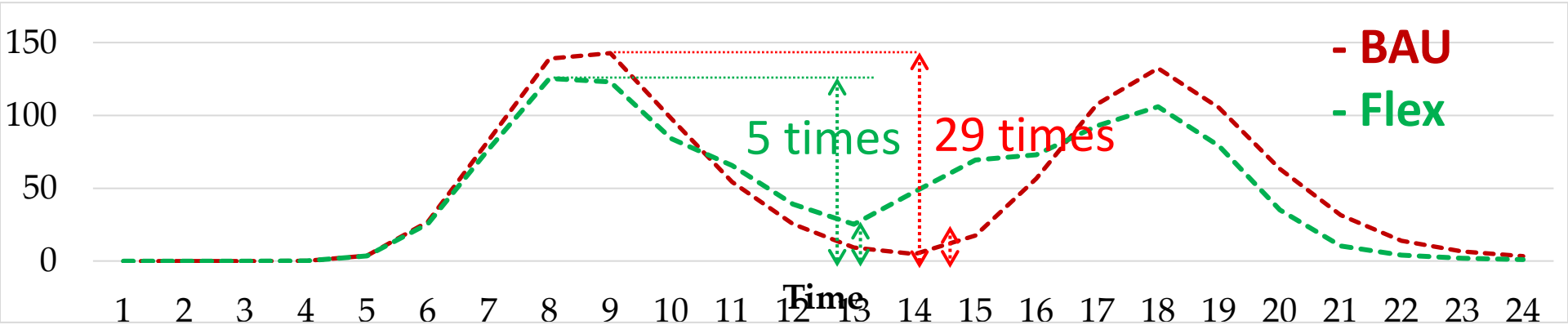
From JICA/JST SATREPS Project 2018-2024“Smart Transport for Thailand 4.0”(CLeader: Yoshitsugu Hayashi)

Effects of Location – Time Shift of Activity & Travel

1. Daily Traffic Congestion

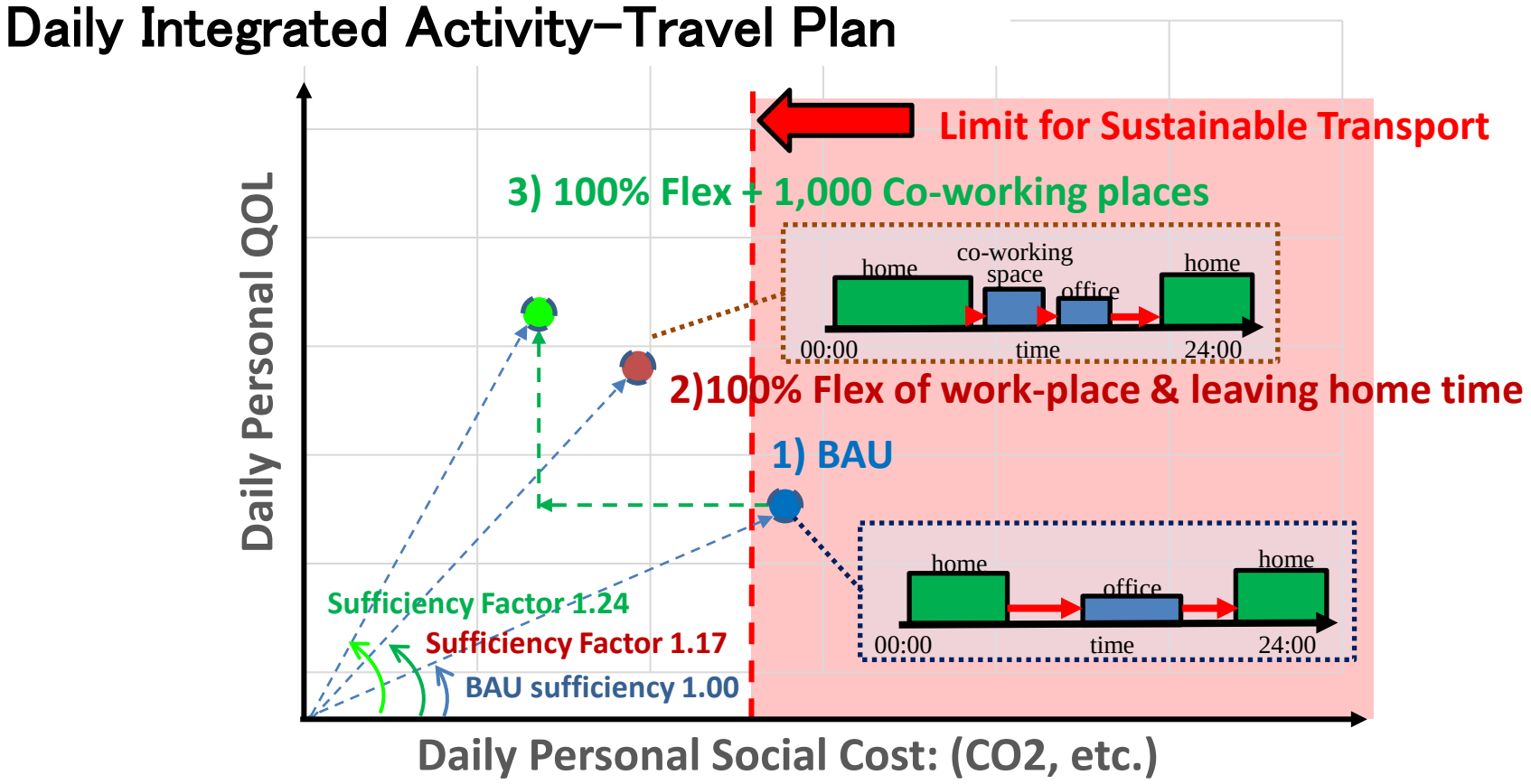


2. Hourly CO2 Emission (ton/ 100,000agents)



From JICA/JST SATREPS Project 2018-2024"Smart Transport for Thailand 4.0"(Leader: Yoshitsugu Hayashi)

"Sufficiency" Factor X



From JICA/JST SATREPS Project 2018-2024"Smart Transport for Thailand 4.0"
(Leader: Yoshitsugu Hayashi)

QOL-MaaS:
Strategy for Mobility-Lifestyle Transformation

- *Solution in Infrastructure → Supply-side*
  - Railway Improvement
  - EV for Cars, FCV for Heavy Duty Trucks, e-Fuel
  - Generation, Power Storage, Charging of Electricity and Hydrogen
- *Solution in Behavior → Demand-side*
  - Flexible Workplace & Commuting Timing
  - "New Normal Lifestyle" in Post COVID-19 Era
  - "QOL-MaaS"
- *QOL*
  - GDP (20th Century) → Personal QOL (21st Century)
  - GDP → GNH (Bhutan)
  - High Carbon → De-Carbon (CO_2)
  - "Efficiency" (GDP/ Direct Cost) → "Sufficiency" (QOL/ CO_2) → SDGs

QOL-MaaS:
Work-Life Style Changer for 21st Century

Wishing EST Asia 2023 in Kuala Lumpur A Great Success

Thank you for your attention !