- For Implementation of Infrastructure as a Metropolitan City -

Changwon Action Plan on Climate Change

Changwon City

(Environment and Parks Bureau)

Contents

- For Implementation of Infrastructure as a Metropolitan City -

Changwon Action Plan on Climate Change

Ⅰ. Domestic and International Trends and Conditions

1. International Trends on Climate Change

□ UN Resolution: Visualization of a new climate system

❍ International societies have been continuously endeavoring to cope with climate change with the adoption of the Kyoto Protocol (1997) as the impetus.

∘ However, since only some advanced countries (Annex Ⅰ, 38 countries) share the obligations to reduce greenhouse, action against climate change is limited by increasing emissions of greenhouse gases in developing countries.

※ During the 1st commitment period (2008~2012) of the Kyoto Protocol, advanced countries reduced emissions by about 5.2% compared to 1990. However, emissions increased by 171% in developing countries (133% up in Korea).

❍ The UN Climate Change Conference in Durban (Nov. 2011) agreed on the launch of a new climate system beginning in 2020, when all countries throughout the world will need to participate in the effort to reduce greenhouse gases.

∘ Agreement on the basic requirements and INDCs, the core of the new climate system, within 3 years since the commencement of negotiations in early 2012 (Lima Call for Climate Action in Dec. 2014)

<Outline of the Lima Call for Climate Action (Dec. 2014)>

① (Submission of INDCs) All countries in the world including advanced and developing countries need to must submit INDC (Intended Nationally Determined Contribution) until by the end of Sep. 2015 (March 2015 for the those countries already ready for INDCs)

② (Principles of Contribution) To advance beyond the existing pledge (“prevention of setback”), to be fair and ambitious in light of individual national circumstances and to clarify how it contributes toward achieving the objective of the Convention.

③ (Determination of main elements of the new international climate agreement as the

element paper.

- Opening of the new climate age with all countries participating in the effort by 2020 after UN Climate Change Conference in Paris (Dec. 2015).

□ Preparation and Submission by Country

❍ (Time for Submission) Most advanced countries (including the EU, USA and Japan) and leading developing countries (including China and India) will submit their INDCs within the first half of this year (June).

- The EU (28 countries, March 6) and Switzerland (Feb. 27) have already submitted their INDCs. Other major countries have been preparing their INDCs.

	By the first quarter	By June	Since July
Countries	About 30 countries (Already submitted) EU (28), Switzerland (to be submitted), USA, Norway, Mexico, South Africa	About 20 countries (Advanced countries) including Japan, Australia, Canada and New Zealand. (Developing Countries) Including China, India and Chile	About 140 countries Including Korea …

❍ (INDC Level) Major advanced countries including the EU submitted ambitious INDCs in consideration of the Lima Call for Climate Action (Dec. 2014)

- The EU and Switzerland aim to reduce emissions by 40% and 50%, respectively, by 2030 (over the emissions in 1990).

	INDC Level
EU, Switzerland	EU by 40% (over 1990) and Switzerland by 50% (over 1990) by 2030
USA	Backcasting of INDC goal (80% reduction over 2005) by 2050. Preparation for INDC goal to 26~28% (over 2005) by 2025.
China	Preparation for INDC goal in consideration of the declaration of the Carbon Peak System by around 2030.

❍ (INDC Goal Setting Approach) Goal setting approaches are classified into Quantified absolute target, Won unit and BAU (deviation from Business-As-Usual). Concerns about the uncertainty of the BAU approach have been recently raised around advanced countries.

- (Major Economics Forum in July 2014) Major advanced countries (including the USA and France) raised concerns regarding the transparency of BAU. In particular, some countries (including Japan and Australia) insisted on the submission of

absolute reduction goals.

※ The USA proposed changes in the BAU to Korea during the 1st Korea and America Talks on Climate Change (Jan. 2014).

∘ (IPCC AR5 in April 2014) Greenhouse gas reductions based on absolute amount were recommended to developing countries.

❍ (Contents of INDCs) The goals need to be classified into “Reduction Goals” and “Reduction Goals+α(including implementation)”

∘ (Advanced Countries) The EU and USA proposed only reduction goals due to the concern about responsibility and damage compensation.

∘ (Developing Countries) China, Mexico and South Africa included reduction goals and adaptation.

❍ Climate Action Plans of Major Countries

- Japan: Installation of global warming relief headquarters and the advisory council comprising experts by field and related parties in various fields.
- USA: Implementation of an action system around a climate change working group and President Obama’s pledge for dynamic efforts to reduce greenhouse gas emissions.
- Canada: Establishment of national climate change action, national implementation strategy related to climate change and climate action plan.
- Australia: Announcement of the national climate action plan and installation of Australian Greenhouse Office, the world’s first independent administrative office exclusively for climate change policy.
- UK: Establishment of UK Climate Change Program and national action plan under the control of the Department of the Environment, Food and Rural Affairs.
- Mexico: Establishment of a national action plan by the Inter-Ministerial Climate Change Commission and implementation of the plan by the National Institute of Ecology under the Ministry of the Environment and Natural Resources.

- China: Coordination and establishment of policies and approaches related to climate change by the National Coordination Committee on Climate Change under the control of the State Council for coping with the UN Framework Convention on Climate Change.

2. Preparations and Issues in Korea

□ (Preparations in Korea) Goal Setting Phase II in progress by organization of the inter-ministerial 「Climate Action TF」 (presided over by the Second Vice Minister of Government Policy) and joint task force (April 2014~).

❍ The joint task force performs the actual analysis (including estimates on emissions and analysis of potential) and the Climate Action TF manages the operations including coordination of different views and checking of schedule.

❍ INDCs need to be submitted before the end of Sept. in consideration of the UN resolution and the trends in international society.

❍ Prerequisites including GDP were established and the estimate on emission (Phase II) is in progress.

□ (Issues) The preparation schedule has been postponed. It is estimated that there may be different views regarding the INDC level and goal setting approach in the future. Thus, there is the concern about whether it will be possible to comply with the submission deadline of the INDCs.

❍ International society expected Korea to submit its INDCs earlier (no later than the first half of this year). The submission plan is behind schedule due to the implementation of relevant systems and change of conditions.

∘ The INDC schedule was adjusted due to a re-examination of the BAU, the emission trading system (about 20 presentations) (Sept.).

∘ Substantial time lapsed due to low oil prices and a reflection of the latest data. Thus, it is difficult to adhere to the submission deadline.

※ Further tasks (“estimate on emission”, “potential to reduce”) may have more

potential conflicts and may require substantial time.

❍ There may be different views regarding the INDC level and goal setting approach.

- The industry prefers an INDC level and goal setting approach that can minimize the impact on Korean industry.
- Civil society insists on the prospective INDC level and absolute level.

	Industry	Civil Society
INDC Level	INDC level minimizing the impact on domestic industry	Prospective INDC level in consideration of domestic impact and evaluation by international society
Goal Setting Approach	Emission estimate (BAU) enabling the adjustment of the INDC level is preferred (2009)	Absolute level (over the base year) is preferred to secure transparency (certainty) and enhance national position

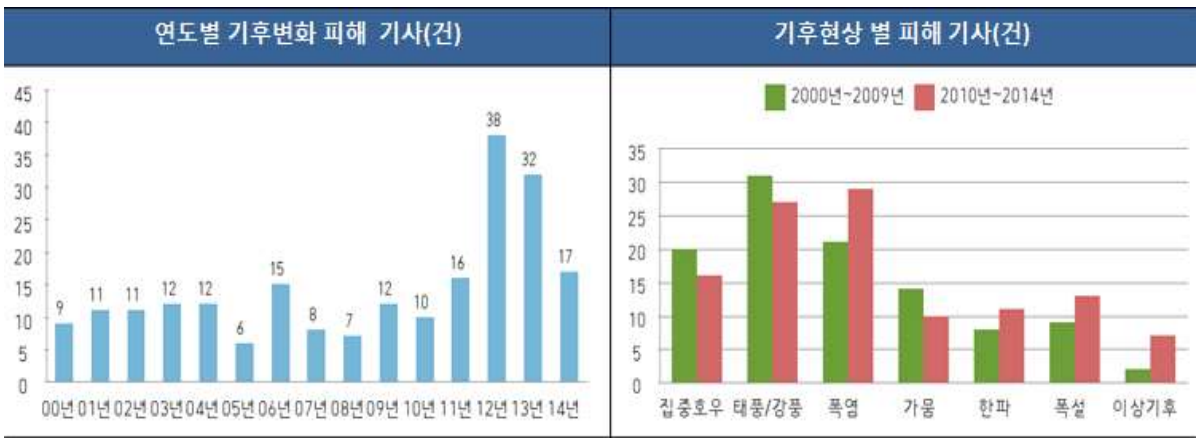
❍ The Korean government determined the voluntary and independent reduction goal of the emissions estimate (BAU) to 30% by 2020 as the first country among non-mandatory reduction countries in Nov. 2009 and implemented the system to faithfully carry out the goal after listing the voluntary reduction activity on the register of the UNFCCC Secretariat in the UN Climate Summit.

3. Climate in Changwon

□ Analysis on the Frequency of Media Reports

❍ Annual damage by climate change: 105 articles on damage from climate change for 10 years from 2000 to 2009, and 111 articles for 5 years from 2010 to 2014. The facts indicate a significant increase in damage from climate change.

❍ Damage from climate condition: 58 reports on damage by strong wind/typhoon, 50 reports on damage from heat waves, 34 reports on damage from heavy rains and 24 reports on damage from drought. Reports on damages from heat wave have been substantially increasing over the past 5 years.



Reports on Damages from Climate Conditions per year (No. of Reports)		Reports on Damages from Climate Conditions (No. of Reports)	
2000, 2001, 2002, 2003, 2004…..2014		2000~2009	
2010~2014		Heavy Rain	
Typhoon/Strong Wind		Heat Wave	
Drought		Cold Wave	
Heavy Snow		Abnormal Climate	

□ Analysis on the Yearbook of Damages

❍ Damage by climate change per year: 38 natural disasters (2.7 cases in average) from 2000 to 2013. Biggest damage by typhoon Maemi in 2003.

❍ Damage per Cause: The number of occurrences and damages by typhoons and heavy rains accounted for the highest ratio.

연도별 자연재해 피해 발생 건수 및 피해액

원인별 피해현황

구분		태풍	호우	강풍/풍랑	대설/폭풍설
발생 횟수		15	18	5	2
피해 규모	이재민(명)	6,829	871	0	0
	인명피해(명)	83	5	0	0
	건물(동)	110.58	463	0	0
	선박(척)	1,198	2	0	0
	농경지(ha)	7.59	1.96	0	0
	사방(개소/ha)	14/12.01	28/7.79	0	0
	비닐하우스(ha)	106.0	0.85	0.3	0
피해액 (백만원)	건물	10,614.5	1,279.5	0	0
	선박	3,785.2	52.2	0	0
	농경지	93.2	189.5	0	0
	공공시설	195503.8	36,568.0	50.0	0
	사유시설	130202.3	313.0	97.4	0
	합계	348,452.6	38,402.2	147.4	0

No. of occurrences and damages by natural disasters per year		Damages per Cause	
(Million KRW)		No. of Occurrences & Damages	
2000, 2001, 2002, 2003……2013			

		Typhoon	Heavy Rain	Strong Wind / Wind Wave	Heavy Snow/Snowstorm
No. of Occurrences					
Damages	Victims (Persons)				
	Loss of Life (Persons)				
	Buildings				
	Ships				
	Farmland (ha)				
	Erosion (Sites/ha)				
	Vinyl Greenhouse (ha)				
Damages (Million KRW)	Buildings				
	Ships				
	Farmland				
	Public Facilities				
	Private Facilities				
	Total				

Ⅱ. Outlook and Future Plans

1. Trend Analysis according to Climate Change

□ Temperature: The average temperature will increase by about 2.2℃ by 2040 over that in the 2000s. The Korean peninsula will be included in the subtropical climate zone in the mid-21st century.

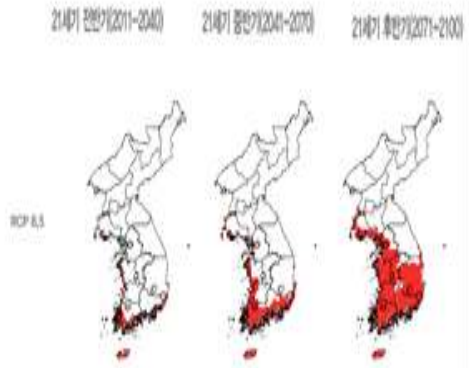
☞ Subtropical climate: The average temperature in the coldest month is below 18℃ and the monthly average temperature is over 10℃ for more than 8 months.

□ Precipitation: Annual precipitation will increase by 793mm on average by 2040 as compared to that in the 2000s. Annual average precipitation in Seongsan-gu and Jinhae-gu will show the highest increase.

□ Extreme Climate Indicator

- No. of summer days, tropical nights and heat waves will increase according to the increase of average temperatures.
- No. of days with frost and freezing will be relatively reduced.
- No. of days with heavy rains will not show any significant difference among districts but will increase by about 2.1 days over that in the 2000s.

한반도 아열대 기후구 변화 전망



*출처: 한반도 아열대 기후구 변화 전망, 기상청(2012)

창원시 구별 기후변화 전망(2000년대 대비 2040년대 변화폭)

구 분	평균기온	강수량	여름일수	열대야일수	폭염일수	호우일수	서리일수 (감소)
의창구	2.2	815	16.5	35.3	21.8	2.2	47.3
성산구	2.24	936	18.3	35.3	15.1	2.3	49.0
마산합포구	2.21	639	24.6	37.4	15.6	2.2	48.6
마산회원구	2.2	675	32.2	36.2	28.2	2.0	44.8
진해구	2.2	901	36.1	28.9	13.4	2.1	50.6
평균	2.21	793	25.54	34.6	18.8	2.1	48.1

Outlook on the Change of the Korean Peninsula to a Subtropical Climate Zone		Early 21st Century (2011~2040)	
Mid 21st Century (2041~2070)		Late 21st Century (2071~2100)	
*Source: Outlook on the Change of the Korean Peninsula to a Subtropical Climate Zone, Korea Meteorological Administration (2012)		Outlook on Climate Change by District in Changwon (Change in 2040 compared to the 2000s)	

	Average Temperature	Precipitation	No. of Summer Days	No. of Tropical Nights	No. of Days with Heat Waves	No. of Days with Heavy Rains	No. of Days with Frost (to be reduced)
Uichang-gu							
Seongsan-gu							
Masan Happo-gu							
Masan Hoewon-gu							
Jinhae-gu							
Average							

2. Climate Action Plans

□ If the standard for INDCs is changed from a BAU to an absolute level in accordance with the climate system, goal management will become much more intensive.

□ The efforts to reduce emissions and adaptive planning will be summarized in the official UNFCC report form, which enables checking whether goals are achieved or not.

□ It is necessary to secure the system to actively cope with the situational changes that will occur in Korea and abroad by establishing a general management system related to reduction and adaptation efforts and updating the greenhouse gas inventory of Changwon.

Ⅲ. Strategic Goals and Tasks

Visions	Realization of Being a Climate Change Action Leader in Cooperation with Citizens	
Strategic Goals	Achievement of Reduction Goals in 2030	Changwon, Eco-Tourism with New Renewable Energy

Establishment of a Culture Practicing Green Living

1 Deployment of citizen's green life campaign
- ▶Expansion of citizens' participation in carbon point system
- ▶Deployment of Cool Style/Warm Style Campaign
- ▶Practice of green living
- ▶Activation of eco-driving campaign

2 Construction of carbon-neutral city led by citizens
- ▶Promotion of green apartment certification project
- ▶Expansion of participation into green transportation point service
- ▶Operation of green leader council
- ▶Climate Action Day
- ▶Distribution of green touch/green print
- ▶Implementation of small enterprise energy management system
- ▶Promotion of greenhouse gas energy goal management system in the public sector
- ▶Promotion of carbon neutrality program
- ▶Disclosure of environmental data

Implementation of Low Carbon Green Infrastructure

1 Expansion of green practices in basic environmental facilities
- ▶Expansion of recyclable energy in small-scale sewage treatment plants
- ▶Recycling afterheat from Jinhae incineration plant
- ▶Operation of Jinhae Sewage Treatment Plant as Exemplary Energy Recycling Complex
- ▶Generation of recyclable energy for offices in Daesan Sewage Treatment Plant
- ▶Promotion of basic environmental facility park project
- ▶Installation of air conditioning system to restore heat from sewage water

2 Implementation of carbon offset project
- ▶Activation of rooftop park project
- ▶Implementation of residential environmental improvement project in farming and fishing villages
- ▶Project to improve aging public facilities in apartments
- ▶Green City Ten Million Tree Planting Campaign

3 Formation of cultural space to experience climate change
- ▶Construction of climate change experience center
- ▶Installation of climate change theme parks and sculptures
- ▶Formation of tourist website to experience climate change

Establishment of Preliminary Tasks for Climate Action

1 Promotion of bio-energy application
- ▶Project to use Bio-gas as fuel
- ▶Promotion of utilization of biomass from forests

2 Formation of carbon-neutral forest

3 Deployment of citizen's carbon neutrality program participation campaign

4 Formation of climate-friendly downtown ecology
- ▶Installation of energy-saving LED street lights
- ▶Changing over to LED lights in government offices
- ▶Promotion of smart Grid project
- ▶Promotion of project to recycle animal manure
- ▶Activation of eco-friendly transportation (bicycles, electric cars)

5 LED distribution in chrysanthemum farms

6 Formation of small scale ocean farms

7 Implementation of emission trading systems

Securing New Renewable Energy Sources

1 Expansion of low carbon clean energy basis
- ▶Establishment of low carbon transportation culture by distributing CNG vehicles
- ▶Blocking carbon waste by prohibiting vehicle idling

2 Development of new renewable energy sources
- ▶Distribution of mini-photovoltaic power plants
- ▶Promotion of Cool Roof Project.
- ▶Expansion of city gas distribution

Ⅳ. Tasks

	Realization of Climate Action Leader in Cooperation with Citizens	Page
1. Short-term Tasks ('15～'19)	**1-1** Deployment of Citizens' Green Life Campaign **1-2** Expansion of Green Practices in Basic Environmental Facilities **1-3** Expansion of Low Carbon Clean Energy Basis **1-4** LED Distribution in Chrysanthemum Farms **1-5** Acceleration of Bio-energy Usage **1-6** Formation of Carbon-neutral Forest **1-7** Deployment of Citizens' Carbon Neutrality Program Participation Campaign	p
2. Mid-term Tasks ('15～'24)	**2-1** Development of New Renewable Energy Sources **2-2** Implementation of Carbon Offset Project **2-3** Formation of Climate-friendly Downtown Ecology **2-4** Formation of Small-scale Ocean Farms **2-5** Implementation of Emission Trading System	
3. Long-term Tasks ('15～'25)	**3-1** Construction of Carbon-Neutral City led by Citizens **3-2** Formation of Cultural Space to Experience Climate Change	

Ⅴ. Action Plan

1 Short-term Tasks (´15~ ´19)

1-1 Deployment of Citizens' Green Life Campaign

□ **Implementation Plan**

① Expansion of citizen participation in the carbon point system

❍ Description

- Period: 2009 ~ 2020
- Subjects: Households, commercial facilities, schools
- Summary
  - ◦ Incentives for households reducing electricity/water consumption by over 5%.
  - ◦ Expansion of participation: 46,000 households (end of 2011) → 300,000 households (2020)
- Total Project Cost: 58 Million KRW

❍ Achievement ('09 ~'14)

- Participation per year
  : 47,000 at the end of 2011 → 76,000 at the end of 2012 → 93,000 at the end of 2013 → 100,000 at the end of 2014
- Reduction effect by carbon point system: electricity saved by 160,798MW, water saved by 10,066 tons, CO2 reduced by 71,515,000 tons.

※ Emission reduction (ton CO_2eq) = Emission reduction unit (2.1 ton CO_2eq/household) × No. of participating households (based on the incentive of 15,000 KRW per household)

- Municipal projects ⇒ Hosting Apartment Carbon Point System Subscription Competition (once a year)

❍ Implementation Plan in 2015

- Hosting apartment carbon point system subscription competition: April ~ May, 2015
- Incentive after identifying electricity/waste reduction twice a year: June/Dec. 2015
- Budget: 474 Million KRW (National budget: 50%, provincial budget: 15%, municipal budget: 35%)

2 Deployment of Cool and Warm Style Campaign

❍ Description

- Period: 2012~
- Subjects: Office workers in densely populated office areas
- Summary: Deployment of promotion and campaign for maintenance of proper heating and cooling temperature.
  - ◦ Preliminary implementation among government employees.
  - ◦ Deployment of campaign during commuting hours of office workers in densely populated office areas.
    - ⇒ Joint campaign with civil groups.
- Method
  - ◦ Summer: Wearing cooler clothing to increase ambient cooling temperature by 2℃
    - ⇒ Casual; without neckties
  - ◦ Winter : Wearing inner layer of clothing and vests to decrease ambient heating temperature by 1℃.
    - ⇒ Room temperature to 18 ~ 20℃. Increasing body temperature by 2.4℃.
- Budget: 45 Million KRW

❍ Implementation Plan

(Unit: %, ton CO_2eq, Million KRW)

		Goals	2012	2013	2014	2015	2016~2020
Participation		47.8	4.8	8.2	14	23.9	47.8
Emission Reduction		27,379	2,664	4,570	7,841	13,452	27,379
Budget	Total	450	50	50	50	50	250
	National	-	-	-	-	-	-
	Provincial	-	-	-	-	-	-
	Municipal	45	5	5	5	5	25

※ Reduction = Reduction Unit (16.8%) × Emission by Cooling/Heating (tCO2) × Participation Ratio(%)

3 Practice of Green Life

❍ Description

- Period: 2012 ~ 2020
- Subjects: All citizens
- Summary: Deployment of green life practice campaign
  - ◦ Expansion of PC standby power saving program (green touch)
    : 130,000 units ⇒ 500,000 units
  - ◦ Cultivation of home energy analysist and analysis program implementation: 1,000 households.
  - ◦ Climate Action Day on the 22nd ofeverymonth
  - ◦ Green Day: meatless meals, no personal cars.
  - ◦ Subscription of green transportation point service
  - ◦ Subscribing and using Nubija membership
  - ◦ All households having carbon point membership
  - ◦ Implementation of 5 Climate Action Tasks: every month.
- Total Project Cost: 25 Million KRW

❍ Implementation Plan

(Unit: %, ton CO_2eq, Million KRW)

		Goals	2012	2013	2014	2015	2016~2020
Implementation Ratio		39	18	21	23	26	39
Emission Reduction		129,866	52,423	61,008	69,890	79,076	129,866
Budget	Total	2,500	200	200	300	300	1,500
	National	1,250	100	100	150	150	750
	Provincial	375	30	30	45	45	225
	Municipal	875	70	70	105	105	525

※ Reduction = Reduction Unit (ton CO_2eq) × No. of Households (479,557 households) x Distribution Ratio per Household (102%) – Implementation Ratio

4 Acceleration of Eco-Driving Campaign

❍ Subjects: Transportation service operators of passenger cars and trucks.

❍ Summary: Reduction of greenhouse gas emission by improving gas mileage of vehicles.

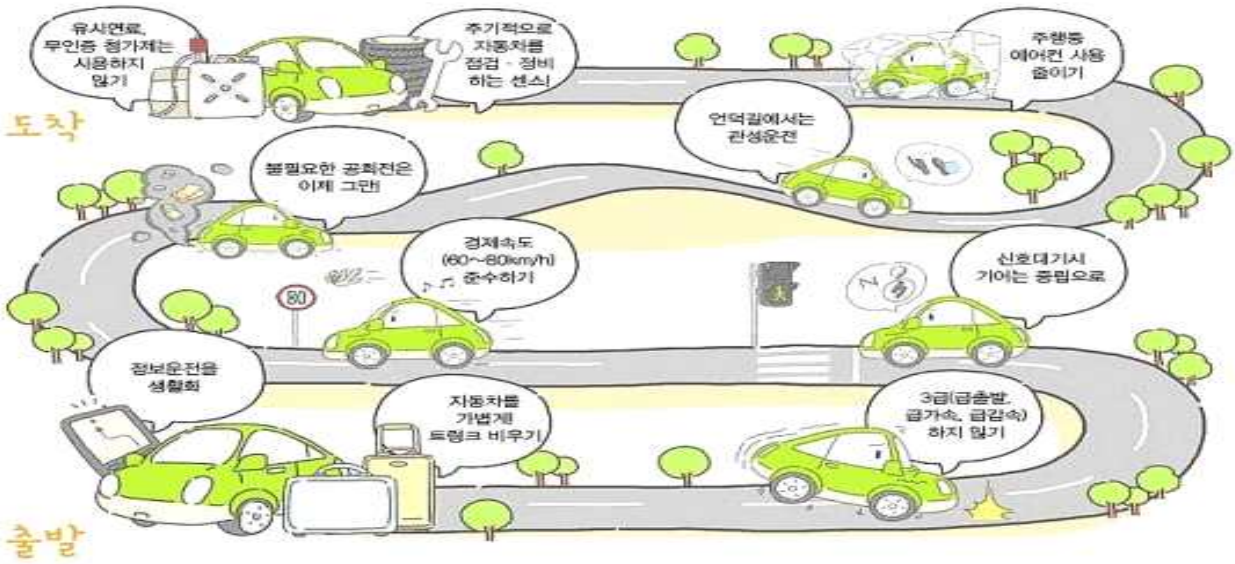
- Reduction of greenhouse gas emission by up to 10%. Improvement of gas mileage of up to 16% (7% in average)
- Reduction in the average number of car accidents by 49% after the implementation of eco-friendly driving.
- Principles of the system: Promoting eco-friendly driving by acknowledging vehicular driving information including fuel consumption (mileage, fuel consumption, gas mileage, CO_2 emissions, and alarms in the case of engine idling or rapid acceleration)
- Subsidy by 50% for purchase of EMS device.
- Budget: 40 Million KRW (subsidy by 50% for purchase: 50% by national budget, 50% by provincial budget)

※EMS device price: About 300,000 KRW for independent styles, about 400,000 KRW for integration styles.

Integration type: EMS (independent device) can integrate Digital tachograph

Independent EMS Device

Independent EMS Device		GPS Receiver	
Accumulated Gas Mileage		Audio Volume Control	
Block Gas Mileage		Display Brightness Control/Input Button	
Block Distance		Power/Reset/Setting Button	
Fuel Consumption		Menu Button	
Injection Time		Speaker	
Engine Oil		Menu Display Value	
GPS		Real-time Gas Mileage	
Power Line		Speed	



10 Promises of Eco-Driving

No semi-fuels or unauthorized additives used	
Check and maintenance of vehicle on a regular basis	
Reduction of air conditioner usage while driving	
Inertial driving on hills	
No more unnecessary engine idling	
Maintain and economic speed (60~80km/h)	
Car in neutral while waiting for signal	
No more 3 sudden actions (sudden departure, sudden acceleration and sudden deceleration)	
Light car! Empty trunk!	
Driving by information as a daily habit	
10 Promises of Eco-Driving	
Arrival/Departure	

1-2 Expansion of Green Practices in Basic Environmental Facilities

□ Implementation Plan

1 Expansion of renewable energy in small-scale sewage treatment plant

❍ Description

- Period: 2013~
- Subjects : Jinjeon Gogan/Bonggok-ri Sewage Treatment Plant
- Summary : Operation of sewage treatment plant by photovoltaic power generation system

		Gogan/Bonggok	Remarks
Capacity	Sewage Treatment Plant	70 tons/day	
	Photovoltaic Power Generation System	10kw	

❍ Operating Plan

(Unit: kw, ton CO_2eq, Million KRW)

	Total	2013	2014	2015	2016~2020
Power Generation	14,902	-	2,117	2,200	10,585
Greenhouse Gas Emission Reduction	1,997	-	1,219	1,266	6,095
Budget	62	41	3	3	15

※Reduction (ton CO_2eq) = Reduction Unit (0.5759 ton CO_2eq/kwh·Year) × Power Generation (kw)

2 Recycling Afterheat from Jinhae Incineration Plan

❍ Description

- Period: 2012~
- Subject: Jinhae Waste Incineration Plant
- Summary: Power generation using the afterheat from incineration system
  - ◦ Installation of power generation system (steam turbine generator 400kw)
  - ◦Total Project Cost: 1.032 Billion KRW

❍ Achievement (by Year)

	Achievement	Remarks
2013	• Gross afterheat generation: 29,404 tons **- Steam turbine generator: 382,286㎾ (afterheat 10,404 tons)** - Internal consumption in the incineration plant: 15,402 tons - Steam supply: 3,598 tons (free supply to community facilities including spa)	
2014	• Gross afterheat generation: 24,775 tons **- Steam turbine generator: 220,207㎾ (afterheat 6,567 tons)** - Internal consumption in the incineration plant: 15,402 tons - Steam supply: 3,781 tons (free supply to community facilities including spa)	
2015	• Gross afterheat generation: 6,634 tons **- Steam turbine generator: 13,815㎾ (afterheat 591 tons)** - Internal consumption in the incineration plant: 4,694 tons - Steam supply: 1,349 tons (free supply to community facilities including spa)	As of the end of March, 2015

❍ Annual Implementation Plan

(Unit: kw, ton CO_2eq, Million KRW)

		Total	2012	2013	2014	2015	2016~2020
Power Generation		2,406,648		382,286	220,207	300,000	1,504,155
Greenhouse Gas Emission Reduction		1,385		220	127	172	866
Budget	Total	20,618	1,032	2,444	2,552	2,349	12,241
	National Budget	722.4	722.4	-	-	-	-
	Provincial Budget	-	-	-	-	-	-
	Municipal Budget	19,895.6	309.6	2,444	2,552	2,349	12,241-
	Others	-	-	-	-	-	-

※Reduction (ton CO_2eq) = Reduction Unit (0.5759kg CO_2eq/kwh·Year) × Supply Capacity (kwh)

3 Operation of Jinhae Sewage Treatment Plant as Exemplary Energy Recycling Complex

❍ Description

- Subjects: Photovoltaic Power Generation Plants and Wind Power Generation Plants
- Summary: Generation and application of new recyclable energy. Utilization as a field trip site for citizens and students.
- Energy: 120Kw by photovoltaic power generation, 10kW by wind power generation.
- Facilities:
  - ◦ 3 photovoltaic power generation systems: 60Kw for sailing ships, 30Kw for performance hall, 30Kw for administrative building.
  - ◦ 1 wind power generation system: 10Kw for the area around administrative building.

❍ Operating Plan

(Unit: kw, ton CO_2eq, Million KRW)

	Total	2012	2013	2014	2015	2016~2020
Power Generation	243,879	26,179	25,628	27,557	26,730	137,785
Reduction of Greenhouse Gas Emission	140,448	15,076	14,759	15,870	15,393	79,350

※Reduction (ton CO_2eq) = Reduction Unit (0.5759 ton CO_2eq/kwh) × Supply Capacity (kwh)

4 Generation of recyclable energy for offices in Daesan Sewage Treatment Plant

❍ Description

- Period: 2013~
- Subjects: Generation of recyclable energy for offices
- Summary: Installation of photovoltaic power generation system in Daesan Sewage Treatment Plant
- Installation of photovoltaic power generation system of 20Kw on the rooftop of the administrative building.

❍ Operating Plan

(단위 : kw, tonCO_2eq, 백만원)

	Total	2013	2014	2015	2016~2020
Power Generation	33,561	4,243	4,030	1,060	21,215
Reduction of Greenhouse Gas Emission	19,325	2,443	2,320	2,345	12,217
Budget	134	120	2	2	10

※ Reduction (ton CO_2eq) = Reduction Unit (0.5759 ton CO_2eq/kwh) × Supply Capacity (kwh)

5 Promotion of Basic Environmental Facility Park Project

❍ Description

- Period: 2012~
- Subjects: Afforestation of sewage treatment plant
- Summary: Formation of green areas using idle areas in the plant
  - ◦ Park Area: 98,819㎡
  - ◦ Facilities: 2 eco-ponds, 5 pergolas, theme park, artificial stream and others.

❍ Achievements (by Year)

	Achievement	Remarks
2012	• Ground pink park formation project	
2013	• Deokdong sewage treatment plant park project	
2014	• Windbreak forest formation project	

❍ 2015 Description

- Project site: Site in front of the main gate of the plant to be expanded (10,000㎡)
- Soil preparation with earth and sand: delivery of 15,000 tons (1,000 loads by 1.5 ton truck)
- Facilities: Carbon-neutral tree planting, cultivation of eco-friendly kitchen garden

❍ Annual Achievement

(Unit: %, ton CO_2eq)

	Goals	2012	2013	2014	2015	2016~2020
Green Areas	6.4	0.7	0.8	0.9	1.0	3.0
Reduction of Greenhouse Gas Emission	40.8	4.4	5.1	5.7	6.4	19.2

※ Reduction (ton CO_2eq) = Reduction Unit (6.41 ton CO_2eq/ha) × Green Areas (ha)

6 Installation of Air Conditioning System using Heat from Sewage Treatment

❍ Description

- Period: 2012~2020
- Subjects: Administrative Building in Jinhae Sewage Treatment Plant (910㎡)
- Summary: Installation of air conditioning system using the heat generated from sewage treatment
  - ◦ Usage of heat from effluence ⇒ central heating
  - ◦ 4 water heat pumps (15 RT), 4 circulating pumps, 22 indoor units
- Total Project Cost: 1,050Million KRW

❍ Annual Implementation Plan

(Unit: kw, ton CO_2eq, Million KRW)

	Total	2012	2013	2014	2015	2016~2020
Reduction	335	36	42	37	40	180
Reduction of Greenhouse Gas Emission	191	20	24	21	23	103
Budget	1,050	350	-	-	350	350

※Reduction (ton CO_2eq) = Reduction Unit (0.5759kg CO_2eq/kwh·Year) × Supply Capacity (kwh)

1-3 Expansion of Low Carbon Clean Energy Basis

□ Implementation Plan

1 Settlement of Low Carbon Transportation Culture by Distribution of CNG Vehicle

❍ Description

- Period: 2001~2020
- Subjects: City buses and garbage trucks/gas stations
- Summary: Expansion of natural gas vehicles and gas stations
  - ◦ Distribution of natural gas vehicles to improve air quality and reduce greenhouse gas emissions.
  - ◦ Expansion of natural gas stations by district (4 stations)
  - ◦ Distribution of CNG hybrid bus in 2016
- Total Project Cost: 24,160 Million KRW

❍ Implementation Plan (by Year)

(Unit: Cars, ton CO_2eq, Million KRW)

		Goals	~2014	2015	2016	2017	2018~2020
No. of Cars to be Distributed		1,156	1,062	36	26	16	16
Reduction of Greenhouse Gas Emission		5,287	4,859	164	118	73	73
Budget	Total	24,160	22,046	1,134	416	282	282
	National Budget	12,080	11,023	567	208	141	141
	Provincial Budget	5,831	5,511	171	63	43	43
	Municipal Budget Others	6,249	5,512	396	145	98	98

※ Reduction (ton CO_2eq) = Reduction Unit (4.576 ton kg CO_2eq/Year·Cars) × No. of Cars Distributed

❍ **CNG Hybrid Bus Overview**

주요 구성부품	배 터 리	작동전압 : 360 V
		용량 : 3.8 kWh
	구동모터	60 kW (82 마력)
	엔 진	G-CNG (240 마력)
	변 속 기	6단 AMT
차량성능	등판성능	30%
	최고속도	100 km/h
연비개선	CNG 대비	**유류비 연 1,200만원 절감**
	디젤 대비	**유류비 연 5,300만원 절감**
CO_2배출량	CNG 대비	**24%이상 감소** (33톤/년)
	디젤 대비	**35%이상 감소** (56톤/년)

Driving Features by Driving Mode				
Stopping	Starting	Acceleration	Constant Driving	Deceleration
Engine Off	Engine +Motor	Engine+Motor	Engine	Battery Charging
Cruise Control	Engine works at the optimum gas mileage range and the residual driving power is saved in the battery.			
Deceleration	Kinetic energy of the vehicle is converted into electric energy and saved in the battery.			

Components	Battery	Operating Voltage: 360V
		Capacity: 3.8kWh
	Driving Motor	60 kW (82 horse power)
	Engine	G-CNG (240 horse power)
	Transmission	6-step AMT
Vehicle Performance	Hill-climbing Ability	30%
	Max. Speed	100 km/h
Improvement of Gas Mileage	Comparison to CNG	Gas expense is saved by 12 Million KRW per year.
	Comparison to Diesel	Gas expense is saved by 53 Million KRW per year.
CO2 Emission	Comparison to CNG	Reduction by over 24% (33 tons/year)
	Comparison to Diesel	Reduction by over 35% (56 tons/year)

2 Blocking Carbon Emissions by Prohibiting Vehicular Engine Idling

❍ Description

- Period: 2012~
- Subjects: Idling restriction zones
- Summary: Intensification of the regulations prohibiting vehicular engine idling in specified restriction zones.
  - ◦ Designation of idling restriction zones: 136 zones (as of Dec. 2010)
  - ◦ Crackdown: administrative measure on vehicles continuing running idle for more than: 5 minutes in the restriction zones (fine 50,000 KRW)
  - ◦ Crackdown period: Restriction of idling when air temperature is over 5℃ and below 27℃.

※Exemptions: Emergency vehicles (patrol car, fire engine and ambulance), freezer & refrigeration cars, construction equipment trucks and maintenance vehicles.

- Total Project Cost: 900 Million KRW

❍ Implementation Plan

(Unit: %, ton CO_2eq, Million KRW)

		Goals	2012	2013	2014	2015	2016~2020
Implementation Ratio		30	4.9	6.2	7.7	9.7	30
Reduction of Greenhouse Gas Emission		357,092	47,544	61,150	78,657	101,188	357,092
Budget	Total	900	100	100	100	100	500
	National Budget	-	-	-	-	-	-
	Provincial Budget	-	-	-	-	-	-
	Municipal Budget	900	100	100	100	100	500
	Others	-	-	-	-	-	-

※Reduction = Reduction Unit x No. of Cars x Implementation Ratio (%)
Reduction Unit: 0.35 ton CO_2eq for passenger cars, 11.505 ton CO_2eq for vans

1-4 LED Installation in Chrysanthemum Farms

□ **Description**

❍ Flowering time has been controlled using 100W incandescent bulbs. Incandescent lamps consume a lot of energy.

❍ Replacement of incandescent lamps by LEDs, which have 10 to 30 times longer life and use less energy.

□ **Implementation Plan**

❍ Location: 1101, Hyeon-dong, Masan Happo-gu

❍ Area: 20,075㎡(9 buildings)

❍ Summary: Replacement of 100W incandescent lamps with 7W LED.

❍ Total Project Cost: 540 Million KRW

□ **Expected Effects**

❍ LED will promote an increase in farmers' income because it has a longer life and can save electrical charges by over 80% as compared to incandescent lamps.

❍ LEDs can reduce greenhouse gas emission by low energy and high efficiency lighting.

1-5 Acceleration of Bio-energy Usage

□ **Implementation Plan**

1 Bio-gas Recycling Project

❍ Description

- Period: 2012 ~ 2015
- Subjects: Digestion tank in Deok-dong Sewage Treatment Plant
- Summary: Generating and recycling bio-gas using sewage sludge and supplying to vehicles
  - ◦ Purification facility: 600㎥/hr㎥×1 unit, Purified gas tank (200㎥): 2 tanks
  - ◦ 1 gas mixer, 2 gas compressors, gas piping of 200m
- Total Project Cost: 8,200 Million KRW(private funds)

❍ Achievement (by Year)

	Achievement	Remarks
2012	• Executed the bio-gas recycling project business agreement [Changwon ↔ Kyungnam Energy Co., Ltd.] • Selected the bio-gas recycling project contractor. • Executed the bio-gas recycling project concession agreement [Changwon ↔ Kyungnam Energy Co., Ltd.] • Started construction	
2013	• Completed civil engineering work and installation of purification facility and gas tank • Submitted the change of GB management plan to the Ministry of Land, Infrastructure and Transport • Notified the extension of a Phase 1 project period for ″Bio-gas recycling project” • Started construction	
2014	• The Ministry of Land, Infrastructure and Transport approved the GB management plan and notified the extension of the Phase 2 project period • The Ministry of Land, Infrastructure and Transport approved the change of GB management plan and approved construction (construction started)	

❍ Future Implementation Plan

- To operate from 2016 after solving such issues as purification of impurities in bio gas.

2 Acceleration of forest biomass usage

❍ Description

- Period: 2011 ~
- Subjects: Households, offices
- Summary: Supply of pallet manufacturing facility and pallet boiler
  - ◦ Replacement of fossil fuel using eco-friendly wooden pallets
  - ◦ Installation of pallet manufacturing facility and supply of boiler
- Total Project Cost: 180 Million KRW

❍ Annual Implementation Plan

(Unit: Units, ton CO_2eq, Million KRW)

		Total	2012	2013	2014	2015	2016~2020
Boilers		55	5	10	15	20	45
Reduction of Greenhouse Gas Emission		469	44	87	131	174	392
Budget	Total	180	20	20	20	20	100
	National Budget	54	6	6	6	6	30
	Provincial Budget	9	1	1	1	1	5
	Municipal Budget	63	7	7	7	7	35
	Other	54	6	6	6	6	30

※Reduction (ton CO_2eq) = Reduction Unit (8.722 ton CO_2eq/Year·No. of Units) × No. of Boilers (No. of Units)

1-6 Formation of Carbon-neutral Forest

□ **Necessity**

❍ Offset of carbon generated by external factors in case of the collective action in a certain area.

❍ Clearance of carbon generated in event areas by afforestation in the relevant areas.

□ **Description**

❍ Period: 2012~

❍ Subjects: Whole areas of Changwon

❍ Summary: Formation of carbon-neutral forest

- Formation of forest carbon sink to offset the carbon generated during events

❍ Total Project Cost: 75 Million KRW

□ **Implementation Plan**

(Unit: ha, ton CO_2eq, Million KRW)

	Goals	2012	2013	2014	2015	2016~2020
Area	473	20	41	9	45	358
Reduction of Greenhouse Gas Emission	3,453	133	266	294	460	2,300
Budget	75	20	20	10	5	20

※ Reduction (ton CO_2eq) = Forest Carbon Sink Unit (6.41 ton CO_2eq/ha) × Forest Area (ha)

1-7 Deployment of Citizens' Carbon Neutrality Program Campaign

□ **Necessity**

❍ Promotion of individual goal setting to achieve the emission reduction goal of Changwon

❍ Stimulation of progressive activity as individuals share social responsibility for greenhouse gases

□ **Description**

❍ Systematic management of the reduction of greenhouse gas emissions including monitoring of progress

❍ Expansion of promotion and participation of carbon neutrality program to reduce greenhouse gas emissions

□ **Implementation Plan**

❍ Diagnosis of carbon generation type by individuals by visiting each household and promotion events

❍ Support for individual reduction activity through monitoring and DB implementation of greenhouse gas reduction

- Calculation and database implementation of greenhouse gas emission of Changwon
- Required Workers: 2 (1 for public sector, 1 for businesses)

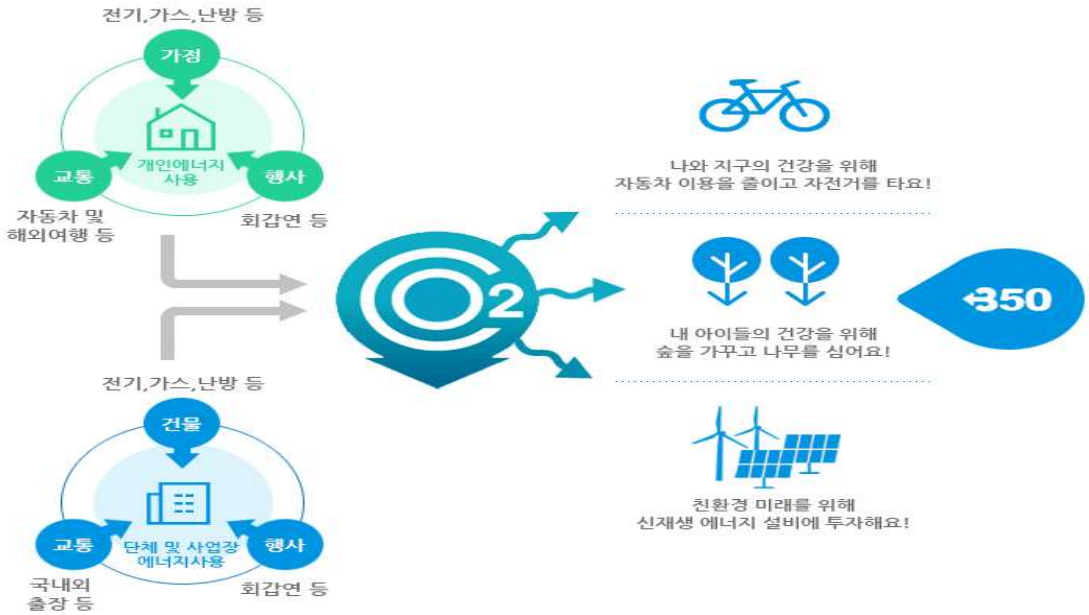
❍ Promotion of carbon neutrality program

- Subjects: individuals, organizations, business entities
- Methods: agreement per related party, official notice, homepage and others

□ **Expected Effects**

❍ Enhancement of participation enabling individuals to offset carbon generated during daily living

❍ Fundamental prevention of emissions from reduction effort focusing on facility investment to reduction by citizens in daily life



Individuals: Usage of Energy
Household/ Including electricity, gas and heating
Transportation / Including vehicles and overseas trips
Events / Including 60thbirthday

Organizations/Business Places: Usage of Energy
Building / Including electricity, gas and heating
Transportation / Including domestic and overseas business trips
Events / Including 60thbirthday

- Reduce the usage of cars and ride a bike for my health and the health of the earth!
- Cultivate wood and plant trees for the health of my kids!
- Invest in the new recyclable energy facility for an eco-friendly future!

2 Mid-term Tasks (´20 ~ ´24)

2-1 Development of New Recyclable Energy Sources

□ **Implementation Plan**

1 Distribution of Mini Photovoltaic Power Generation System

❍ Need

- To achieve the goal to reduce greenhouse gases by generating non-carbon energy using sunlight.
- Pride and educational effect as each household participates in the effort to reduce greenhouse gas as a part of a new recyclable energy generation facility.

❍ Description

- Project: Pilot Distribution of Mini Photovoltaic Power Generation System to be Installed on Apartment Verandas
- Scope: 20,000 apartment households
- Budget: 8 Billion KRW (Changwon Ordinances on Climate Change Adaptation)
- Requirements: 50% of the system cost to be granted for each household (up to 400,000 KRW)

❍ Implementation Plan

- Installation of mini photovoltaic power generation system of about 250W
- Generation of energy to run a 900L refrigerator (about 292KWh/year).
- Maximization of the promotion effect for citizens including visual educational effect by close installation at close range.
- Continuing implementation as part of the long-term climate change adaptation plan as a future strategy for Changwon.
- Expansion of installation for consolidating the infrastructure as a self-energy supporting city.

※ Annual distribution to 10% of households in apartments (20,000 households)

Mini Photovoltaic Power Generation System	Usage of Energy Generated by System (supply through outlet)
	

2 Implementation of Cool Roof Distribution Project

❍ Necessity

- Need to develop the method to effectively reduce the urban heat island effect against global warming including heat waves.
- Reduction of carbon generation and secondary heating effect by reducing the cooling energy in the downtown area.

❍ Description

- Reduction of energy consumption in a building by applying the insulation engineering to the building rooftop.
- Implementation as the leading project to cope with the potential increase of temperature caused by global warming.
- Area: 200 sites including apartment and business facilities
- Budget: 1,000 Million KRW (Climate Action Ordinances of Changwon)
- Requirements: 50% subsidy for construction costs (Up to 500 Million KRW)

❍ Implementation Cases

- Implementation of internal pilot project for verifying the effect of cool rooftops which has been implemented in the USA and Japan.
- Sites: Roof tops of the city hall building and roof tops of Changwon University.
- Results: The temperature difference between cool roofs and roof tops of existing buildings is about 1~2℃. The temperature difference between the building using urethane green water proofing and using white water proofing was confirmed.

《Pilot Project》

<table>
<tr><th colspan="2">Cool Roof Installation on the Roof Top of the City Hall</th><th>Roof Top Model Experiment Plan in Changwon University</th></tr>
<tr><td>  </td><td>➢Area: 600㎡ (30m × 20m)
➢Method: Applying cool roof paint (1mm thick)
• Basecoat→Fabric→Basecoat →Finish coat→Finish coat
• Application of existing urethane water proofing material.</td><td>  </td></tr>
</table>

❍ Implementation Plan

- Cool roof installation and white finish waterproofing process for detached homes at the same time.

  ⇒ Selective support in consideration of the sharing ability and economic feasibility.

- Applying thermal insulation paints with waterproofing and sunlight reflection/radiation function on the roof top.
- Reduction of cooling energy consumption by reducing heat transmitted from the roof top to the inside of a building.
- Reduction of temperature in the city by prior application to the buildings in the downtown causing the heat island effect.
- Applicable to all buildings by economic and quick installation as compared to roof top greening.

References

Thesis in Kyungpook National University

▶ **Conclusion: Cool roofs could save energy by 28% as it could drop room temperature by 4℃ as compared to the existing brown roofs (Energy consumption is reduced by 7% per 1℃ _ Korea Energy Agency)**

▶ Purposes: Analysis on the effects of the cool roof system of U-Rim Mastic Co., Ltd.

▶ Method

- Place: Installation of miniature cool roof on the roof top of Kyungpook National University Daegu Campus (1m in each side)
- Period: May 2012~ to present
- Results (10:00~17:00. Measurement by thermal camera every hour)

	White (Cool Roof Installation)	Green Roof	Blue Roof	Brown Roof
Roof Surface	38.6℃	60.8℃	62.6℃	65.9℃
Room Temperature	34.9℃	37.0℃	39.0℃	39.0℃

Report by Passive House Institute Korea

▶ **Conclusion: It is concluded that cool roofs will be an effective solution for tropical nights and heat islands in the downtown area. Leadership In Energy and Environmental Design (LEED) also proposed a cool roof by giving the same points as the roof top greening.**

▶ Purposes: Analysis on the effects of cool roofs by installing it on a passive house roof (detached home) in Bongyang-dong, Yangju, Gyeonggi-do.

▶ Method

- Period/Roof Type: June 14, 2012 (13:10) / zinc roof (slate gray)
- Results

	Zinc Roof	Cool Roof Installed	Difference
Roof Temperature	60.1℃	38.1℃	22.0℃

3 Expansion of City Gas

❍ Description

- Period: 2012 ~
- Subjects: Entire Changwon Area
- Summary: Supply of city gas (supply rate: 48.6% for detached houses, 94.6% for apartment complexes)
- Expansion of city gas to detached houses with low economic value.
- Subsidy for users' infrastructure contribution for connection to city gas (50%) (Max. 1.5 Million KRW per household)
- Total Project Cost: 325,322 Million KRW

❍ Implementation Plan

(Unit: Households, ton CO_2eq, Million KRW)

		Total	2012	2013	2014	2015	2016~2020
No. of Households with City Gas		172,258	33,940	53,789	75,928	90,165	172,258
Reduction of Greenhouse Gas Emission		70,626	13,915	22,054	31,131	36,968	70,626
Budget	Total	325,322	41,540	41,540	41,555	31,095	169,592
	National Budget						
	Provincial Budget						
	Municipal Budget	13,013	1,660	1,660	1,665	1,245	6,783
	Other	312,309	39,880	39,880	39,890	29,850	162,809

※Reduction (ton CO_2eq) = Reduction Unit (ton CO_2eq) × No. of Households with City Gas (Diesel and Kerosene 50% each

Reduction Unit: Diesel→City Gas 0.39, Kerosene→City Gas 0.43

2-2 Carbon Offset Project

□ **Implementation Plan**

1 Roof Top Greening

❍ Description

- Subjects: Entire Changwon Area
- Summary
  - ◦ Artificial ground landscaping including roof top greening in private and public buildings and wall landscaping
  - ◦ Roof top greening: expansion of private greening by subsiding 50% of the required cost (large buildings and detached homes).
  - ◦ Wall landscaping (façade): Prior wall landscaping for public buildings (Implementation of "Visible Landscaping" project)
- Total Project Cost: 7,329 Million KRW

❍ Implementation Plan

(Unit: Households, ton CO_2eq, Million KRW)

		Goals	2012	2013	2014	2015	2016~2010
No. of Buildings with Wall or Roof Top Landscaping		199	45	59	79	99	199
Reduction of Greenhouse Gas Emission		13,514	3,045	4,007	5,365	6,723	13,514
Budget	Total	7,329	800	600	847	847	4,235
	National Budget	-	-	-	-	-	-
	Provincial Budget	2,198	240	180	254	254	1,270
	Municipal Budget	2,198	240	180	254	254	1,270
	Other	2,933	320	240	339	339	1,695

※ Reduction (ton CO2eq) = Reduction Unit (0.108 ton CO2eq/Year·㎡) × No. of Buildings with Wall or Roof Top Landscaping × 628㎡/unit

2 Residential Environment Improvement Project for Farming and Fishing Villages

❍ Necessity

❍ Description

- Period: 2015 ~ 2021
- Subjects: 1,218 buildings
- Summary: house renovation, empty house maintenance, roof improvement.
- Total Project Cost: 1,893 Million KRW

❍ Achievement (per Year)

(Unit: Households/Million KRW)

		2012	2013	2014	Remarks
No. of Works		**120**	**159**	**186**	Linked to the project by Korea Environment Corporation (national ·provincial· municipal budget) District project (provincial· municipal budget)
Budget	Total	121	189	269	
	National Budget	30	64	98	
	Provincial Budget	27	37	50	
	Municipal Budget	64	88	117	

❍ Implementation Plan

(Unit: Households, ton CO_2eq, Million KRW)

		Goals	2015	2016	2017	2018	2019~2021
No. of Works		**1,218**	**186**	**241**	**313**	**406**	**1,218**
Reduction of Greenhouse Gas Emission		**1,602**	**244**	**317**	**412**	**534**	**1,602**
Budget	Total	**1,893**	**288**	**374**	**486**	**631**	**1,893**
	National Budget	534	82	106	137	178	534
	Provincial Budget	396	61	79	102	132	396
	Municipal Budget	951	145	188	244	317	951

※ Reduction (tCO_2eq) = Reduction Unit (1,317kg CO_2eq/Year·No. of Households) × No. of Households

3 Project to Improve Aged Public Facilities in Apartments

❍ Description

- Period: 2005~
- Subjects: Public facilities in apartments

❍ Summary: Project to improve (maintenance/renovation) aging public facilities in apartments

- Target Facilities: General facilities (security lighting, Silver Hall, playground, roads inside apartment complexes, sewerage, fence removal, facilities used by many and unspecified persons), and facilities by municipal police (bike racks)
- Subsidy: Up to 50% of total project budget (those who receive the subsidy cannot apply for the subsidy for the next 3 years following)
- Full funds for the projects with a total budget of less than 5 Million KRW as apartments with less than 100 households and for policy projects
- Total Project Cost: 8,100Million KRW

❍ Annual Achievement

	Achievement	Remarks
2012	• Subsidy: 117 apartments 1,427 Million KRW	
2013	• Subsidy: 105 apartments 1,500 Million KRW	
2014	• Subsidy: 72 apartments 997 Million KRW	

❍ Implementation Plan

(Unit: Households, ton CO_2eq, Million KRW)

		Goals	2015	2016	2017	2018	2019~2023
No. of Subjects		677	77	75	75	75	375
Reduction of Greenhouse Gas Emission		892	101	99	99	99	494
Budget	Total	8,100	900	900	900	900	4,500
	National Budget						
	Provincial Budget						
	Municipal Budget	8,100	900	900	900	900	4,500
	Other	-	-	-	-	-	-

※ Greenhouse Gas Emission Reduction (ton CO_2eq) = Reduction Unit (1,317 kg CO_2eq/Year·Households) × No. of Households for Maintenance/Renovation

4 Green City Ten Million Tree Planting Campaign

❍ Description

- Period: 2011~2020
- Subjects: Entire Changwon Area
- Summary: Implementation by dividing the project into two phases: Phase 1 (2012~2013), Phase 2 (2014~2020)
- Planting by citizens: Commemorative planting, planting for donation, building greening, garden landscaping, plant landscaping.
- Public planting: Roadside landscaping, park greening, mountains and rivers greening, wide workplaces.
- Implementation in connection with the project for 1 million tree planting for environment purification and the prestigious environmental (best) village formation project.
- Total Project Cost: 17,980 Million KRW

❍ Implementation

- Tree distribution event and citizens' tree planting event
- Organizing and supporting the commemoration planting events with citizens (more than 10 times)
- Promotion of tree planting with citizens (mainly in spring and autumn)

❍ Implementation Plan

(Unit: Thousand Trees, ton CO_2eq, Million KRW)

		Goals	2012	2013	2014	2015	2016~2020
No. of Trees Planted		10,000	2,000	3,000	4,000	5,000	10,000
Reduction of Greenhouse Gas Emission		21,333	4,267	6,400	8,533	10,667	21,333
Budget	Total	17,980	1980	2,000	2,000	2,000	10,000
	National Budget	-	-	-	-		-
	Provincial Budget	-	-	-	-		-
	Municipal Budget	17,980	1980	2,000	2,000	2,000	10,000
	Other	-	-	-	-		-

※ Reduction = Reduction Unit (0.0021333 ton CO_2eq/Trees) × No. of Trees Planted

2-3 Formation of Climate-Friendly Downtown Ecology

□ **Implementation Plan**

1 Energy-saving LED street lighting

❍ Description

- Period: 2012~
- Subjects: 25,389 street lamps (based on entire Changwon area)
- Summary: Replacement of street and security lighting with less energy efficiency with LED lamps.
- Total Project Cost: 423 Million KRW

❍ Achievement

	Achievement	Remarks
2012	•90 LED (street lighting) installed.	
2013	•73 LED (street lighting) installed.	
2014	•47 LED (street lighting) installed.	

❍ Implementation Plan

(Unit: Lamps, ton CO_2eq, Million KRW)

		Goals	~2012	2013	2014	2015	2016~2020
No. of LEDs installed		423	90	73	47	188	25
Reduction of Greenhouse Gas Emission		60	13	10	7	26	4
Budget	Total	423	90	73	47	188	25
	National Budget	-	-	-	-	-	-
	Provincial Budget	-	-	-	-	-	-
	Municipal Budget	423	90	73	47	188	25
	Other	-	-	-	-	-	-

※ Reduction (ton CO_2eq) = Reduction Unit (0.1401 ton CO_2eq/Year·No. of LEDs) × No. of LEDs installed.

2 Government Building LED Replacement Project

❍ Description

- Period: 2010 ~ 2015
- Subjects: Replacement of all lamps in Changwon City Hall with LEDs
- Summary: Replacement with high efficiency LEDs
  - ◦ 30% of all lamps will be replaced with LED by 2015 as a part of the low carbon green growth project.
  - ◦ Annual replacement by high efficiency LEDs
- Total Project Cost: 1,100 Million KRW

❍ Achievement

	Achievement	Remarks
2010~2015	•5,691 lamps replaced by LED (total No. of lamps: 5,878)	

❍ Implementation Plan

(Unit: Lamps, ton CO_2eq, Million KRW)

		Goals	~ 2012	2013	2014	2015	2016~2020
No. of LEDs Installed		5,878	4,100	330	976	285	187
Reduction of Greenhouse Gas Emission		13.8	11	12	14.6	15.4	15.9
Budget	Total	1,100	900	50	90	30	30
	National Budget	200	200		-	-	-
	Provincial Budget	-	-	-	-	-	-
	Municipal Budget	900	700	50	90	30	30
	Other	-	-	-	-	-	-

※ Reduction (ton CO_2eq) = Reduction Unit (0.0027 ton CO_2eq/Year·No. of Lamps) × No. of LEDs installed.

3 Smart Grid Project

❍ Description

- Period: 2015 ~ 2020
- Subjects: Consumers using a large amount of power including industrial complexes, buildings or railroad stations.
- Summary: Smart Grid Project
  - ◦ Organization of consortium: 12 organizations including local authority, enterprises and public organizations.
  - ◦ Checking power consumption and controlling power supply on a remote place by applying IT to the existing power grid.
  - ◦ Improving energy consumption efficiency by reducing greenhouse gas emission and peak power consumption.
  - ◦ Stabilizing power service quality and improving reliability by controlling power variability.
- Total Project Cost: 118,900,660,000 KRW

❍ Implementation Plan

(Unit: ton CO_2eq, Thousand KRW)

		Total	2015	2016	2017	2018~2020
Reduction of Greenhouse Gas Emission		23,000	5,444	4,762	3,406	9,388
Budget	Total	118,900,660	28,310,200	24,522,600	18,507,600	47,560,260
	National Budget	59,450,330	14,155,100	12,261,300	9,253,800	23,780,130
	Local Budget	11,456,026	2,280,000	2,260,000	2,160,000	4,756,026
	Other	47,994,304	11,875,100	10,001,300	7,093,800	19,024,104

4 Animal Manure Recycling Project

❍ Description

- Period: 2012 ~ 2020
- Subjects: Animal manure
- Summary: Implementation of animal manure recycling project
  - ◦ Operation in connection with animal manure treatment plant
  - ◦ Expansion of liquid fertilizer fermentation and storage facility, installation of liquid manure sludge separator and the facility for deodorizing and reducing foul odors
- Total Project Cost: 1.532 Billion KRW

❍ Achievement

	Achievement	Remarks
2012	•11 liquid manure sludge separators, 1 compost shed, 1 manure spreader, 2,000-ton liquid manure tank	
2013	•3 liquid manure sludge separators, 1 compost shed, 3 manure spreaders, liquid manure spreading on 82ha, 1 compost maturity reader	
2014	•4 skid loaders, 1 liquid manure truck, 1 tractor, liquid manure spreading on 133 ha	
2015	•1 sludge separator, 1 skid loader, 1 manure spreader, 200-ton liquid manure tank, liquid manure spreading on 330ha	

❍ Implementation Plan

(Unit: ㎥, ton CO_2eq, Million KRW)

		Total	2012	2013	2014	2015	2016~2020
Amount of Resources		-	218,000	218,000	218,000	218,000	218,000
Reduction of Greenhouse Gas Emission		-	67,000	67,000	67,000	67,000	67,000
Budget	Total	1,532	450	159	349	157	417
	National Budget	468	132	46	95	48	147
	Provincial Budget	156	42	13	41	16	44
	Municipal Budget	361	97	32	95	37	100
	Other	547	179	68	118	56	126

○ Relevant Regulations: Article 19 and 22, Act on the Management and Use of Livestock Excreta

5 Activation of Eco-friendly Transportation (bike/electric car)

❍ Description

- Period: 2012~
- Subjects: All citizens
- Summary
  - ◦ Implementation and improvement of Nubija system: Expansion of terminal and maintenance of aged system.
  - ◦ Expansion of bike usage culture: Elevating the position as a leading eco-transportation city, education for citizens (leader development program, citizen lecturer certification test, free bike class for citizens, bike license test for children)
  - ◦ Activation of electric cars: distribution of public and private electric cars.
- Total Project Cost: 127,540 Million KRW

❍ Achievement

	Achievement	Remarks
2012	• Bike path formation: L=7.1km • Expansion of distribution of Nubija bike: 2,000 bikes • Installation of Nubija terminals: 11 terminals. • Electric cars and charging stations: 21 electric cars (for official use) ※ 40 electric cars in 2012	
2013	• Bike path formation: L=6.0km • Installation of Nubija terminals: 1 terminal. • Electric cars and charging stations: 50 electric cars (20 for official use, 30 for private use)	
2014	• Bike path formation: L=9.5km • Installation of Nubija terminals: 5 terminals. • Electric cars and charging stations: 100 electric cars (100 for private use)	
2015	• Bike path formation: L=6.2km • Installation of Nubija terminals: 8 terminals. • Electric cars and charging stations: 200 electric cars (20 for official use, 180 for private use)	

❍ Implementation Plan

(Unit: %, ton, Million KRW)

		Goals	2012	2013	2014	2015	2016~2020
Transportation Share		20	-	6.9	-	8	20
Reduction of Greenhouse Gas Emission		61,321	5,559	6,737	6,665	7,060	35,300
Budget	Total	127,540	20,905	13,537	11,966	13,522	67,610
	National Budget	34,532	4,447	2,139	2,950	4,166	20,830
	Provincial Budget	5,383	1,403	593	495	482	2,410
	Municipal Budget	87,625	15,055	10,805	8,521	8,874	44,370
	Other	-					

※ Reduction = Average CO_2 Emission of Vehicle (210g/km)
※ Annual Mileage (km): Electric car + public bike mileage (internal data)
※ Daily average mileage of electric car (26.2km for official use, 38.9km for private use)

2-4 Formation of Small-scale Ocean Farms

□ **Description**

❍ Period: 2008 ~

❍ Summary: Formation of infrastructure for fishing industry, expansion of marine resources, experience fish farms and others.

❍ Total Project Cost: 4,450 Million KRW

❍ Subjects: Sea around U-do, Socuri Island, Chori Island and Jiri Island in Jinhae-gu

□ **Achievement**

	Achievement	Remarks
2008	•Execution drawing contract	
2009~2011	•149 marine forest plants, 280 artificial fishing banks	
2012	•Determination of species of fish for stock enhancement	

□ **Implementation Plan**

(Unit: ha, ton CO_2eq, Million KRW)

		Total	~2012	2013	2014	2015	2016~2020
Area		130	50	60	70	80	130
Reduction of Greenhouse Gas Emission		33,410	12,850	15,420	17,990	20,560	33,410
Budget	Total	4,450	1,250	400	400	400	2,000
	National Budget						
	Provincial Budget	1,479	415	133	133	133	665
	Municipal Budget	2,971	835	267	267	267	1,335
	Other	-	-	-	-	-	-

※Reduction (ton CO_2eq) = Reduction Unit (257 ton CO_2eq/Year·ha) × Area (ha)

2-5 Emission Trading System Implementation

□ **Background**

❍ Designation and announcement of business entities for emission trading system in 2015 (Sep. 12, 2014; Ministry of the Environment)

❍ Purchasing or borrowing emission permits in the case of the excess of allocated emission, selling or carrying forward in the case of less usage of allocated emission.

❍ Basis for policy: Act on the Allocation and Trading of Greenhouse Gas Emission Permits (Article 8)

□ **Description**

❍ Subjects: 26 basic environment facilities

❍ Period: 2015~2017(1st Phase)

❍ Implementation Period: Jan. 1, 2015 ~ Dec. 31, 2017 (1st Phase)

❍ Criteria for Selection: Annual gross emissions of over 125,000 tons (3 years: 2011~2013)

- Changwon: Average annual emissions 273,373 tons.

❍ Subjects in Changwon: 26 facilities (525 facilities in Korea)

- Changwon (1): 26 basic environment facilities (emission permits, 726,777 tons for 3 years)

❍ Budget: 100 Million KRW/year (Budget to estimate emissions and manage emission sources)

□ **Implementation Plan**

❍ Notification to each business entity to comply with the emission permits when the emission permits are confirmed.

❍ Selection of the contractor specializing in emission rights management and execution of the management contract.

❍ Determination of the budget to purchase emission permits on the basis of the results of monitoring emissions trends.

Concept of Emission Trading System

Sales available		Purchase available	
Emission Permits		Excess of Emission Permits	
Actual Emission		Company A, Company B	
Emission Permits > Emission		Emission Permits < Emission	

3 Long-term Tasks (from 2025)

3-1 Construction of Carbon-Neutral City led by Citizens

□ **Implementation Plan**

1 Green Apartment Certification Project

❍ Necessity

- Expansion of the desire to practice low carbon green living in each apartment to reduce greenhouse gas emissions to manage climate change.
- Stimulation of joint effort and unity by cooperation and sound competition among apartments.

❍ Description

- Period: March ~Aug. every year from 2013 (6 months) Carbon Emission Reduction Competition
- Participants: apartments with more than 200 households.
- Assessment: general assessment including electricity/water consumption reduction ratio, carbon point system membership.
- Method: Public notice (Feb.) → Interim Assessment (June) → Final Assessment (Sept.)
- Prize: Prize money and attachment of Green Apartment Certificate.
- This project has been implemented since 2013 as the special policy of Changwon to help mitigate climate change.

	Participants	Green Certificates	Achievement
2013	34 apartments	6 apartments	. Saved 1.02 million KW. 493 resident leaders cultivated. . Household Energy Diagnosis: 1,612 households
2014	47 apartments	7 apartments	. Saved 1.77 million KW. 429 resident leaders cultivated. . Household Energy Diagnosis: 1,346 households . 28 times APT Sharing Market, Installation of photovoltaic power generation system in 4 apartments

❍ Future Schedule in 2015

- Final Assessment (written assessment + field assessment): July 2015

- Awards ceremony: Early Oct. 2015

2 Expansion of Green Transportation Point Service

❍ Necessity

- Expansion of an environment that encourages the participation of citizens in walking or bike riding without financial burden to the municipal government.
- Contribution of the practical reduction of greenhouse gas emission, improvement of air quality in the city and improvement of personal health.

❍ Description

- GTPS is the acronym of **Green Transportation Point Service**
- Green Card service provider gives points to citizens walking or riding bikes and these points can be used as cash.

  ⇒ **Changwon has been distributing as the leading city among local authorities in Korea since its agreement with the Korea Transportation Safety Authority.**
- System operation: The Korea Transportation Safety Authority has developed and operates this service.

❍ **Achievement**

- **GTPS Participation Status**

(As of Dec. 31, 2014)

	No. of Members	Points (P)	Carbon Emission	Remarks
Changwon	9,745	17,534,187	233	Changwon citizens' participation accounts for 37% of total participation in Korea

- Implementation every month as the task selected to practice on Climate Action Day.
- 14 education programs for 1,580 citizens. 12 campaigns. Activities more than 20 times a year.

❍ Implementation Plan in 2015

- Participation Goals: 10,000 in 2014 → 20,000 in 2015
- Reflection on a variety of assessment indicators as the citizens' task for green living.
- Education for citizens and campaigns: including schools and enterprises.
- Incentives (including transportation cards) to good participants every half year.
- Awarding good enterprises and organizations achieving high participation.

3 Green Leaders Council

❍ Necessity

- Support for Green Start Network activity for expanding the campaign to reduce greenhouse gas emissions.
- Organizing the council to strengthen unity among green leaders[1], securing operation and management systems and sharing information.

❍ Description

- Date of Establishment: Nov. 29, 2012
- Members: 33 members (Top leaders selected from 54 in 2014)
- Qualification: applicants among higher level Intermediate Green Leader.
- Functions/Roles
  - ◦ Support for a variety of policies to cope with climate change promoted by the Changwon Network
  - ◦ Development and distribution of Elementary Green Leader education programs and relevant education materials.
  - ◦ Greenhouse gas emission diagnosis program by visiting households and promotion of green life practice among citizens.
  - ◦ Sharing a variety of information and programs among Green Leaders.
- Operation Directions
  - ◦ Selection from the applicants among Intermediate and Advanced Green Leaders.
  - ◦ Organization: 1 chairman, 1 vice chairman, 1 manager and 1 secretary each in education/practice team 1 and 2, 1 advisor

    ※ Official member: 1 from Changon Municipal Government, 1 from Green Start Changwon Network
  - ◦ Term of Office: 1 Year (consecutive term available)
  - ◦ The chairman of the council is appointed as the Gyeongsangnam-do Green Leader Council.

1) Green Leader: **21st centurygreenactivists**leading the Green Start campaign and playing pivotal roles for spreading low carbon and green living lifestyles.

❍ Implementation Actions in 2015

- Encouragement of practical activity and assessment on implementation by holding the steering/sectional meeting on a regular basis.
- Promotion of effective mentoring by designating the mentors for the apartments applying for Green Apartment Certification.
- Reflection of budget for sectional activity and unit program activity ⇒ maximization of voluntary participation and activity.

❍ Budget: 27 Million KRW (50% from national budget, 50% from municipal budget) ※ 25 Million KRW in 2014

4 Climate Action Day

❍ Necessity

- Citizens practice 5 Climate Action Tasks designated by Changwon and
- Changwon Municipal Government deploys promotional activities to encourage greater participation

❍ Description

- Designation of “Climate Action Day” for practical reduction of greenhouse gas emission to cope with climate change and the establishment and intensive promotion of 5 citizens’ tasks in detail.

- Description

◦ Climate Action Day: 22nddayofeverymonth(exceptpublicholidays)

◦ Participants: including the municipal government and its affiliated organizations, public organizations, enterprises, institutions and citizens.

◦ Activities: Promotion of citizen participation in 5 Climate Action Tasks.

▷ 5 Climate Action Tasks ◁

① Do not ride a car and eat more vegetables. ② Join a Carbon Point System ③ Join a Green Transportation Point Service. ④ Install Green Touch. ⑤ Use Nubija.

❍ Achievements in 2014

- Visiting promotion campaign to enterprises: 2,790 citizens in 6 visits.
- Promotion booth (Sept.), street campaign (Dec.): 3,000 citizens in 2 campaigns.
- Sending notices asking for cooperation to public organizations, enterprises and schools: 8 times.
- Incentives to participants: 2,100,000 KRW to 42 citizens.

❍ Implementation Actions in 2015

- Visiting promotion campaign to enterprises (12 times)
- Promotion booth (Sept.), street campaign (Dec.)
- Budget: 11 Million KRW ※ 2014 21 Million KRW

5 Green Touch/Green Print Distribution

❍ Description

- PC Power Saving Program converts PCs automatically to the power saving mode when not in use for a while (including meetings or break times). Installation and distribution of program to save paper by double-side printing or black and white printing.
- Developed by the Ministry of Environment. Free for everyone.

❍ Achievement

- Distribution of Green Touch

	No. of Installations (accumulated)			Saved Power (kwh)	CO_2 Reduction (kg)	Effect of Tree Planting (No. of Trees)	Remarks
	Total	Personal	Business				
Changwon	131,863 (16,656 in 2014)	**8,634**	**123,229**	**6,239,138**	**2,645,394**	**955,015**	
Gyeongsangnam-do	165,245	29,109	136,136	7,439,191	315,4216	1,138,706	
Korea	1,299,307	247,835	1,051,472	53,402,532	22,642,673	8,174,250	

※ Effect to save electric fees by about 700 Million KRW.

- Distribution of Green Printers

	No. of Installations (accumulated)	CO_2 Reduction (kg)	Effect of Tree Planting (No. of Trees)	Cost Reduction (Thousand KRW)	Paper Reduction (Sheets)	Remarks
Changwon	13,290 (6,210 in 2014)	**8,756**	**3,161**	**21,282**	**3,040,324**	
Gyeongsangnam-do	28,008	9,413	3,398	22,879	3,268,406	
Korea	278,442	438,972	15,847	106,694	15,242,000	

※ Effect to reduce costs by 21 Million KRW.

❍ Implementation Plan

- Intensive promotion and distribution around public organizations, enterprises and hospitals using a number of PCs.
- Increasing the criteria for green apartment certification in the low carbon green apartment certification project in 2015 (2~3 points è 5 points)
- Progressive promotion to citizens through various approaches: all year round.

6 Implementation of Energy Management System for Small Business.

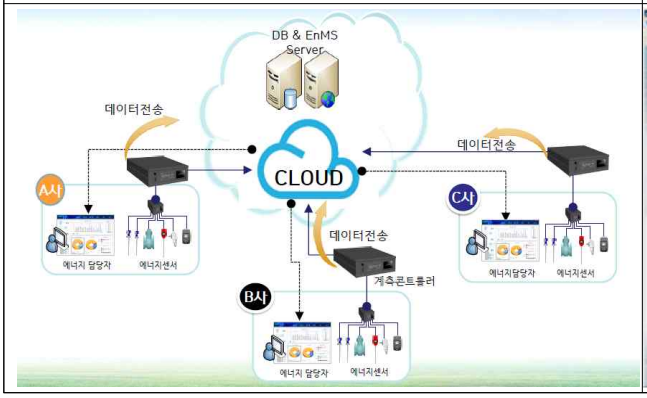
❍ Necessity

- Implementation of low cost energy management system for small businesses using ICT.
- Implementation as a public bidding project by the Korea Energy Management Corporation in cooperation with the relevant local authority.

❍ **Description**

- Budget: about 100 Million KRW (subsidy from the Korea Energy Management Corporation)
- Participants: Changwon, Gyeongsangnam-do Green Environment Center, Enforce Co., Ltd.

⇒ Consortium

System Diagram	Energy Management System Main Screen
	

※ What is the energy saving system? Promoting energy savings by real time monitoring of energy consumption using the power meter installed in major systems in workplaces.

❍ Achievement

- Total project budget (170 Million KRW) was secured by being selected as the successful bidder by the Korea Energy Management Corporation.
- Phase 1: Implementation of energy diagnosis (5 sites) and energy saving systems (1 site) (Seongwu Techron Co., Ltd.)
- Phase 2: Implementation of cloud server (1) and energy saving systems (2 sites)
- Samsong Company, Kortek Co., Ltd.

❍ Implementation Actions in 2015

- Bidding application for 2015 project: June 2015
- Public bidding with small companies and project implementation: June ~Nov. 2015
- Performance monitoring and report: Dec. 2015

7 Public Sector Greenhouse Gas Energy Goal Management System

❍ Necessity

- Achievement of greenhouse gas emission reduction goals of Changwon by reducing emissions and saving energy in the public sector.
- Reduction of greenhouse gas emissions by 20% in the public sector (average in 2007~2009)

❍ Description

- Subjects: 86 divisions (City Hall, business offices, Eup/Myeon/Dong offices)
- Facilities: Buildings and vehicles
- Reduction Goals: 20% (2,898 tons) of existing emissions (14,467 tons) by 2015.

❍ Achievement

- 2011 ~ 2014: 2,895 tons reduced (3%)

❍ Implementation Plan

- Input of phase 1 management plan report: March 30, 2016
- Input of phase 2 implementation plan according to the management goals: Jan. 31, 2016.

8 Carbon Neutrality Program

❍ Necessity

- Taking the initiative for public organizations by a national campaign for voluntary efforts to neutralize (offset) the greenhouse gas emissions generated in daily life.

❍ Description

- Offsetting carbon emissions with energy to be used for domestic or international events in connection with the Green City Thousand Tree Planting Campaign.

❍ Implementation Methods

- Cooperation for achieving a tree planting program by Forest Service and Parks Division.
- Cooperation with divisions organizing large-scale international or domestic events.
- Establishment of carbon neutrality implementation plan.
- Application for the certificate from the Korea Energy Management Corporation.
- Submission of the certificate for joint assessment of the government.

9 Disclosure of Environmental Information

❍ Necessity

- Environmental management in enterprises or organizations, environmental organizations, resource/energy savings, minimization of greenhouse gas emissions and environmental pollution.
- Annual input as the environment information disclosure system for stimulation social responsibility.

❍ Description

- Expansion of the demand for environmental information related to green management as environment-related regulations have been strengthened due to a variety of environmental issues including global warming and resource depletion.
- Increasing policies in the world prompting the disclosure of environmental information including greenhouse gas emissions and environmental reports for activing green management.

❍ Background

- Article 16-8 (Preparation and Disclosure of Environmental Information), Environmental Technology and Industry Support Act.

❍ Implementation Plan

- Subjects to Disclose: 79 sites (city hall and all its affiliated offices)
- Registration and Disclosure: Registration through the end of Sept. every year (Disclosure in Dec.)
- Disclosure Procedure: Registration with the Environmental Information System → Verification of Environmental Information by the Korea Environmental Industry & Technology Institute → Field Investigation → Confirmation of Verification Results → Disclosure

❍ List of Registration Information

- 19 items in 6 categories: Business Profile, Strategy and Green Management System, Resources/Energy, Greenhouse Gas/Environmental Pollution, Green Purchase, Social/Ethical Responsibility

3-2 Formation of Cultural Space For Climate Change Experience

□ **Necessity**

❍ Effort to identify policies to stimulate public participation and infrastructure for low carbon growth

❍ No space to experience or practice climate change actions that can be applied in daily life and that citizens can actually feel climate change and its effects.

❍ Use as the space for youth to experience climate change and to offer education on climate action against carbon emissions.

□ **Strategy and Implementation Direction**

❍ Formation of an education space for improving civic awareness and experience of climate change and enhancing the promotion of climate actions.

❍ Installation of small scale theme park and sculptures themed on climate change.

❍ Experience of the participation in the effort to reduce carbon emission as a space to experience a zero carbon life for 1 night and 2 days.

□ **Implementation Plan**

1 Climate Change Experience Center

❍ Description

- Improvement of the image of Changwon as the leading climate action city and the capital of the environment.
- Formation of an education space for experiencing climate change, enhancing the awareness of climate change and promoting climate change and action among citizens.

❍ Background and Purposes

- Strengthening the need for climate action through the experience of climate change and new renewable energy.
- Maximization of promotion by constructing the Climate Change Energy Experience Center in Jinhae Ocean Solar Park.

❍ Summary

- Location: Jinhae Ocean Park
- Floor area: 14,977㎡(Exhibition Building 6,023㎡)
- Facilities: Tower Building and Exhibition Building
- Tower Building: Landmark tourist attraction with photovoltaic module and night landscape.
- Exhibition Building: For promotion and experience
  - ◦ Exhibition and promotion of professional technology on new recyclable energy, successful cases related to green projects, causes and damages from climate changes.
  - ◦ Facilities enabling visitors to directly experience the need for new renewable energy.

(including a globe showing global warming phenomena, radio or mobile phone chargers using photovoltaic energy)

- Total Project Cost: 3,000 Million KRW

❍ Expected Effects

- Enhancement of the awareness of the severity of climate change and experience of new renewable energy.
- Improvement of usage of ocean park by integrating the relevant facilities in the Jinhae Ocean Solar Park.

2 Installation of Climate Change Theme Park and Sculptures

❍ Description

- Improving the image of Changwon as a climate change model city and the capital of environment in Korea.
- Installation of small-scale theme park and sculptures with materials enabling visitors to feel the climate change.

❍ Summary

- Formation of small-scale climate-related theme park
  - ◦ Location: including Yongji Culture Park
  - ◦ Facilities: Including power generating playground facilities and facilities using natural energy.
  - ◦ Budget: 1,000 Million KRW
- Installation of sculptures acknowledging the severity of global warming.
  - ◦ Sites: including Yongji Culture Park
  - ◦ Area: 10m high, about 5m in depth and width
  - ◦ Implementation method: Design Contest
  - ◦ Budget: 100 Million KRW

❍ Expected Effects

- Enhancement of attention on climate change, improvement of its image as the leading climate action city.
- Enhancement of civic awareness on climate change as citizens participate in the sculpture design contest.

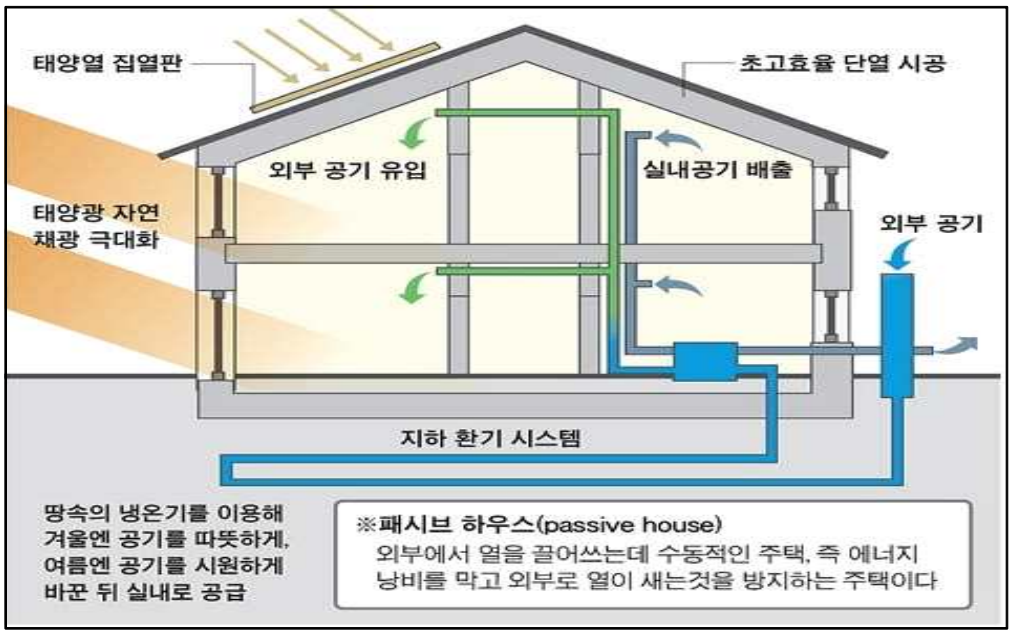
3 Implementation of Climate Change Experience Website

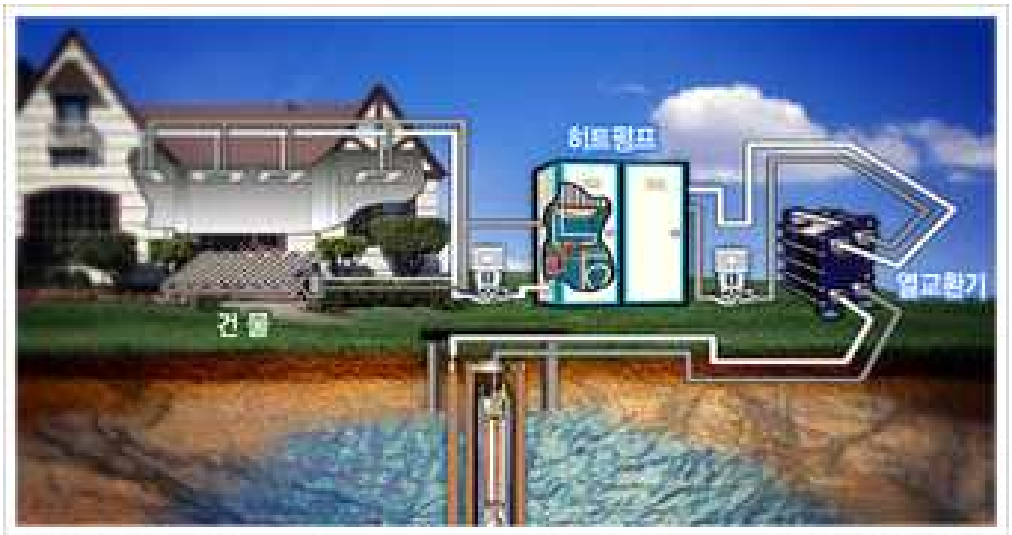
❍ Description

- Formation of a space to educate about the reduction of carbon emissions by a zero-carbon experience for 1 night and 2 days.
- Various kinds of zero-carbon life programs including housing, lighting, air conditioning and cooking.
- Area: Facility dimension 2,000㎡, eco-forest exploration trail 3Km
- Location: around a forestation area enabling ecology exploration.
  - ◦ Including the sun tree forest in Jinbuk, Cheonjabong Exploration Trail and Cheonjusan Mountain Recreation Forest.

❍ Summary

- Experience of zero carbon house
  - ◦ Facilities: Insulated cabin (10 cabins), geothermal air conditioning system
  - ◦ Budget: 2 Billion KRW





Solar Panels		Ultra-High Efficiency Insulation	
Maximization of Natural Lighting using sunlight		Inflow of External Air	
Ventilation of indoor air		External Air	
Underground Ventilation System			
Supply of warm air and cool air into rooms in winter and summer, respectively, using geo-thermal air modification			
※ Passive house Passive house drawing heat from outside, which blocks energy from being wasted and prevents thermal leakage to the outside.			
Heat Pump		Heat Exchanger	
Building			

- Non-carbon Cooking Kit Experience

  ◦Facilities: Solar cooking kit

  ◦Budget: 100 Million KRW

- Clean non-carbon water heater

◦Facilities: Installation of solar water heater

◦Budget: 500 Million KRW

- Generation of renewable energy for resorts

◦Facilities: Wind power generation complex

◦Budget: 300 Million KRW

- Carbon Sink Forest Tour

  ◦Facilities: Ecology Exploration Trail, Wind Path

  ◦Budget: 300 Million KRW