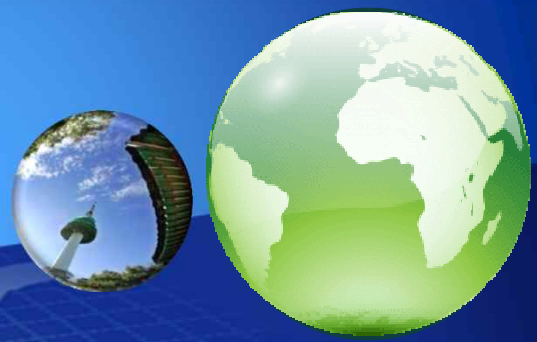
International Symposium on "Realizing Low Carbon Cities in NE Asia"

Sustainable Energy Planning Towards Low Carbon City : The Case of Seoul

2013. 12. 5



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① Ways to the Low Carbon City

Source : Maryke(2013), "Global Climate change and Challenges for metropolises"

Cities ....

Why cities are heading for the Low Carbon City?

100 *largest cities produce* ***30%*** *of global GDP...*

Cover ***1.2%*** *of Earth's surface*

major contributors & vulnerable to impacts

predominant consumer of energy

urban policies leading to global Climate & Green growth agenda

synergies between climate & urban policy

application of cost-effective actions

Integrating climate priorities Into urban policy-making process

Global is Local, Local is Global
(Think Globally, Act Locally)

1 *Megacity like Seoul is larger than every one of the* ***150*** *smallest UN member states*

① Ways to the Low Carbon City

Advantages of sustainable energy action planning

Low Carbon City : "Low-carbon, low-emission or even carbon-neutral cities, are signposts to sustainability and global climate change mitigation". *from ICLEI Global/Low-carbon City*

The Power of Local Act **ities are central in tackling climate change. They are proving grounds for our efforts in ensuring a low carbon future that benefits people and the planet".**

- UN Climate C *nce in W* *from UN* *eneral Ban Ki-Moon*

Improvements in local air quality

New partnerships

Financial saving

Sustainable energy Action planning

Local economic development

New jobs

Transition to Clin[illegible] City in Seoul

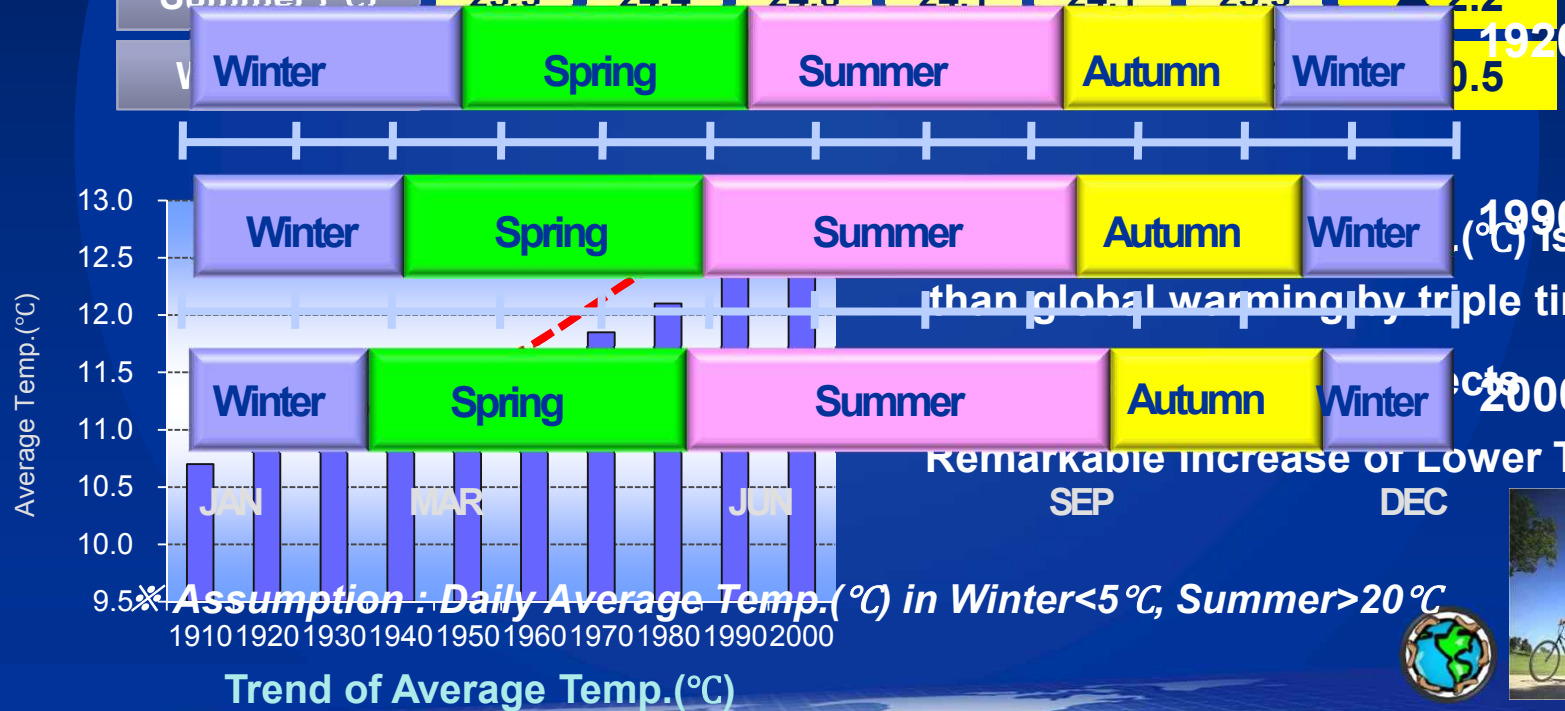
- preparing 'Low Carbon Gr[illegible]an in 2030'
- new movement[illegible]14 by focusing on [illegible]tions of 'energ[illegible]
  saving and effic[illegible]th clean fuel supply

② Conditions of LCC Development

Urban Climate Change (Seasonal Period)

- Days of Winter are shorted by 27 days (1920s vs. 1990s)
- Days of both Spring and Summer are extended

	1908	2005	2009	2010	2011	2012	Diff. (2012-1908)
Yearly Average(℃)	10.4	12.5	12.6	12.1	12.2	12.2	▲2.2
Summer (℃)	23.3	24.4	24.8	24.1	24.1	25.5	▲2.2



.(℃) is faster than global warming by triple times

ects

Remarkable increase of Lower Temp.

※ *Assumption : Daily Average Temp.(℃) in Winter<5℃, Summer>20℃*

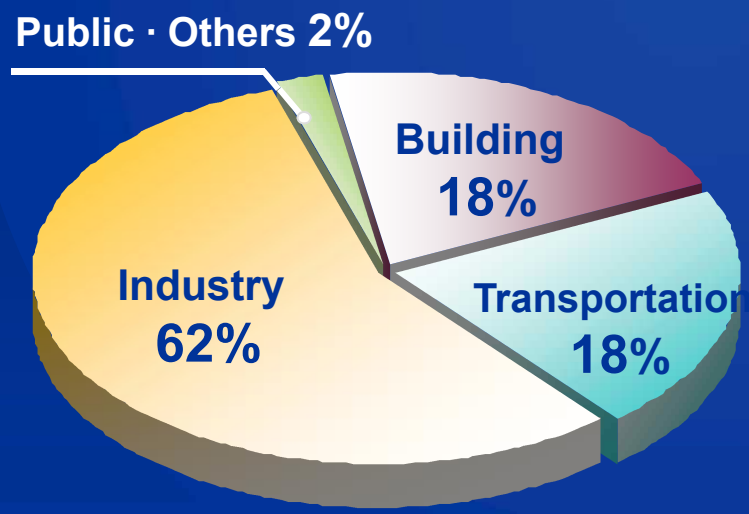
Trend of Average Temp.(℃)

② Conditions of LCC Development

Energy Consumption By Sector (2011)

(unit : thousand toe)

	Building	Transportation	Industry	Public · Others	Total
Korea	37,542	36,875	126,886	4,560	205,863
Seoul	8,664	4,631	1,197	1,004	15,496



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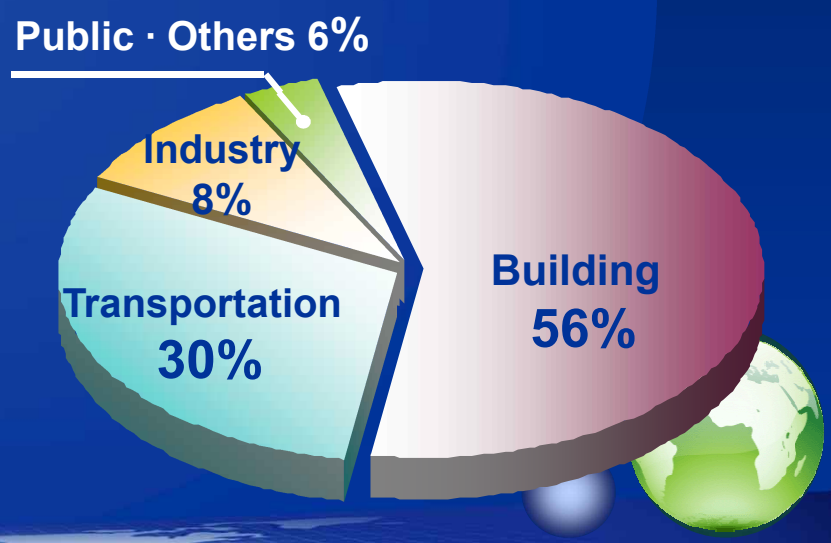


< Seoul >

② Conditions of LCC Development

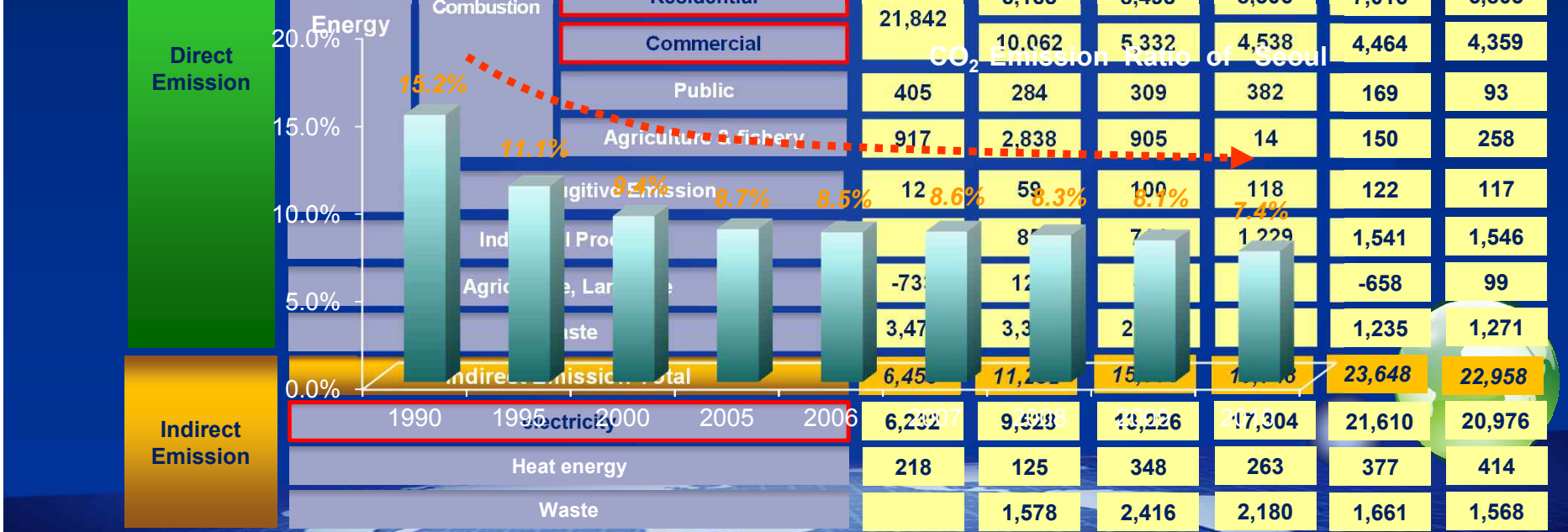
Trend of CO_2 Emissions(Korea, Seoul)

(unit : thousand ton CO_2)

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
Korea	296.1	445.9	512.0	568.8	575.4	590.3	604.1	609.1	668.8	669,008
Seoul	45.0	49.7	48.3	49.5	49.0	50.5	50.4	49.1	49.8	46,051

(unit : MT of CO_2)

		1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
Direct Emission	Fuel Combustion										
	Residential	21,842				6,165	8,493	8,306	7,016	6,803	
	Commercial					10,062	5,332	4,538	4,464	4,359	
	Public	405				284	309	382	169	93	
	Agriculture & fishery	917				2,838	905	14	150	258	
	Fugitive Emission	12				59	100	118	122	117	
	Industrial Process					85	7	1,229	1,541	1,546	
	Agriculture, Land use	-73				12			-658	99	
	Waste	3,47				3,3	2		1,235	1,271	
	Direct Emission Total	6,45				11,2	15	1	23,648	22,958	
Indirect Emission	Electricity	6,232				9,528	13,226	17,304	21,610	20,976	
	Heat energy	218				125	348	263	377	414	
	Waste					1,578	2,416	2,180	1,661	1,568	



③ Sustainable Energy Planning in Seoul

Declaration of Low Carbon & Green Growth

1St. Declaration
2007.4.2.

- 2020 yr. Energy Saving 15% (Ref. 2000 yr.)
  GHG Emission Reduction 25% (Ref. 1990 yr.)
  Renewable Energy Use 10%

Low Carbon Green Growth Paradigm

Low Carbon Green Growth Plan
2009. 7.2

- 2030 yr. Energy Saving 20%
  GHG Emission Reduction 40%
  Renewable Energy Use 20%

③ Sustainable Energy Planning in Seoul

New Movement to Energy Saving & Production

via energy saving & recirculation of resources

World-leading Climate & Environment Capital City, Seoul

- *Goal: Energy Savings of 3Mtoe by 2014*

Low Rati… Pow…
(Sharp Increasing of Electricity Demand)

Fukushima
(Spread of Safety Problem)

mi… ang…
(Intensified Urban Climate Change)

Climate & Environment Governance

Sustainable Energy

eq. to 1 Nuclear Power Plant

Energy Saving & Production eq. to 1 Nuclear Power Plant

Top-runner in resources recycling

Healthy & comfortable Living Environment

Promotion of Green Industry & Creation of Green Jobs

- *Production of Renewable Energy : 0.3Mtoe*
- *Energy Efficiency : 0.8Mtoe*
- *Citizen Participation : 0.9Mtoe by 2014*
- *Capacity Building*

③ Sustainable Energy Planning in Seoul

New Movement to Energy Saving & Production

3 Citizen Participation

- Citizen's Campaign for Energy-Savings eq. to One nuclear power Plant generation
- Public Promotion and education for tailored energy savings
  - School education
  - Training green leaders(Students and Housewives)
- Establishment of "Seoul Energy Complex Information Center" for energy demand management
- Use of waste heat from incineration, power generation from neighboring local governments

4 Capacity Building

- Energy-efficient Building
  - Rooftop of public building and school
  - FIT subsidy & Financial loan to private buildings (Apt., Commercial Buildings)
  - Production of "Sage Eat energy for district heating
- Energy-efficient Building
  - Application of more stringent RPS
  - BRP 10 thousands detached houses(~2014)
  - BRP 221 large-scale buildings(~2014)
- Enforcing "energy diagnosis" to private sector(Building with 2,000 TOE/year to 1,000 TOE/year)
- Low Carbon green campus : 30 units(~2014)
- Upgrading total building energy use management
- Recommendation of guidelines to standardized building energy use
- Pilot model of school, community, subway station to save energy eq. to One nuclear power Plant generation
- Energy-efficient Transportation
  - Introduction of Car-Sharing
- Lighting Energy Efficiency
  - LED lighting to public facilities : Underground Subway & Shopping area
  - LED lighting subsidy to private sector

④ Steps to Sustainable Energy Planning

Local Government's Initiatives ?_common Questions

1. What is the major source of GHG emissions in your city?
2. What is the projected growth of total GHG emissions by sector and modes of energy consumption?
3. How sensitive is the urban climate change issue in your city and what are the implementing strategies in major source of energy consumption?
4. Currently implemented and planned measures to reduce emissions from sources. Priorities and future strategies
5. What are positive trends or good practice examples in your city?

④ Steps to Sustainable Energy Planning

Inventory is the first step in energy planning

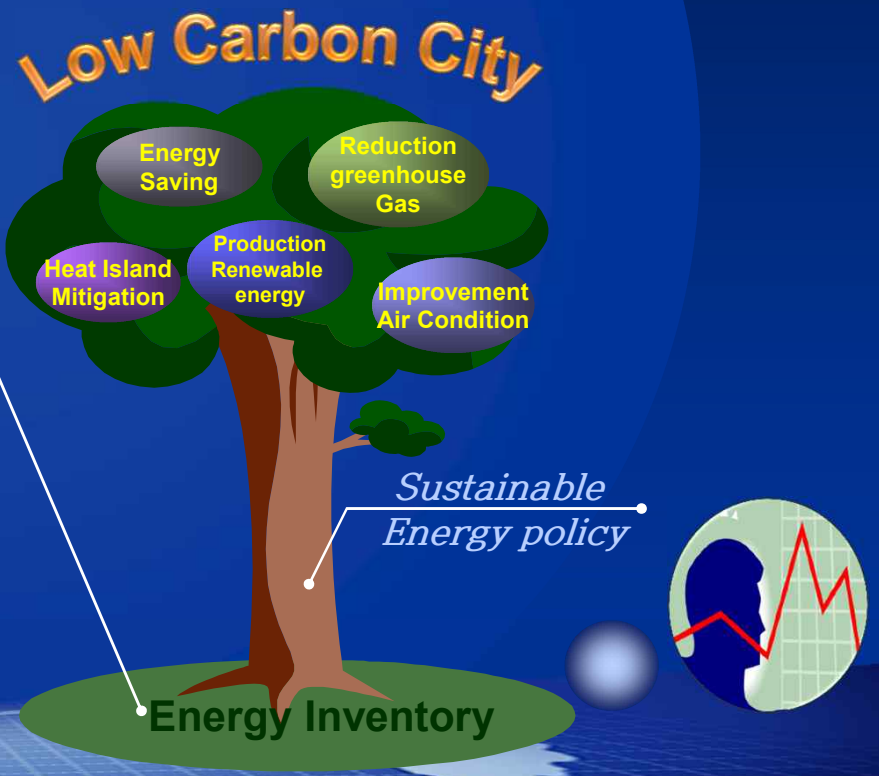
- **Sustainable energy policy supporting system is referred by inventories.**
- **Requirements: Energy Census Survey**

Fianl Energy Consumption by Sector

(unit : 1,000to

	Industry	Tranportation	Redidential / Commercial	Public & Other	Total
2000	1,791	5,734	8,241	684	16,450
2001	2,283	4,547	8,114	457	15,401
2002	1,467	4,802	8,264	473	15,006
2003	1,336	4,612	8,350	448	14,746
2004	1,586	4,625	8,385	466	15,062
2005	1,527	4,292	8,777	587	15,183
2006	1,512	4,674	8,847	552	15,585
2007	1,551	4,870	8,829	758	16,008
2008	1,380	4,942	8,493	666	15,481
2009	1,044	4,857	8,380	747	15,028

- *Primary Energy Production*
- *Primary Energy Consumption by Source*
- *Primary Energy Consumption*
- *Final Energy Consumption*
- *Final Energy Consumption by Sector*
- *Coal Consumption*
- *Petroleum Products Consumption by Sector*



④ Steps to Sustainable Energy Planning

E^2 Management _combinations of instruments

Planning instruments that include measures on urban land use and infrastructure changes,

- e.g. Reduction of travel distances and increased use of public transport

Regulatory instruments that include norms, rules or standards to influence behavior of individuals and corporate entities

- e.g. defining allowable levels of emissions, quality of fuel

Economic instruments, such as taxes, fees, and markets

Informational instruments that can increase the public awareness of alternative modes

- e.g. changing of peoples' travel behavior, encouraging the use of public transport, minimizing the length and frequency of trips and improving driver behavior

Technological instruments that can reduce the emissions from motorized transport

- e.g. provision of cleaner fuels and improving vehicle efficiency.

④ Steps to Sustainable Energy Planning

Instruments for Energy Planning

- Planning instruments
- Regulatory instruments
- Economic & informational instruments
- Technological instruments

Infrastructure(hydrogen station, charging points, etc) for Green Cars

Citizen's voluntary [illegible] to follow energy(electricity, gas, water) saving action program

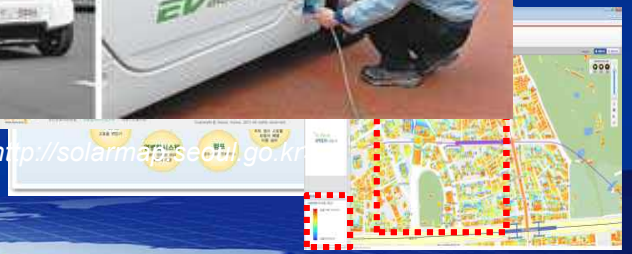
<http://ecomileage.seoul.go.kr>

<Sangamdong Hydrogen station >

Hydrogen fuel cell Energy-saving Eco-friendly

practical information and steps for installing solar

<http://solarmap.seoul.go.kr>



④ Steps to Sustainable Energy Planning

E^2 Management in Transportation Sector _key principles

"Avoid – Shift – Improve" approach

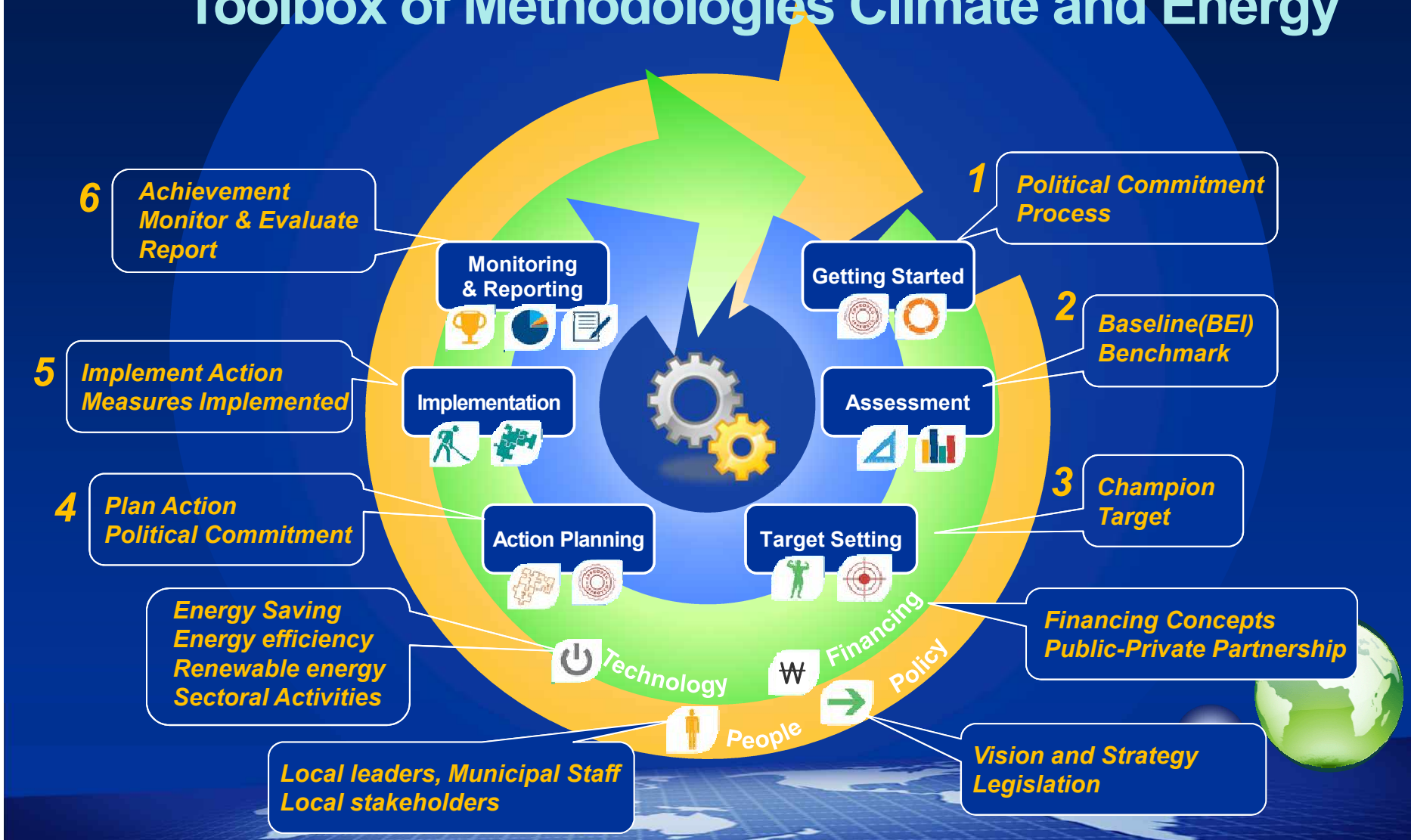
Avoid *(i.e., avoid travel or avoid travel by motorized modes)*

Shift *(i.e., shift to more environmentally friendly modes*

Improve *(i.e., vehicle technology improvements, fuel technology improvements, including alternative fuels)*

④ Steps to Sustainable Energy Planning

Toolbox of Methodologies Climate and Energy



④ Steps to Sustainable Energy Planning

GHGs Reducing Calculation Tool

Seoul GHGs•Energy Assement Tool

GHGs•Energy Inventory

- GHGs Emission Inventories with BAU Forecasts
- Energy statistics

Reduction Project classification system

sector | Reduction Project | Inventory

분야	사업	단위사업	온실가스인벤토리
신재생에너지 생산확대	태양광 시민햇빛발전소 건설	태양광 시민햇빛발전소 설치, 나눔발전소 건립, 햇빛지도 제작, 에너지 자립마을 조성	에너지 공급
	수소연료전지등활용주요사업에너지자립확대	분산형 전력시스템 확보, 자능형 전력 수요관리, 소수력 발전소 건립, 운동시설 친환경에너지 발전시스템 도입	
	버려지는열에너지활용지역난방공급확대	하수열 이용 지역난방 공급, 소각폐열, 발전폐열 활동, 자원회수시설 소각열 증산, 바이오가스 활용 열병합 발전, 바이오에너지 생산, 마곡지구 집단에너지 공급시설	
	신축건물신재생에너지생산확대	신재생에너지 의무비율 강화	
건물부문 에너지 효율화	신축건물에너지절약에등설계기준강화	대형건물 에너지소비 총량제, 중소형건물 에너지절약 설계기준 강화, 친환경 에너지 저소비형 건물 인센티브 지원	가정,상업,공공
	건물에너지효율개선사업확대	중대형 건물, 단독, 공공임대주택 , 사회복지시설 BRP 추진 그린캠퍼스, 에코스쿨 프로젝트	
	건물에너지진단및우수건물인증확대	에너지진단 의무화, 에너지 진단, 친환경건축물 인증확대 등	
	LED보급의확대확대	공공, 민간 LED 보급 확대, 간판, 보안등, 가로등 고효율원으로 교체	
친환경 고효율 수소시스템 구축	카쉐어링사업확산	카쉐어링 도입	수송
	승용차이용억제	대형건물 승용차요일제 가입, 차없는 거리, 도심 차량운행 억제 추진	
	대중교통이용활성화를위한인프라지속개선	중앙버스 전용차로 확충, 대중교통 환승시설, 자전거 이용 활성화	
	친환경운전문화확산	공회전 제한지역, 친환경운전장치 보급, 시내버스 운행효율 개선 등	

Reduction Action plan

- Low carbon Green Growth master plan
- Energy Saving & Production eq. to 1 Nuclear Power Plant

Quantitative criteria | *Qualitative Criteria*

Reduction effect Assessment

- Yearly calculation of GHGs & Energy reduction
- Reduction ration to Target year(%)

Total Reduction Management | Sectoral Reduction Management

NO | Yes

Seoul GHGs·Energy Reduction Target achievement

④ Steps to Sustainable Energy Planning

GHGs Reducing Calculation Sheet

Energy Production Sector

1. Sunlight generation(Solar PV)

Unit Requirement	Energy saving	0.28	TOE/kW
	GHGs Reduction	1.47	tCO_2/kW
Plan	Projects/Measures	2,550	kW
Effects	Energy saving	725.85	TOE
	GHGs Reduction	3,748.5	tCO_2

Generating Day	*365*	*day*
Generating Time	*24*	*time*
Generating efficiency	*15.4*	*%*
Electricity Ton of Oil Equivalent	*0.000211*	*TOE*
Electricity CO_2 Emission factor	*0.443*	*Kg/kWh*
Electricity CO_2 Emission factor	*5.15*	*tCO_2/TOE*

Energy Efficiency Sector

12. LED light supply

1) Public sector

Unit Requirement	Energy saving	0.010	TOE/unit
	GHGs Reduction	0.054	tCO_2/unit
Plan	Projects/Measures	10,000	unit
Effects	Energy saving	104.98	TOE
	GHGs Reduction	540.8	tCO_2

Fluorescent light Electricity Consumption	*66*	*W*
LED light Electricity Consumption	*40*	*W*
Lighting time		*time/day*
Lighting day		*day*
Electricity Ton of Oil Equivalent	*0.000086*	*TOE*
Electricity CO_2 Emission factor	*0.443*	*Kg/kWh*
Electricity CO_2 Emission factor	*5.15*	*tCO_2/TOE*

⑤ Concluding Remarks

Virtuous Circle Design for Energy Management

- **Incomplete Process for Energy Management**
  - Step 4 is sufficient ?
  - What's next step ?
  - Where are we going to ?

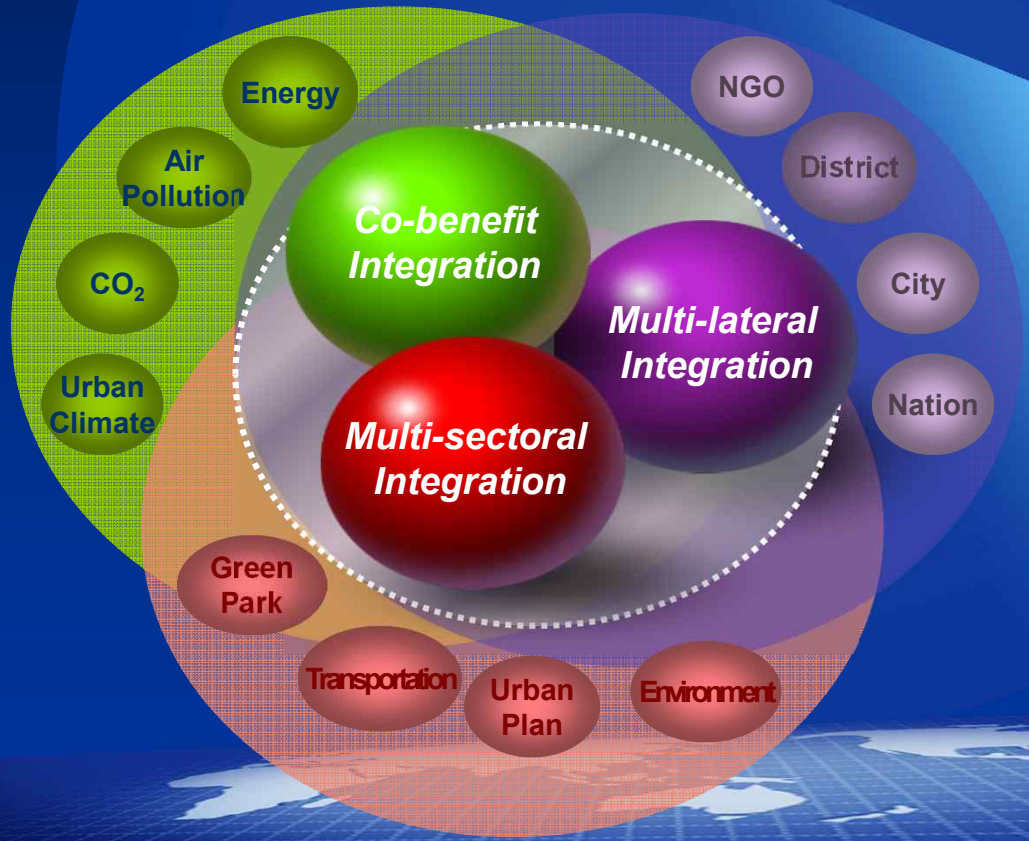
"More Solid, Substantial Energy Plan To Be Guaranteed"

- **Establishment of Monitoring System**
- **Performance Measurement**

⑤ Concluding Remarks

Adoption of Integrated Management System

- Elements of sustainable energy planning: energy, air pollution, CO_2, etc.
- Multi-sectoral/lateral approach is more efficient for co-benefit



Integrated Management System

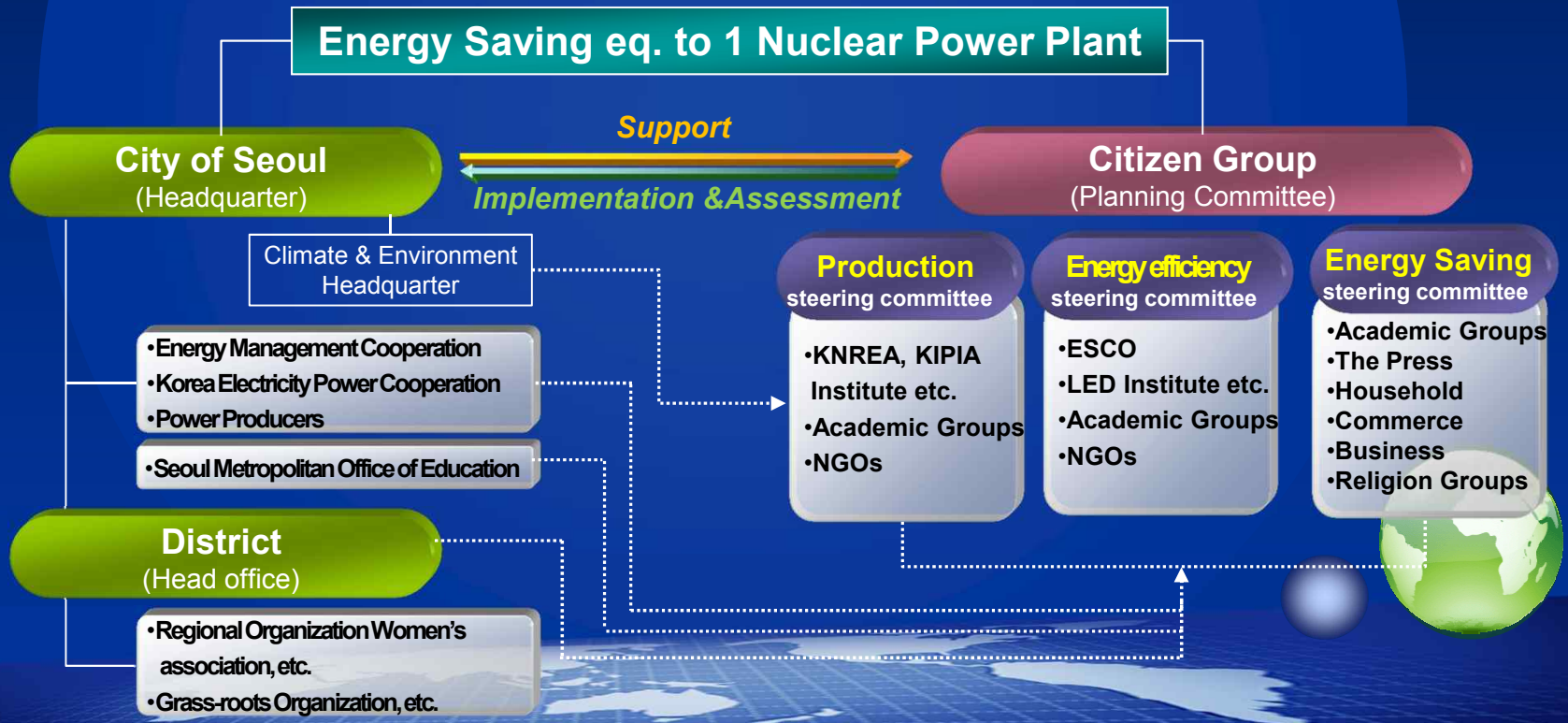
(+ Institution Integration)

⑤ Concluding Remarks

Governance is the best policy in energy planning

- Low carbon society is expected through participation & collaboration.
- Requirements: enforcement and incentives

<Schematic Diagram of Citizen Governance System>



⑤ Concluding Remarks

Energy Welfare for Better Low Carbon Society

- **Sustainable energy planning be considered efficiency and equity.**
- **Requirements : elimination of possible blind spot for poor class**

Program to Improve Energy Efficiency for Low-Income Families

Program to Provide Emergency Support for Heating Fuel in Winter

Program to Support Payment of Defaulted Power Bills for families whose Power Service is Suspended

Energy Welfare

- *Low-Income Groups*
- *A person of merit*
- *Social facility*

energy welfare

Thank you for Attention

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