

INTRODUCTION TO SUSTAINABILITY

13006103: Life and Environment

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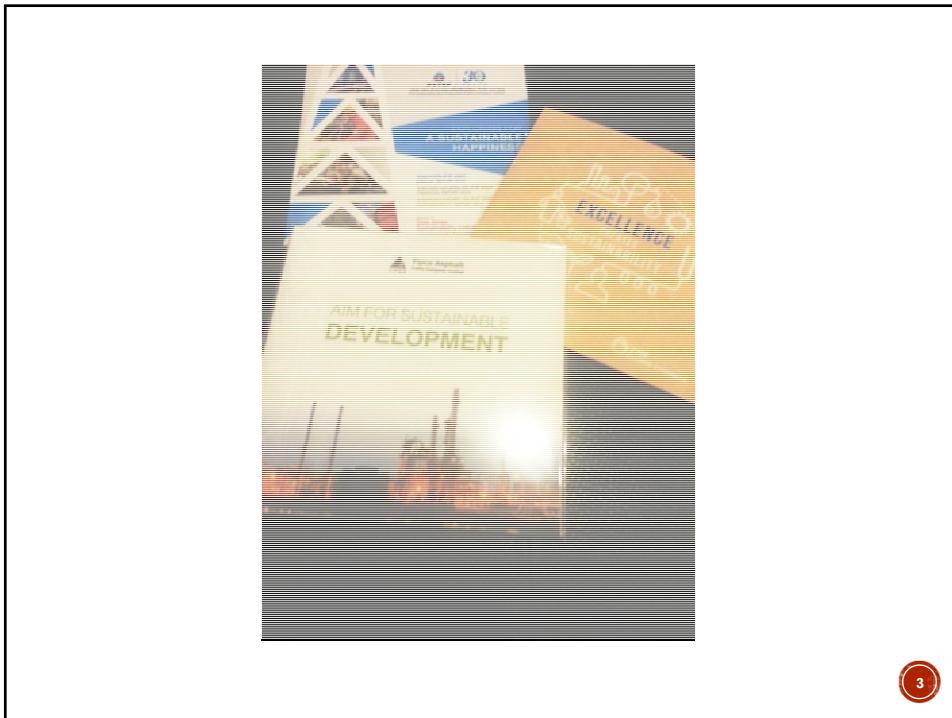


COURSE GRADING AND EVALUATION

- Examination (30%)
- Assignments (70%)

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WHAT IS SUSTAINABILITY?

The diagram consists of a large circle divided into three segments. The left segment is labeled 'Society' in red and shows a group of people. The right segment is labeled 'Economy' in blue and shows a factory or industrial building. The bottom segment is labeled 'Environment' in green and shows a landscape with trees and water. In the center of the circle, the words 'Sustainable Development' are written in white.

- Sustainable development has been defined in many ways, but the most frequently quoted definition is from **Our Common Future**, also known as the **Brundtland Report** (WECD, 1987):
- "Sustainable development is development that **meets the needs of the present without compromising the ability of future generations to meet their own needs**. It contains within it two key concepts:
 - the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
 - the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

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GOAL 1

END POVERTY IN ALL ITS FORMS EVERYWHERE

- Eradicate extreme poverty (less than \$1.25 per day) for all people everywhere
- Ensure that all men and women have equal rights to economic resources
- Reduce the poor's exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
- Create sound policy frameworks at the national, regional and international levels to support accelerated investment in poverty eradication actions

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GOAL 2
END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

- End hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
- Double the agricultural productivity and incomes of small-scale food producers
- Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change
- Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks
- Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies
- Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility

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GOAL 3
ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL AT ALL AGES

- Reduce the global maternal mortality ratio to less than 70 per 100,000 live births
- End preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births
- Halve the number of global deaths and injuries from road traffic accidents
- Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate

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GOAL 4**ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL**

- Ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes
- Substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education
- Substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries

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GOAL 5**ACHIEVE GENDER EQUALITY AND EMPOWER ALL WOMEN AND GIRLS**

- End all forms of discrimination against all women and girls everywhere
- Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life
- Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences

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GOAL 6
ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

- Achieve universal and equitable access to safe and affordable drinking water for all
- Achieve access to adequate and equitable sanitation and hygiene for all and end open defecation
- Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

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GOAL 7
ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

- Increase substantially the share of renewable energy in the global energy mix
- Double the global rate of improvement in energy efficiency
- Enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

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GOAL 8

PROMOTE SUSTAINED, INCLUSIVE AND SUSTAINABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL

- Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries
- Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services
- Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour

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GOAL 9

BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION

- Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
- Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
- Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets

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GOAL 10 REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES

- Progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average
- Ensure equal opportunity and reduce inequalities of outcome, including by
- Eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard

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GOAL 11 MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

- Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
- Enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries
- Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

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GOAL 12

ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

- Halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
- Achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
- Substantially reduce waste generation through prevention, reduction, recycling and reuse

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GOAL 13

TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
- Integrate climate change measures into national policies, strategies and planning
- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
- Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

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GOAL 14
CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES
FOR SUSTAINABLE DEVELOPMENT

- Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
- By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

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GOAL 15
PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS,
SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND
REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

- By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally
- Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

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GOAL 16

PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT,
PROVIDE ACCESS TO JUSTICE FOR ALL AND BUILD EFFECTIVE, ACCOUNTABLE AND
INCLUSIVE INSTITUTIONS AT ALL LEVELS

- Significantly reduce all forms of violence and related death rates everywhere
- Promote the rule of law at the national and international levels and ensure equal access to justice for all
- By 2030, provide legal identity for all, including birth registration
- Promote and enforce non-discriminatory laws and policies for sustainable development

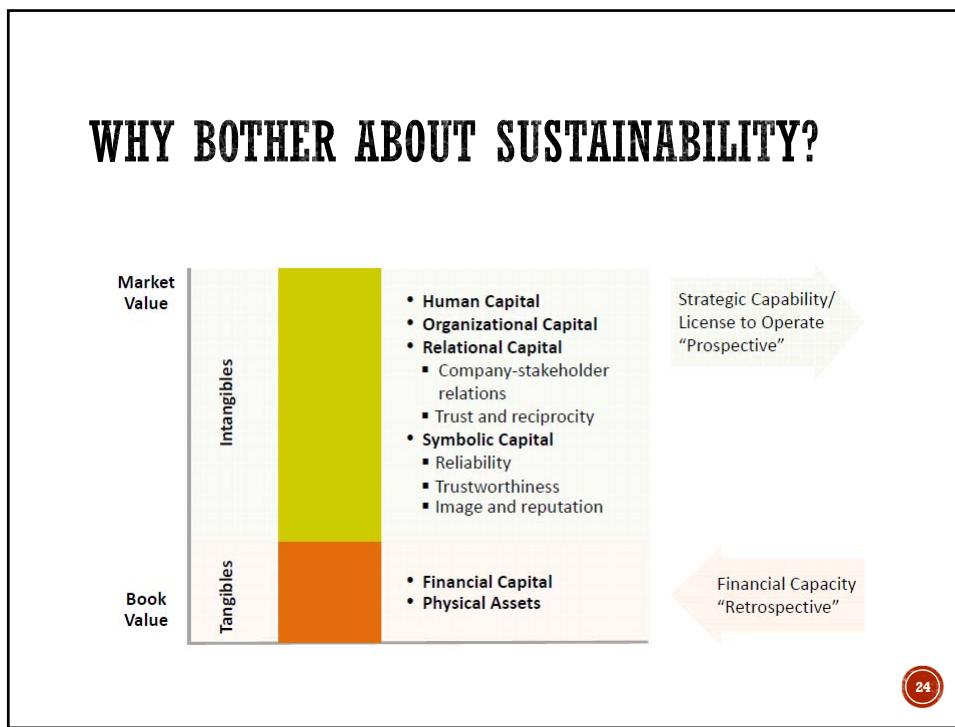
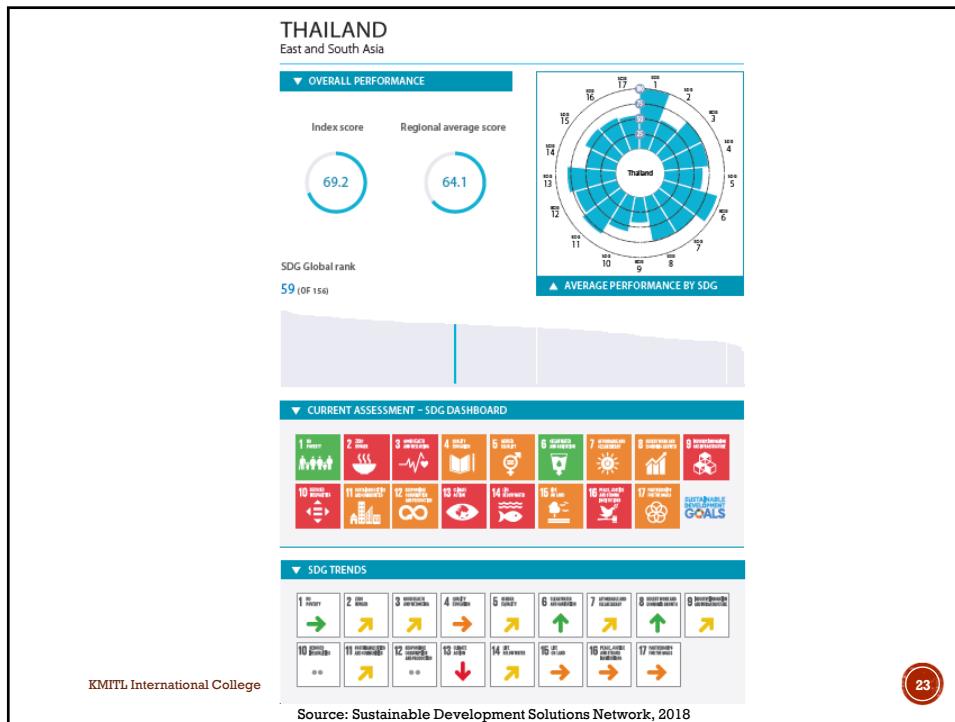
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GOAL 17

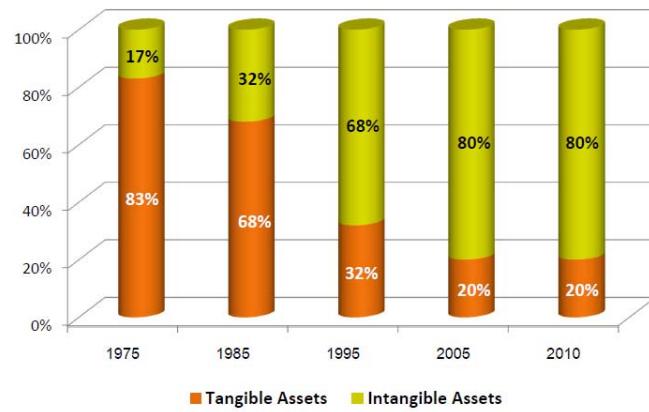
STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT

- Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection
- Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed
- Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions

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COMPONENTS OF S&P 500 MARKET VALUE



Source: Ocean Tomo, 2013

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WHY BOTHER ABOUT SUSTAINABILITY? (CONT.)



- The Dow Jones Sustainability Indices (DJSI) serve as benchmarks for investors who integrate **sustainability considerations** into their portfolios, and provide an effective engagement platform for companies who want to adopt sustainable best practices.

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WHY BOTHER ABOUT SUSTAINABILITY? (CONT.)

- 2,528 companies listed on global stock exchanges (DJSI World) and another 803 firms listed on emerging markets based on market capitalization
- DJSI World – KBANK, PTT, PTTEP, PTTGC, SCC
- DJSI Emerging Markets – AOT, BANPU, CPALL*, CPF, CPN, HMPRO*, IRPC, IVL*, MINT, TOP, TRUE*, TU

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ข่าวรอบวัน
17 บจ.ติด “DJSI” ปี 2017 CPALL, IVL, HMPRO, TRUE เข้าร่วมติด Emerging Markets

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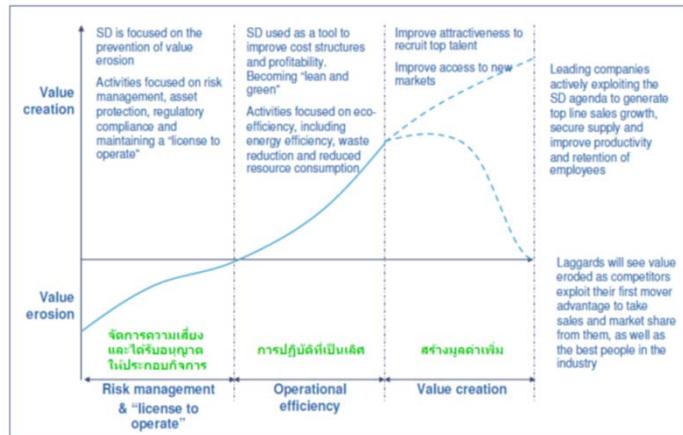
Industry Group Leaders 2017

For each of the 24 industry groups represented in the Dow Jones Sustainability Index, you find a detailed report on the respective RobecoSAM industry group leader below.

Name	Industry Group	Country	Report
Peugeot SA	Automobiles & Components*	France	
Westpac Banking Corp	Banks	Australia	
CNH Industrial NV	Capital Goods	United Kingdom	
SGS SA	Commercial & Professional Services	Switzerland	
LG Electronics Inc	Consumer Durables & Apparel	Republic of Korea	
InterContinental Hotels Group PLC	Consumer Services	United Kingdom	
UBS Group AG	Diversified Financials	Switzerland	
Thai Oil PCL	Energy	Thailand	
METRO AG	Food & Staples Retailing	Germany	
Coca-Cola HBC AG	Food, Beverage & Tobacco	Switzerland	
Abbott Laboratories	Health Care Equipment & Services	United States	
Henkel AG & Co KGaA	Household & Personal Products	Germany	
Allianz SE	Insurance	Germany	
Grupo Argos SA/Colombia	Materials	Colombia	
Pearson PLC	Media	United Kingdom	
Roche Holding AG	Pharmaceuticals, Biotechnology & Life Sciences	Switzerland	
Mirvac Group	Real Estate	Australia	
Industria de Diseno Textil SA	Retailing	Spain	
Advanced Semiconductor Engineering Inc	Semiconductors & Semiconductor Equipment	Taiwan	
Amadeus IT Group SA	Software & Services	Spain	
Konica Minolta Inc	Technology Hardware & Equipment	Japan	
Koninklijke KPN NV	Telecommunications	Netherlands	
Royal Mail PLC	Transportation	United Kingdom	
Red Electrica Corp SA	Utilities	Spain	

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WHY BOTHER ABOUT SUSTAINABILITY? (CONT.)



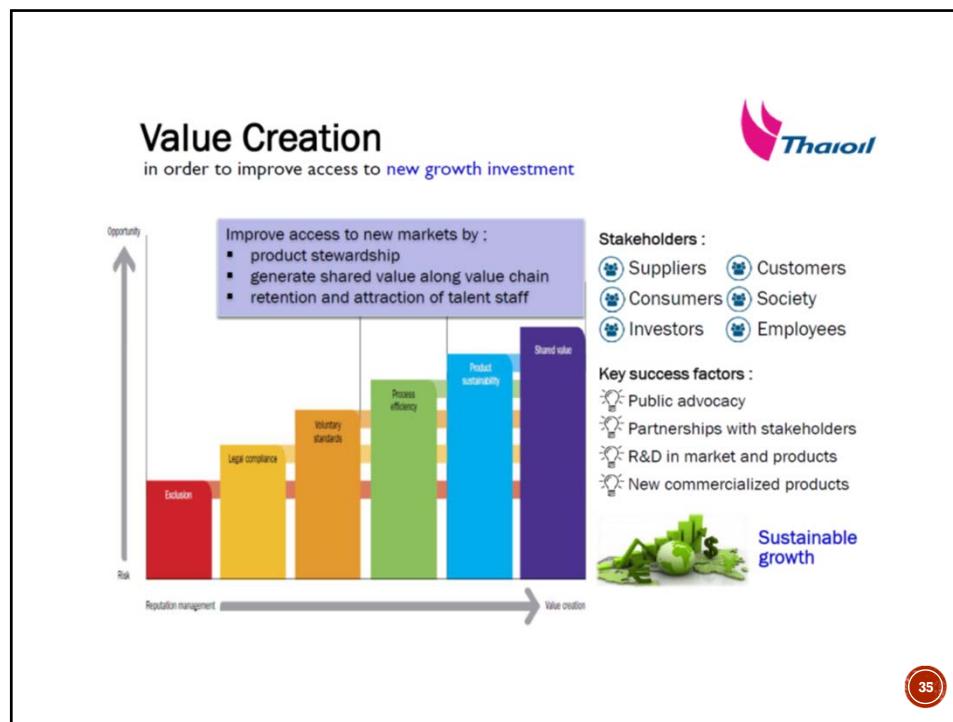
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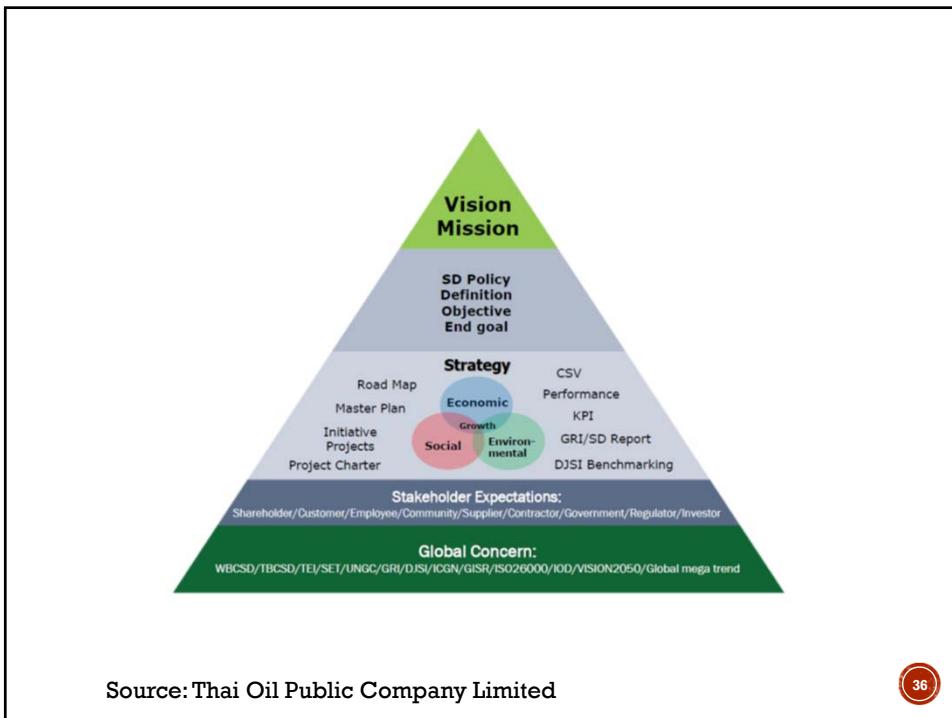
License to Operate

In order to provide [license to operate](#) and business reliability

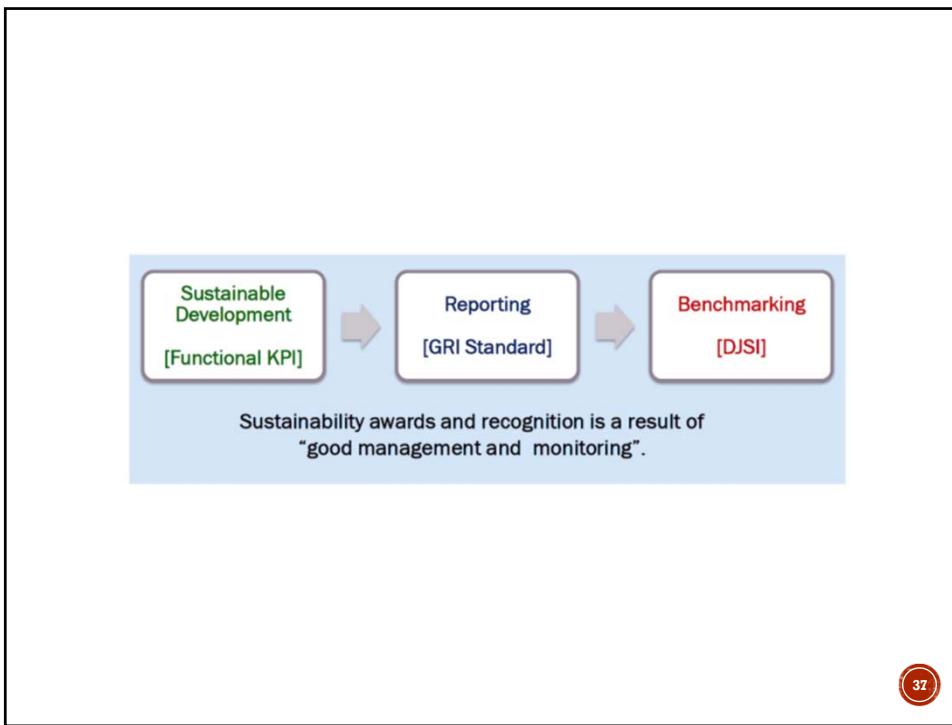


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WHY BOTHER ABOUT SUSTAINABILITY? (CONT.)

- The FTSE4Good Index Series is designed to measure the performance of companies demonstrating strong **Environmental, Social and Governance (ESG)** practices. Transparent management and clearly-defined ESG criteria make FTSE4Good indices suitable tools to be used by a wide variety of market participants when creating or assessing responsible investment products.



FTSE4Good

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WHY BOTHER ABOUT SUSTAINABILITY? (CONT.)

- International Finance Corporation (IFC), a member of the World Bank Group, is the largest global development institution focused exclusively on the private sector in developing countries.
- IFC Performance Standards



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GREEN CAMPUS



University	Country	Score	Students	Faculty	Expenditure	Revenue	Debt	Endowment	Net Assets	Detail
Universidad de Zaragoza	Spain	89	6,179	420	1,730	1,425	950	1,200	455	Detail
Universitas Diponegoro	Indonesia	90	6,172	621	1,420	1,500	525	1,375	731	Detail
Thammasat University	Thailand	91	6,164	446	1,385	1,575	775	1,375	608	Detail
Universidad Autonoma de Nuevo Leon	Mexico	92	6,138	692	1,445	1,425	875	1,108	594	Detail
Universiti Tunku Abdul Rahman	Malaysia	93	6,124	558	1,385	1,575	875	1,350	381	Detail
Bangkok University	Thailand	94	6,116	581	1,545	1,800	660	1,375	155	Detail
Indiana University Bloomington	US	95	6,102	615	1,245	1,425	1,000	1,300	517	Detail
University of Bologna	Italy	96	6,094	557	1,460	1,650	750	1,325	351	Detail
Carleton University	Canada	97	6,074	350	1,360	1,800	1,000	1,125	439	Detail

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อันดับ ในไทย	อันดับ โลก	มหาวิทยาลัย	คะแนน
1	30	จุฬาลงกรณ์มหาวิทยาลัย	6219
2	52	มหาวิทยาลัยเทคโนโลยีสุรนารี	5888
3	54	มหาวิทยาลัยเกษตรศาสตร์	5876
4	61	มหาวิทยาลัยมหาสารคาม	5824
5	71	มหาวิทยาลัยเดลินส์	5736
6	73	มหาวิทยาลัยราชภัฏสระบุรี	5726
7	77	มหาวิทยาลัยมหิดล	5701
8	78	มหาวิทยาลัยมหิดลและมหาวิทยาลัยศรีนครินทรวิโรฒ	5686
9	95	มหาวิทยาลัยธรรมศาสตร์	5522
10	124	มหาวิทยาลัยแม่ฟ้าหลวง	5147
11	156	มหาวิทยาลัยเชียงราย	4800
12	185	สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง	4480
13	200	มหาวิทยาลัยเชียงใหม่	4342
14	216	มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี	4221
15	230	มหาวิทยาลัยราชภัฏราษฎร์	4055
16	287	มหาวิทยาลัยราชภัฏอุบลราชธานี	3559
17	312	มหาวิทยาลัยราชภัฏมหาสารคาม	3253
18	330	มหาวิทยาลัยราชภัฏฯ	3079
19	353	มหาวิทยาลัยราชภัฏราชบูรณะ	2866



บกส. คัว ถนน 2 ของไทย
อันดับ 52 ของมหาวิทยาลัยสีเขียวโลก

จากผลการอันดับมหาวิทยาลัยสีเขียวโลก
UI GreenMetric World University Ranking 2015
ยังคงคว้าอันดับ 2 ของประเทศไทยและอันดับ 4 ของโลก



10 อันดับมหาวิทยาลัยสีเขียวของไทย ประจำปี 2559




จุฬาฯ มหาวิทยาลัยสีเขียว
อันดับ 1 ของประเทศไทย
อันดับ 30 ของโลก
และ อันดับ 4 ของโลก
ประเกก City Center University

โดย UI Green Metric World University Ranking 2015

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CLIMATE CHANGE

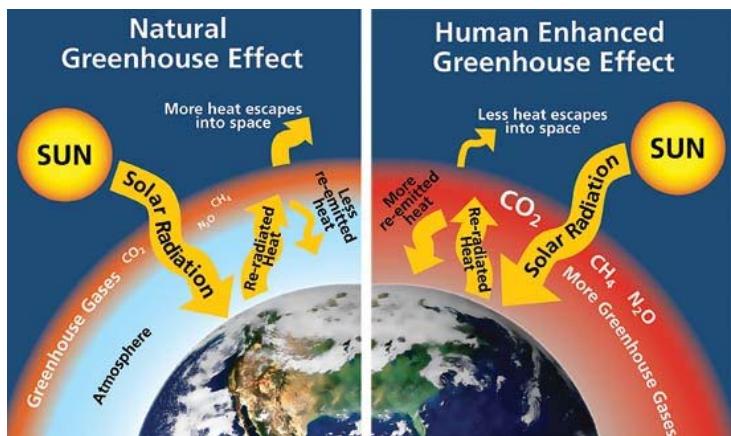


Kerstin Langenberger
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GREENHOUSE EFFECT



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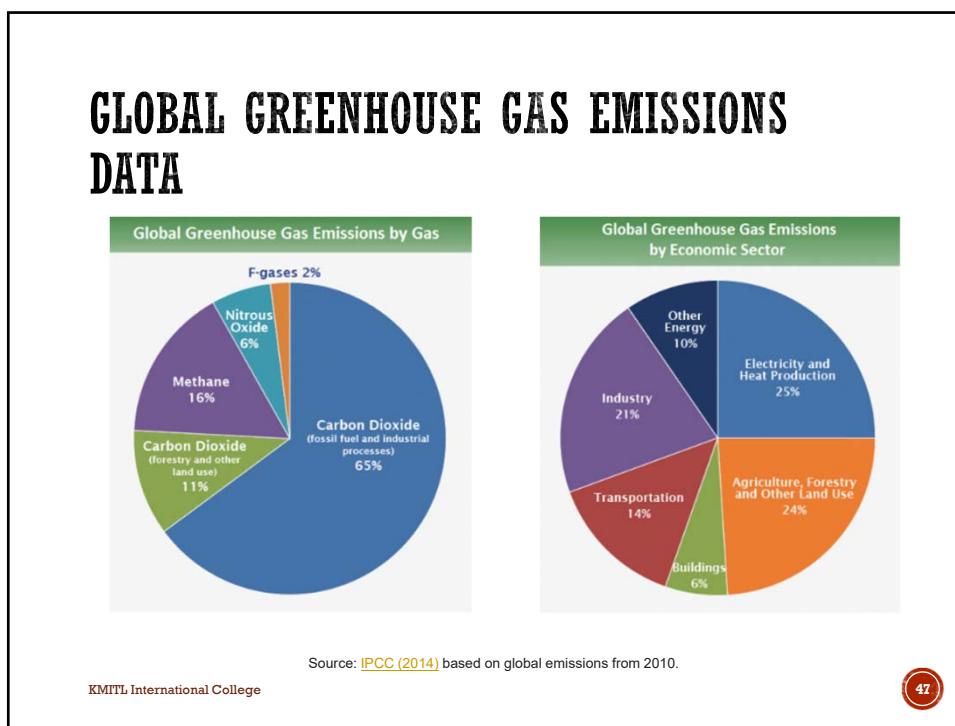
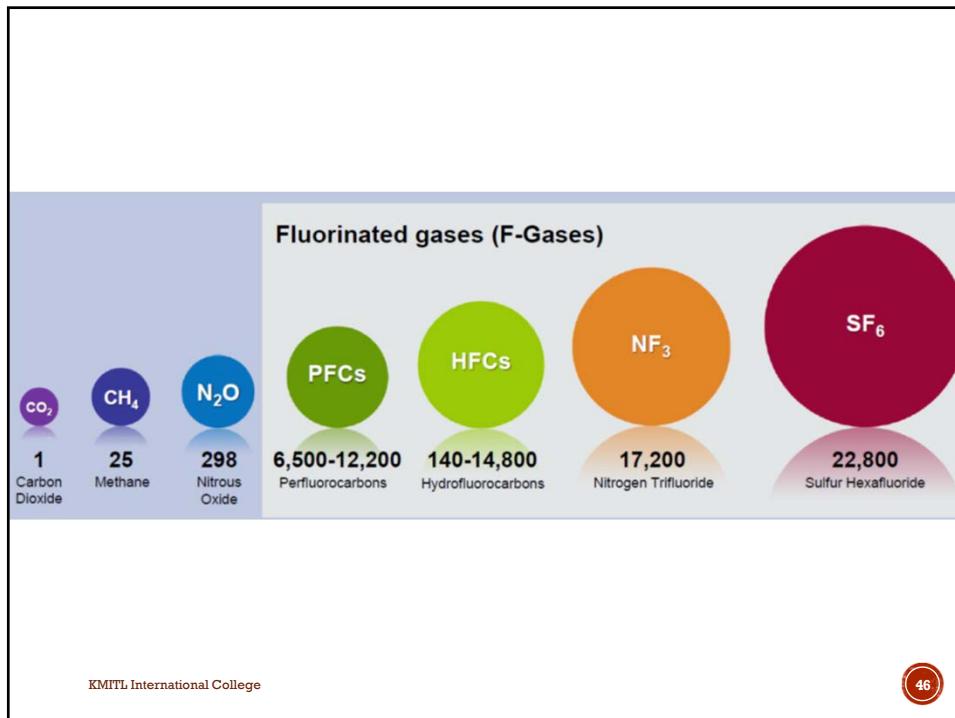
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GREENHOUSE GASES

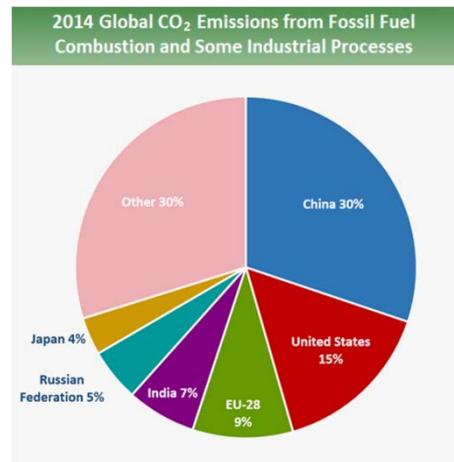
- **Carbon dioxide (CO₂):** Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- **Methane (CH₄):** Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- **Nitrous oxide (N₂O):** Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- **Fluorinated gases:** Hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases ("High GWP gases").

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GLOBAL GREENHOUSE GAS EMISSIONS DATA



KMITL International College Source: Boden, T.A., Marland, G., and Andres, R.J. (2017). [National CO₂ Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1751–2014](#)

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CLIMATE CHANGE - EVIDENCE



*Scientific evidence for warming of the climate system
is unequivocal.*

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- Intergovernmental Panel on Climate Change

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CLIMATE CHANGE - EVIDENCE

Sea level rise

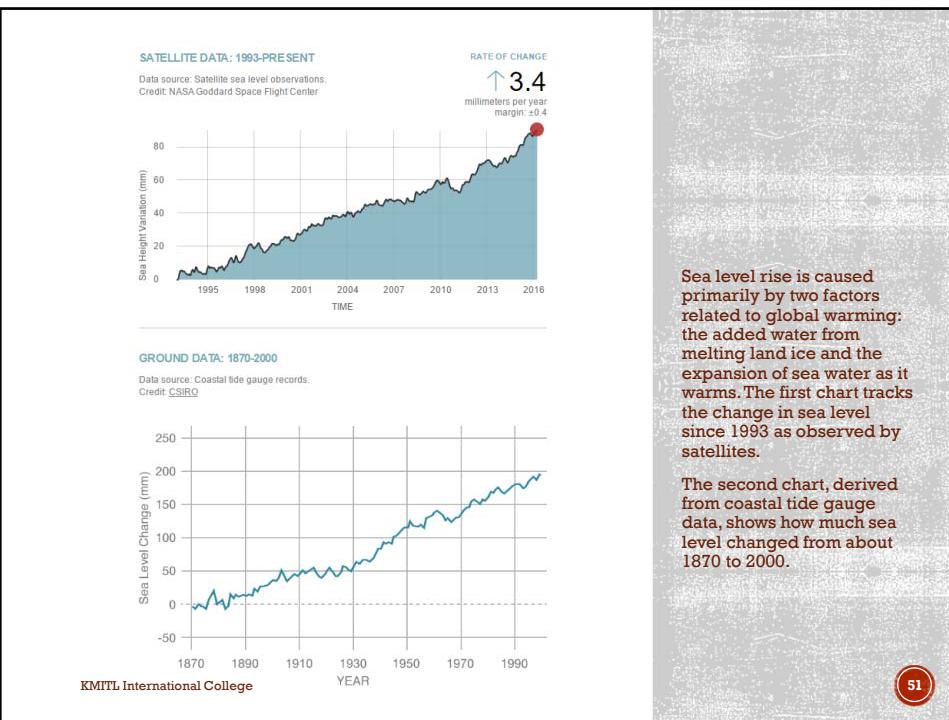


Global sea level rose about 17 centimeters (6.7 inches) in the last century. The rate in the last decade, however, is nearly double that of the last century.⁴

Image: Republic of Maldives: Vulnerable to sea level rise

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CLIMATE CHANGE - EVIDENCE

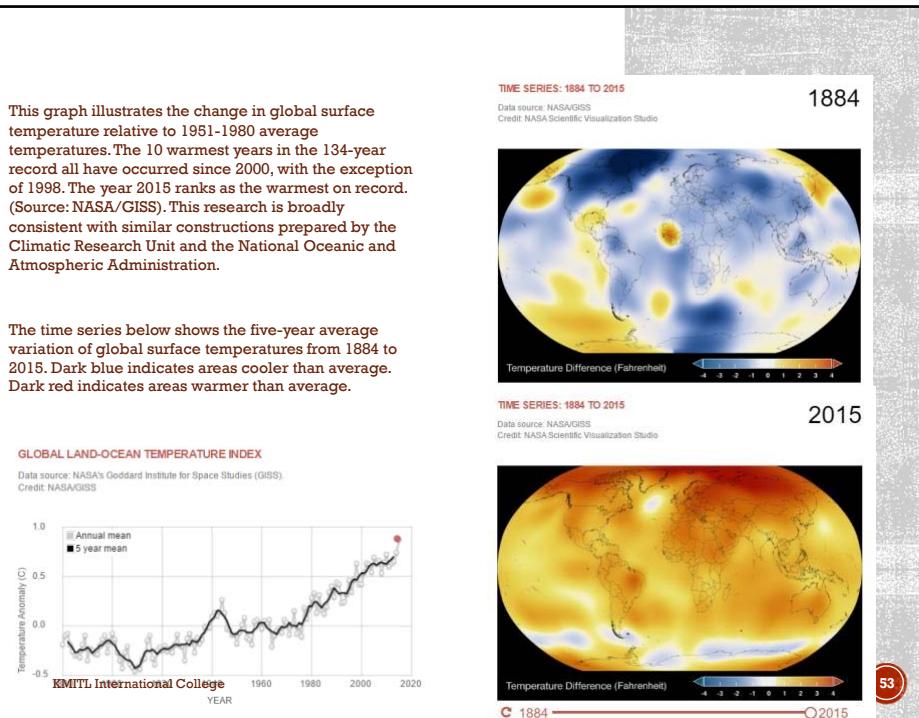
Global temperature rise



All three major global surface temperature reconstructions show that Earth has warmed since 1880.⁵ Most of this warming has occurred since the 1970s, with the 20 warmest years having occurred since 1981 and with all 10 of the warmest years occurring in the past 12 years.⁶ Even though the 2000s witnessed a solar output decline resulting in an unusually deep solar minimum in 2007-2009, surface temperatures continue to increase.⁷

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CLIMATE CHANGE - EVIDENCE

Warming oceans



The oceans have absorbed much of this increased heat, with the top 700 meters (about 2,300 feet) of ocean showing warming of 0.302 degrees Fahrenheit since 1969.

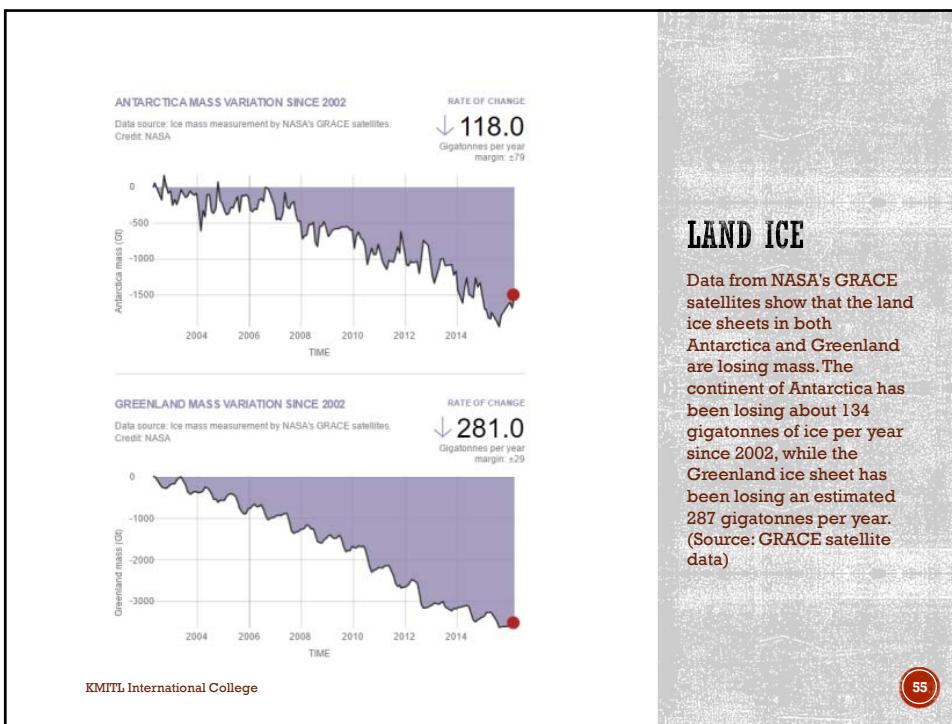
Shrinking ice sheets

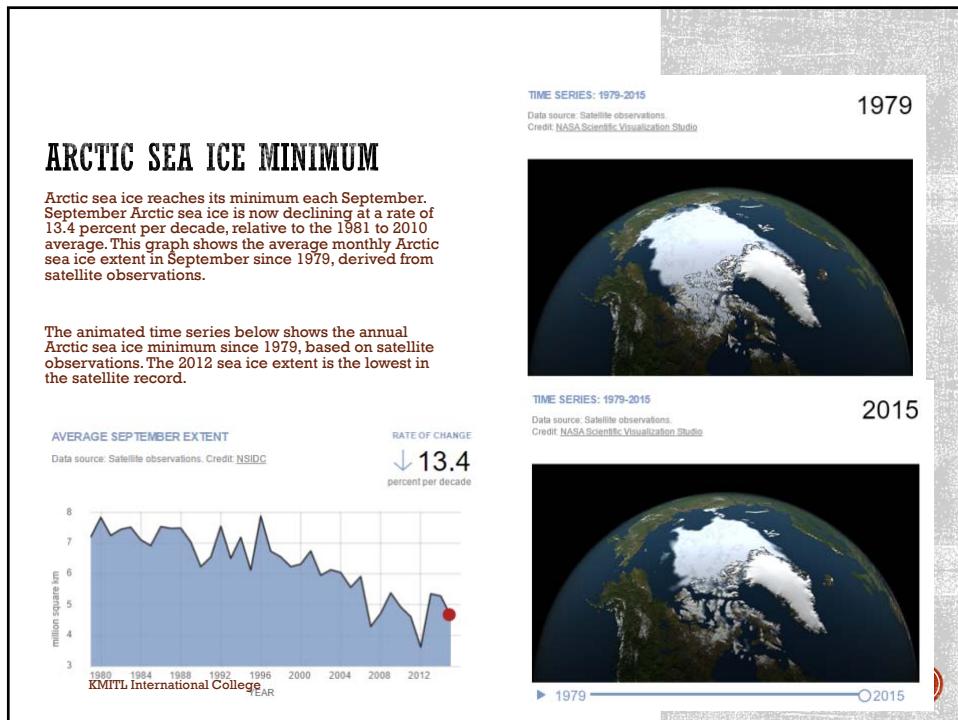


The Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost 150 to 250 cubic kilometers (36 to 60 cubic miles) of ice per year between 2002 and 2006, while Antarctica lost about 152 cubic kilometers (36 cubic miles) of ice between 2002 and 2005.

Image: Flowing meltwater from the Greenland ice sheet

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THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

- The UNFCCC is a “Rio Convention”, one of three adopted at the “Rio Earth Summit” in 1992.
- 197 countries that have ratified the Convention are called Parties to the Convention.



United Nations
Framework Convention on
Climate Change

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KYOTO PROTOCOL

- The Kyoto Protocol is an international agreement linked to the UNFCCC, which commits its Parties by setting internationally binding emission reduction targets.
- The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. Its first commitment period started in 2008 and ended in 2012.
- In Doha, Qatar, on 8 December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted.
- During the first commitment period, 37 industrialized countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020

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KYOTO MECHANISMS

- International Emissions Trading
 - Parties with commitments under the Kyoto Protocol (Annex B Parties) have accepted targets for limiting or reducing emissions. These targets are expressed as levels of allowed emissions, or "assigned amounts," over the 2008-2012 commitment period. The allowed emissions are divided into "assigned amount units" (AAUs).
 - Emissions trading, as set out in Article 17 of the Kyoto Protocol, allows countries that have emission units to spare - emissions permitted them but not "used" - to sell this excess capacity to countries that are over their targets. This is known as the "carbon market."
- Clean Development Mechanism (CDM)
 - CDM allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO₂, which can be counted towards meeting Kyoto targets.
- Joint implementation (JI)
 - JI allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Party) to earn emission reduction units (ERUs) from an emission-reduction or emission removal project in another Annex B Party, each equivalent to one tonne of CO₂, which can be counted towards meeting its Kyoto target.
 - Joint implementation offers Parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host Party benefits from foreign investment and technology transfer.

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THE PARIS AGREEMENT

- At COP 21 in Paris, Parties to the UNFCCC reached a historic agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs).
- Keep global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius
- The Paris Agreement entered into force on 4 November 2016. So far, 151 Parties have ratified of 197 Parties to the Convention

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ECOLOGICAL FOOTPRINT

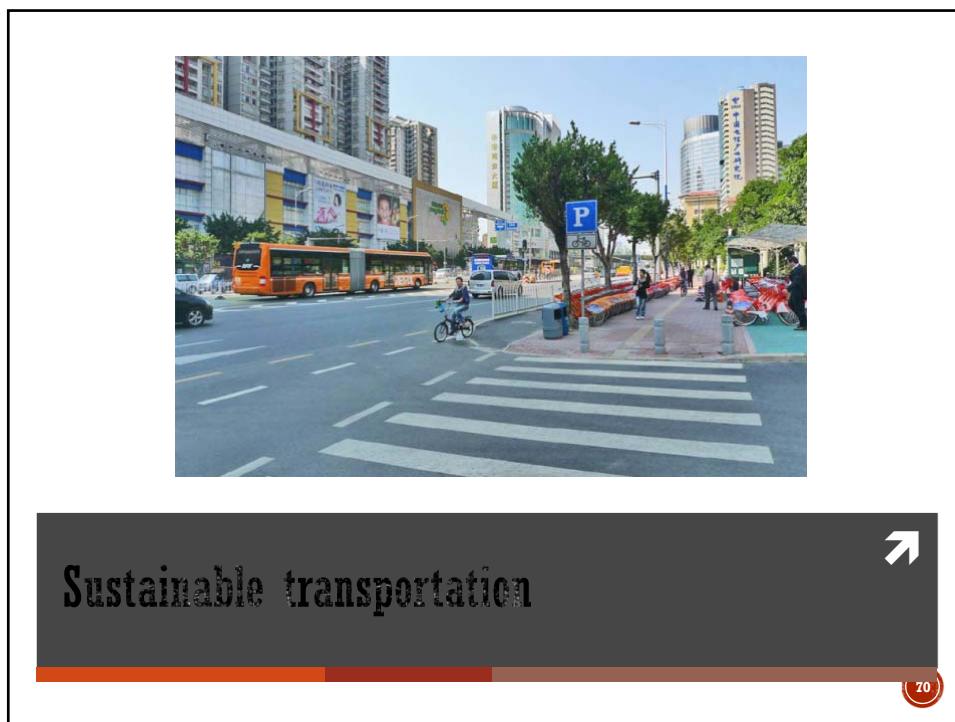
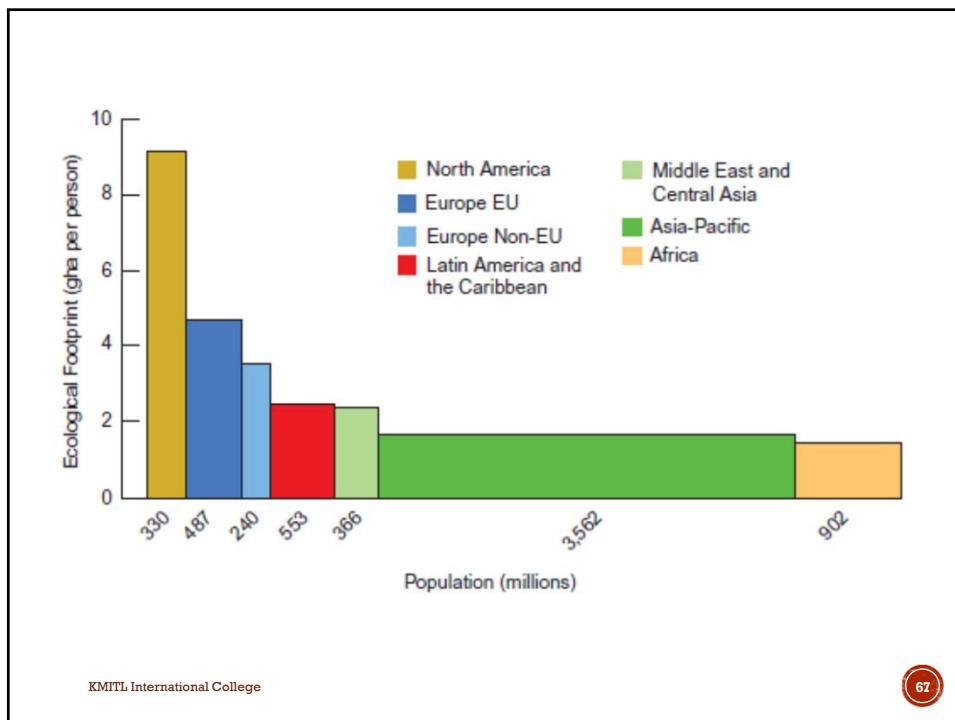
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ECOLOGICAL FOOTPRINT

- Can the earth sustain our current lifestyles? Will there be adequate natural resources for future generations?
- Living sustainably means meeting our own vital needs without compromising the ability of future generations to meet their own needs.
- Redefining Progress, a nongovernmental environmental organization, has developed a measure called the ecological footprint to compute the demands placed on nature by individuals and nations.
- The average world citizen has an ecological footprint equivalent to 2.3 hectares (5.6 acres), while the biologically productive land available is only 1.9 hectares (ha) per person.

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THE PROBLEMS OF AUTOMOBILE DEPENDENCE

Environmental problems	Economic problems	Social problems
Oil vulnerability	Congestion costs	Loss of street life
Urban sprawl	High urban infrastructure costs for sewers, water mains, roads, etc.	Loss of community in neighbourhoods
Photochemical smog	Loss of productive rural land	Loss of public safety
Acid rain	Loss of urban land to pavement	Isolation in remote suburbs with few amenities
High greenhouse gases – global warming	Poor transit cost recovery	Access problems for those without cars or access to cars and those with disabilities
Greater storm water runoff problems	Economic and human costs of transportation accident trauma and death	Road rage
Traffic problems: noise, neighbourhood severance, visual intrusion, physical danger	High proportion of city wealth spent on passenger transportation	Anti-social behaviour due to boredom in car-dependent suburbs
Decimated transit systems	Public health costs from air and other pollution Health costs from growing obesity due to sedentary auto lifestyles	Enforced car ownership for lower-income households Physical and mental health problems related to lack of physical activity in isolated suburbs

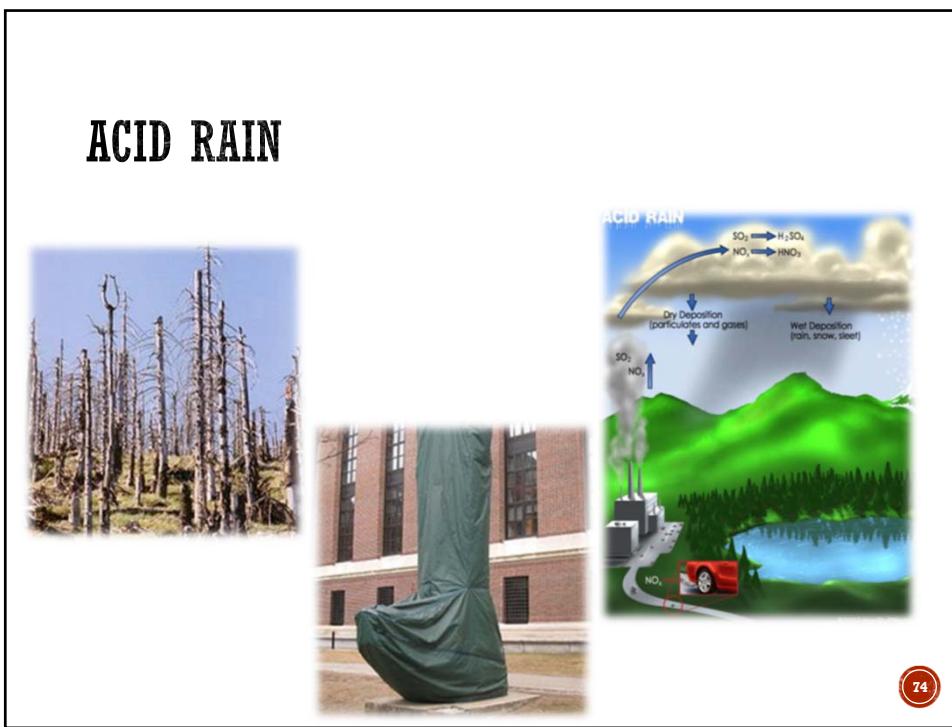
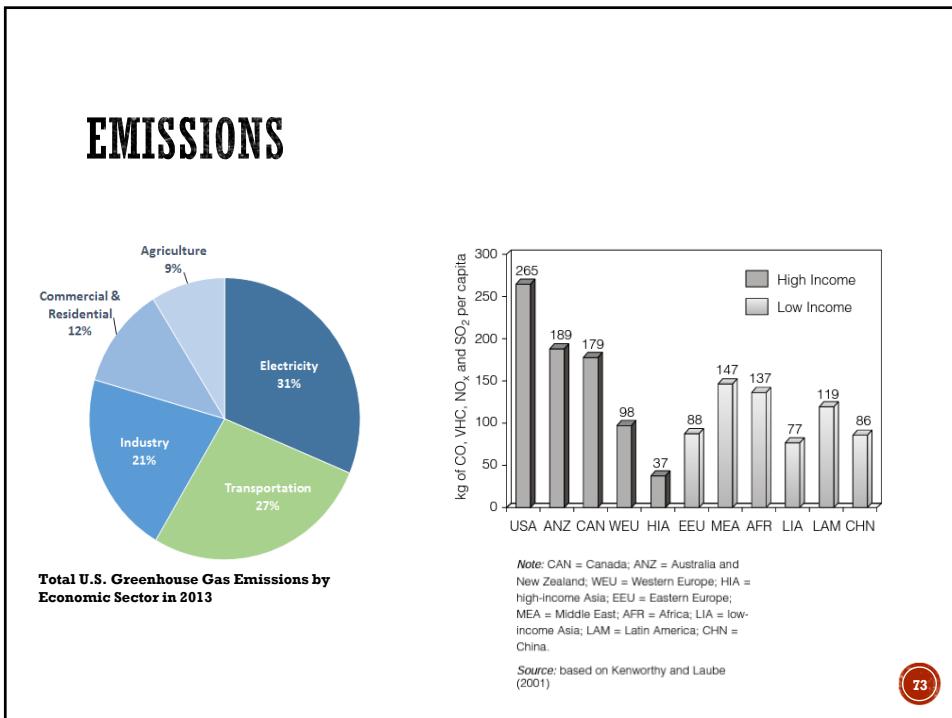
Source: Jeffrey R. Kenworthy

11

ENVIRONMENTAL PROBLEMS

- An average American city of 400,000 inhabitants uses as much energy for private passenger transportation as an average Chinese city of 10 million people.
- Greenhouse gases and emissions such as carbon monoxide, volatile hydrocarbons and nitrogen oxides, which contribute to the formation of photochemical smog.
- Sulphur dioxide (from transportation and industry), when mixed with precipitation causes acid rain, which results in the acidification of inland waters and kills native forests (e.g. the Black Forest in Germany and Switzerland).
- Automobile-dependent cities also lose large quantities of productive land or natural areas to suburban sprawl every year. With the peaking of world oil production, cities increasingly need to retain as much near-city agricultural production as possible to minimize the energy content of food.

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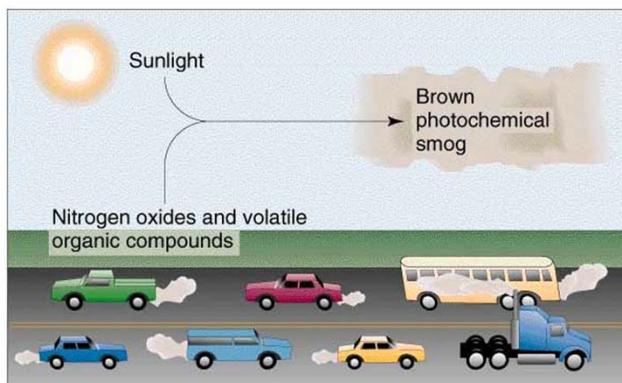


ACID RAIN EFFECT IN THE BLACK FOREST

- Some of the most dramatic effects on forests have been observed in Europe. In 1983, a survey in West Germany showed that 34 % of the country's total forest is damaged by air pollution. This included about one half of the famous Black Forest. Switzerland has recorded damage to 14 % of her forest trees.

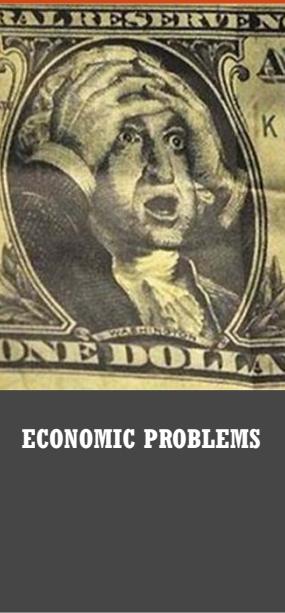
75

PHOTOCHEMICAL SMOG



(b) Photochemical smog

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ECONOMIC PROBLEMS

- Automobile cities suffer a number of economic impacts, such as congestion costs in terms of lost time and the high costs of urban infrastructure for the extra distances that must be traversed for water, sewage and drainage systems, roads, and a variety of social infrastructure such as schools, medical centers and community halls that must be duplicated as the city spreads.
- There are large economic costs associated with road accidents and deaths in cities. About 45,000 people die on US roads per year, equivalent to a full-scale war. Road accidents cost developing countries US\$100 billion per annum

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ECONOMIC PROBLEMS (CONT.)

- The biggest cost to cities of dependence on cars comes when one adds up all the operating and infrastructure investment costs for both private and public transportation and normalizes it according to wealth (i.e. as a percentage of gross domestic product – GDP).

Average Annual Cost of Owning a Car: \$10,452
Based on 18,000km of driving per year



Category	Cost	Rate per km
1. Value Depreciation	\$3,634	20¢/km
2. Auto Insurance	\$2,867	15¢/km
3. Fuel Costs*	\$1,821	10¢/km
4. Maintenance & Repair	\$1,180	7¢/km
5. Financing Charges	\$1,025	7¢/km
6. License & Registration	\$124	1¢/km

*Based on Condition Automobile Association 2012 Driving Costs, \$1/JL/km

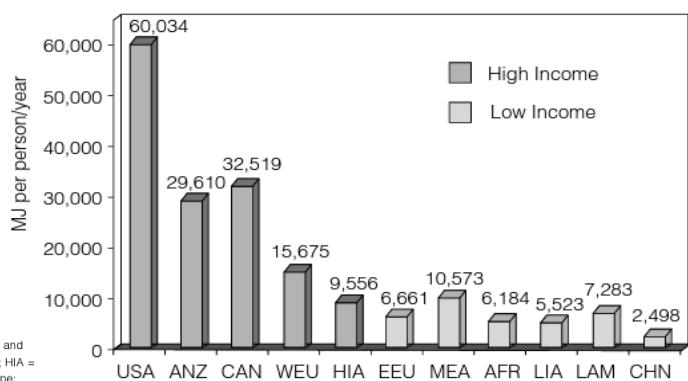
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CAR OWNERSHIP COSTS



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ENERGY CONSUMPTION



Note: CAN = Canada; ANZ = Australia and New Zealand; WEU = Western Europe; HIA = High-income Asia; EEU = Eastern Europe; MEA = Middle East; AFR = Africa; LIA = low-income Asia; LAM = Latin America; CHN = China.

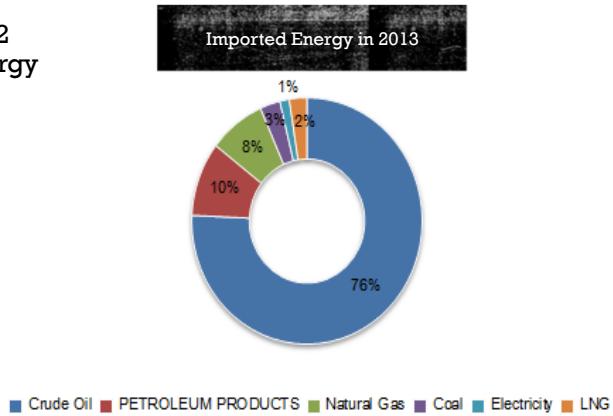
Source: based on Kenworthy and Laube (2001)

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SUSTAINABLE TRANSPORTATION (CONT.)

- Thailand imports approximately 1.42 billion baht of energy yearly.
- 76% of imported energies are oil.

Imported Energy in 2013



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**ไทยติดอันดับ 6 ทั่วโลก
ตายด้วยอุบัติเหตุ
บนท้องถนน**

สหราชอาณาจักร มีนักท่องเที่ยว มาเลียเช็คที่ไทย เป็นอันดับ 2

2 นักปั่นจักรยาน สามีกรรยาชาวอังกฤษ เสียชีวิตในไทย หลังจาก ตระเวบปั่นจักรยาน มาแล้ว 23 ประเทศ

ประ掏ต่างๆ เริ่มต้นตัว เมืองเพลเมืองระวงศ์ตัว หากมาเยือนไทย

ข้อมูลจาก องค์การอนามัยโลก วันที่ 19 ก.พ. 56

FLASH NEWS

ภาพนี้เป็นภาพจากกรณีอุบัติเหตุที่เกิดขึ้นในประเทศไทย



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SUSTAINABLE TRANSPORTATION

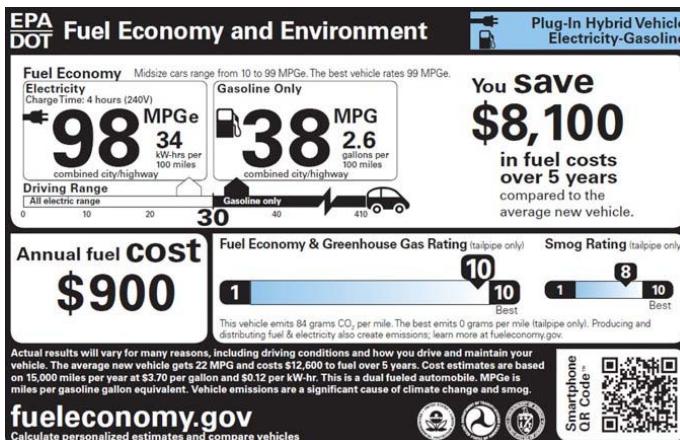
- It is about making important everyday destinations, such as shopping, employment, basic services and recreation, **closer and more accessible**, rather than **increasing mobility in order to overcome inaccessibility**.
- It is about **healthier ways** of getting around communities – ways that improve the individual's health through more activity: the few minutes' walk to the transit stop or station or the pleasant bicycle trip to the store.
- It attempts to find ways of improving the health of communities through **lowering traffic** and its accompanying **pollution and safety hazards**.

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CAFE, LABELLING, AND GAS GUZZLER TAX

- **Corporate Average Fuel Economy (CAFE)** requires vehicle manufacturers to comply with the gas mileage, or fuel economy, standards set by the Department of Transportation (DOT). CAFE values are obtained using the city and highway fuel economy test results and a weighted average of vehicle sales. Tests are conducted in a laboratory by operating vehicles on a dynamometer. EPA administers the testing program that generates the fuel economy data.
- **The Gas Guzzler Tax** is imposed on manufacturers of new cars (not minivans, sport utility vehicles or pick-up trucks) that do not meet required fuel economy levels, to discourage the production and purchase of fuel-inefficient vehicles. The tax is collected by the Internal Revenue Service and paid by the manufacturer. The amount of the tax is displayed on the vehicle's fuel economy label (the window sticker on new cars).

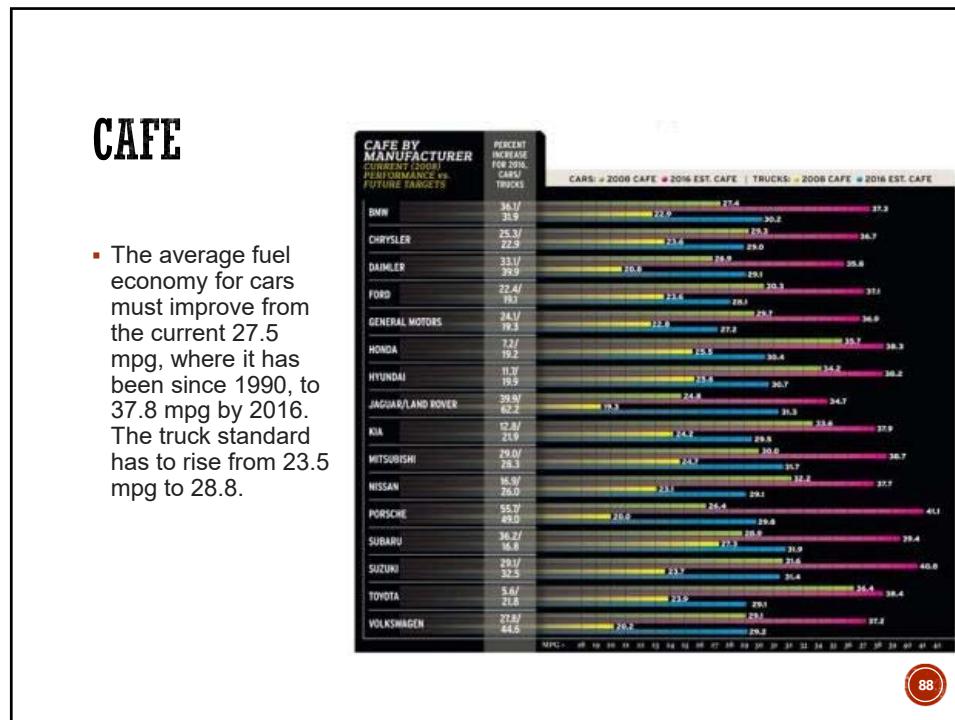
85



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 United States Environmental Protection Agency		Office of Transportation & Air Quality EPA-420-B-14-015 March 2014
MPG: Label Values vs. Corporate Average Fuel Economy (CAFE) Values		
Label MPG	CAFE MPG	
1. Examples (MPG for average new car)		
<ul style="list-style-type: none"> Today (MY 2014): 24 2025: 40 		<ul style="list-style-type: none"> Today (MY 2014): 31 2025: 50
2. Where you'll find it		
<ul style="list-style-type: none"> On the Fuel Economy and Environment Label that is part of the window sticker on new vehicles on auto dealership lots Websites: Fueleconomy.gov – EPA/DOE comprehensive vehicle website—and other vehicle search sites Labels provide a single combined value, as well as separate city and highway values; automakers and/or dealers sometimes display only the highest of these three values 		<ul style="list-style-type: none"> Corporate Average Fuel Economy regulations—The average fuel economy of a manufacturer's annual fleet of vehicle production must be at or above the defined standard ; see "Summary of Fuel Economy Performance" for details Press articles about these regulations
3. Purpose		
<ul style="list-style-type: none"> To provide consumers with a real-world MPG estimate they can use to compare different vehicle models 		<ul style="list-style-type: none"> To reduce energy consumption by increasing the fuel economy of cars and light trucks Regulatory tool – Vehicle manufacturers are required to comply with the CAFE standards, which increase every year, per the Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards
4. Derivation		
<ul style="list-style-type: none"> Based on tests reflecting urban commuting, rural highway operation, high speed/acceleration, high temperature/air conditioning, and cold temperature operation Methodology often referred to as 5-cycle testing 		<ul style="list-style-type: none"> Based on tests reflecting urban commuting (city) and rural highway (highway) operation Methodology often referred to as 2-cycle testing Reflects various credits, incentives, and adjustments available to automakers
5. Comparison of Results		
<ul style="list-style-type: none"> Label MPG values are, on average, 20-25% lower than CAFE MPG values 		
6. Lead Agency		
<ul style="list-style-type: none"> Environmental Protection Agency (EPA) 		<ul style="list-style-type: none"> National Highway Traffic Safety Administration (NHTSA), within the Department of Transportation (DOT)

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Timeline of the eco car program

Year	Milestone
2007	Eco Car Program: Phase 1 introduced to automobile manufacturers.
2008	5 automobile manufacturers granted the Eco Car incentives.
2013	Eco Car program: Phase 2 launched to automobile manufacturers
2015	10 automobile manufacturers granted the Eco Car Phase 2 incentives.
2019	GM has already withdrawn from the program. Production of eco car phase 2 must start by 2019.

Requirements, benefits Thailand's eco-car program

First Phase	Product	Second Phase
Nissan, Honda, Mitsubishi, Suzuki, Toyota (approved by government)	Manufacturer	Participants in first phase, plus Mazda, GM, Ford, Volkswagen, SAIC Motor-CP (applied to participate)
Gasoline-powered cars with engine displacements of 1.3 liters or less	Engine displacement	Gasoline-powered cars with engine displacements of 1.3 liters or less
Diesel-powered cars with engine displacements of 1.4 liters or less		Diesel-powered cars with engine displacements of 1.5 liters or less
20km/liter or more	Mileage	23km/liter or more
Euro 4 (European emissions standard)	Emissions standard	Euro 5
100,000 cars per year in year 5 and beyond	Annual production	100,000 cars per year in year 4 and beyond
5 billion baht or more	Minimum investment	6.5 billion baht or more (5 billion baht or more for automakers participating in first phase)
8 years	Corporate tax exemption	6 years
17%	Excise tax on new cars	14% (estimate)
In production since 2010	Other	Production to start in 2019

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Categories Of Vehicle	Tax Structure in Present					Tax Structure in Future		
	Engine Capacity (Horse Power)	Tax Rate (%)			CO ₂	Tax Rate (%)		
		E10	E20	E85		E10/E20	E85/NGV	Hybrid
Passenger Vehicles - Passenger Vehicles and, Vans less than 10 seats	≤2,000 CC 2,001-2,500 CC 2,501-3,000 CC >3,000 CC (≥20 HP)	30 35 40 50	25 30 35 50	22* 27 32 50	≤ 100 g/km 101-150 g/km 151-200 g/km >200 g/km >3,000 CC	} 30* 35 40 50	} 25 30 35 50	10 20 25 30 50
PPV / DC /Space Cab/Pick Up	≤3,250 CC >3,250 CC	20/12/-/8,18			≤ 200 g/km >200 g/km	25*/12/5/3,18 30/15/7/5,18		
Eco Car (Benzine/Diesel) / E85	1,300/1,400 CC	17			≤100 g/km 101-120 g/km	14*/12 17/17		
Electric Vehicle /Fuel Cell/ Hybrid	≤ 3,000 CC >3,000 CC	10 10 50			>3,000 CC	10 ** 50		
NGV-OEM	≤ 3,000 CC >3,000 CC	20 50			>3,000 CC	** 50		

Remarks: * Assign safety standard for Active Safety (ABS+ESC) for Passenger Vehicles and, Vans less than 10 seats must obtain CO₂ ≤ 150 g/km / PPV must obtain CO₂ ≤ 200 g/km / Eco Car must obtain CO₂ ≤ 100 g/km
** Depend on CO₂ emission □ Less than 1,500 CC but not over 2,000 CC

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GERMAN GOVERNMENT VOTED TO BAN INTERNAL COMBUSTION ENGINES BY 2030

- Vehicles sold before the ban would still be allowed, but after 2030, automakers would be banned from selling new fossil fuel-powered vehicles in the EU.
- Increase in EU incentives to automakers to bring more zero-emissions offerings to the market. It also seems to encourage broad changes to the EU's current practice of placing lower taxes on diesel fuel, a decision made by the EU years ago to encourage increased adoption of diesel-powered vehicles to reduce fuel consumption across the 28 member nations.

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GERMAN GOVERNMENT VOTED TO BAN INTERNAL COMBUSTION ENGINES BY 2030

- The EU's diesel-friendly fuel tax setup led to diesels making up more than half of annual new car sales since roughly 2010. But the move seems to have unintentionally created an automotive pollution crisis, with [Volkswagen's diesel emissions cheating scandal](#) ongoing, and evidence of [similar deception](#) at [numerous other European automakers](#).
- The German Bundesrat's decision dovetails with [the Paris Climate Agreement](#), a UN agreement to combat greenhouse gas emissions starting in 2020. To meet the agreement, Germany must reduce its CO₂ emissions by 95 percent by the year 2050; the auto industry makes up [about 2.7 percent of Germany's gross domestic product](#), and vehicles and vehicle components are 20 percent of that nation's exports.

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THE FACTS BEHIND MAJOR AUTOMAKER EMISSIONS AND FUEL ECONOMY CHEATING SCANDAL



- Volkswagen installed emissions software on more than a half-million diesel cars in the U.S.—and roughly 10.5 million more worldwide—that allows them to sense the unique parameters of an emissions drive cycle set by the Environmental Protection Agency.
- The engines emitted nitrogen oxide pollutants up to 40 times above what is allowed in the US.
- VW recalled millions of cars worldwide. It has set aside €6.7bn (£4.8bn) to cover costs. That resulted in the company posting its first quarterly loss for 15 years of €2.5bn in late October.
- TDI owners who purchased their cars before September 17, 2015, can sell their cars back to Volkswagen for between \$12,500 and \$44,000, depending on model, age, trim, and region. TDI lessees will receive a cash value between \$2600 and \$4900.
- Owners who do not sell their cars back to Volkswagen will receive between \$5100 and \$10,000 to compensate for diminished resale value, plus a free emissions fix.

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THE FACTS BEHIND MAJOR AUTOMAKER EMISSIONS AND FUEL ECONOMY CHEATING SCANDAL



- General Motors' German brand came under fire in mid-May of 2016, after a joint investigation by German news magazine found that its cars turn off emissions controls during real-world driving.
- The software is likely to be found 100-percent compliant with European Union laws. That's because E.U. law allows automakers to program their emissions controls to deactivate when necessary to protect the engine from harm.
- The fact that the vast majority of real-world driving would trigger an emissions control shutdown? Irrelevant, says Opel: "Our engines are in compliance with the legal requirements."

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THE FACTS BEHIND MAJOR AUTOMAKER EMISSIONS AND FUEL ECONOMY CHEATING SCANDAL



CHEVROLET

- It was discovered that the 2016 Chevy Traverse, GMC Acadia, and Buick Enclave were all sold with window stickers that indicate fuel economy ratings a full two MPG better than the EPA's official numbers. GM blamed the issue on "improper calculations," and put a temporary stop-sale on inventory of affected vehicles until corrected window stickers could be printed. For owners who purchased the mislabeled vehicles, GM is offering up to \$900 in make-good money or a free extended warranty to make up for the calculated lifetime cost associated with a two-MPG drop in fuel economy. The action is expected to cost GM approximately \$100 million.

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THE FACTS BEHIND MAJOR AUTOMAKER EMISSIONS AND FUEL ECONOMY CHEATING SCANDAL



- In February 2016, a group of U.S. Mercedes owners filed a class-action lawsuit, alleging that the automaker's BlueTEC diesel-powered vehicles shut off their emissions controls in real-world driving. A second class-action suit filed in April characterized the software as a "defeat device" akin to Volkswagen's TDI cheat. Both suits allege that Mercedes BlueTEC diesels, which use a costly and complex urea-injection system to combat diesel NOx emissions, shut down at ambient temperatures below 50F. Mercedes-Benz parent company Daimler characterizes this as a necessary measure to protect the engine—the same justification Opel is currently using in its own diesel saga. At the request of the U.S. Department of Justice, Daimler has launched an internal investigation into its certification process for U.S.-market diesel engines.

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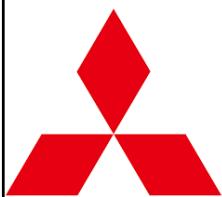
THE FACTS BEHIND MAJOR AUTOMAKER EMISSIONS AND FUEL ECONOMY CHEATING SCANDAL

- Fiat recently found itself in an emissions imbroglio over the European-market diesel-powered 500X. It's similar to the Opel situation, but with trademark Italian flair and brashness.
- Late in April, German news outlet Bild am Sonntag reported that Fiat's 2.0-liter diesel-powered 500X almost entirely shuts off its emissions control devices after 22 minutes of driving. German environmental activist group DUH, which claims to have uncovered Opel's shutoff software, says a diesel 500X it tested put out between 11 and 22 times the legal limit of NOx emissions when tested with a warm engine



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THE FACTS BEHIND MAJOR AUTOMAKER EMISSIONS AND FUEL ECONOMY CHEATING SCANDAL



- Mitsubishi admitted that the fuel economy deception reached all the way back to 1991, a systematic effort affecting untold millions of vehicles. By mid-May, the Japanese automaker announced that President Tetsuro Aikawa would resign, along with Executive Vice President Ryugo Nakao. But at that point, Nissan had already secured its 34-percent controlling stake, likely at a steep discount: Right before Nissan made its move, the news of the fuel economy deception had gutted Mitsubishi's market value by roughly half.

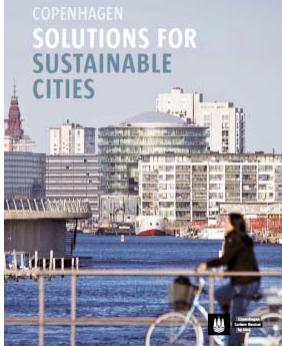
101

THE FACTS BEHIND MAJOR AUTOMAKER EMISSIONS AND FUEL ECONOMY CHEATING SCANDAL

- French antifraud authorities raided Renault headquarters after testing inspired by Volkswagen's diesel debacle found many Renault diesel models emitted more than the legally permissible maximum in real-world driving. Officials found no evidence of a "defeat device" after searching engineers' computers, though the automaker recalled nearly 16,000 European-market diesel-powered SUVs and offered a "voluntary" software fix to reduce the NOx emissions of nearly 700,000 diesel-powered vehicles.
- Meanwhile, French rival PSA, maker of Peugeot and Citroën, faced near-identical antifraud raids by the same agency in April, triggered by similar real-world emissions test findings.



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**COPENHAGEN
SOLUTIONS FOR
SUSTAINABLE
CITIES**

**COPENHAGEN – SOLUTIONS
FOR SUSTAINABLE CITIES**

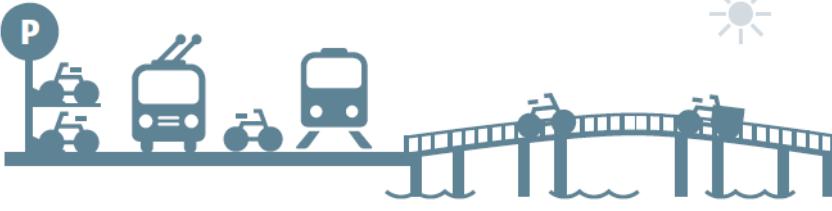
THE SUSTAINABLE BENEFITS

ECONOMIC	ENVIRONMENTAL	SOCIAL
<ul style="list-style-type: none"> Cycling provides a low-cost form of transport. Reduced journey times and traffic congestion increase economic productivity. Healthier citizens reduce health care costs at an estimated rate of € 0.77 per km cycled. 	<ul style="list-style-type: none"> Reduced noise. Reduced air pollution. Reduced CO₂ emissions. 	<ul style="list-style-type: none"> 88% of cyclists do it because it is the fastest or most convenient way of getting to work. Creation of jobs. Improved city life.

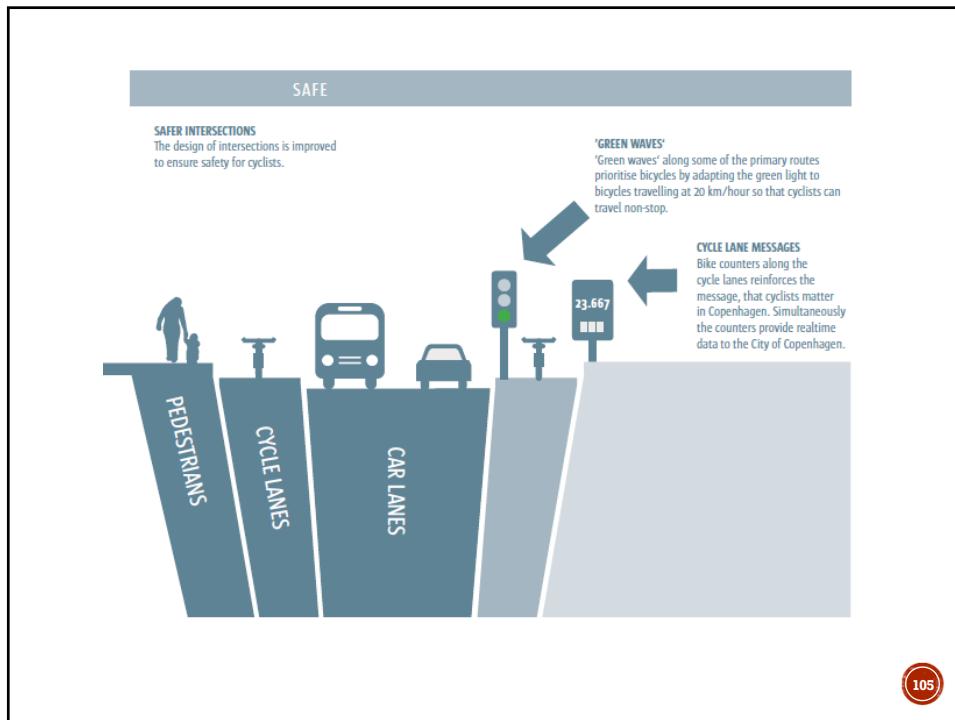
Distance in km travelled each workday in Copenhagen by bicycle.

1995: 0.8 mil.
2000: 1.05 mil.
2012: 1.23 mil.

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TIME SAVING	CONVENIENT
<p>TRANSPORT NETWORK Bicycles are integrated into the wider transport network. Passengers can easily transfer between cycling and public transport. Carriages on trains are upgraded to accommodate bicycles.</p> 	<p>NO MISSING-LINKS-STRATEGY 2 bicycle bridges have been constructed as part of the No Missing-Links-Strategy, which secures a city connected by bike routes that are made more direct to key destinations.</p>
<p>BICYCLE SUPER HIGHWAYS A safer, faster, direct, continuous and comfortable way of commuting to work or education by bike.</p>	<p>BICYCLE PARKING Good parking facilities for bikes.</p>
<p>SEPARATE LANES Cycle lanes along roads include a curb to separate cyclists from cars and pedestrians, which maximises safety and sense of safety for cyclists.</p>	<p>43 KM OF 'GREENWAYS' In Copenhagen green cycle routes are made to provide routes away from main roads and through parks and recreational spaces.</p>
<p>CARGOBIKES Design of different cargobikes gives families a great alternative to the car.</p>	

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COPENHAGEN VS BANGKOK

body	Administration
Government	Special administrative area
• Type	Sukhumphand Paribatra
• Governor	
Area^[1]	
• City	1,568.737 km ² (605.693 sq mi)
• Metro	7,761.6 km ² (2,996.8 sq mi)
Highest elevation	91 m (299 ft)
Lowest elevation	1 m (3 ft)
Population (2013) ^{[2][3]}	
• City	562,379
• Density	7,300/km ² (19,000/sq mi)
• Urban	1,230,728 (details)
• Metro	1,956,278 (details)
• Metro density	646/km ² (1,670/sq mi)
Elevation^[3]	1.5 m (4.9 ft)
Population (2010 census) ^[4]	
• City	8,280,925
• Density	5,300/km ² (14,000/sq mi)
• Metro	14,565,547
• Metro density	1,900/km ² (4,900/sq mi)
Demonym	Bangkokian

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POLITICAL FLAWS

Streetcar Scandal



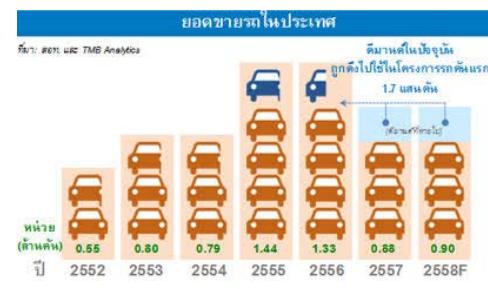
Cash for Clunkers



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FIRST-TIME CAR BUYER POLICY

- The tax breaks, which the World Bank estimates cost Thailand \$2.5 billion, were intended to revive auto manufacturing in the region's biggest car-making hub following devastating floods in 2011.
- Like the U.S. "cash for clunkers" program in 2009, the incentives distorted the market, creating a boom in demand that collapsed once the tax breaks expired.
- Research from IHS Global Automotive shows around 10 percent of the 1.2 million Thais who signed on to the incentive scheme have either changed their minds or couldn't pay monthly installments.
- Japanese automakers, who control 80 percent of the local market, reported a 30 percent drop in sales on average in the second quarter of 2013.



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ASSIGNMENT – SDG STATUS

- Describe SDG status of your country
- What are the key national strategies and related policies?
- Provide some examples of contribution from private sector
- Deliverable
 - Give 15-min presentation on 2/9/18
 - Send your slides via Line by 1/9/18, 10 pm
 - 20% credit penalty for late submission
 - 10 pts
 - Students are to grade others by themselves. 5 pts on contents and 5 pts on format and presentation.
 - 1st place 10 points and then in descendent order

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ASSIGNMENT – SUSTAINABLE CITY

- Find an example of sustainable city. Describe their sustainability components (e.g., infrastructure, policy , incentive) and profile (e.g., size, population, demographic, weather, economic condition, etc.)
- What kinds of regulatory measures were used to help transform the city?
- Analyze and describe whether the sustainable city you share and Bangkok have or don't have in common.
- Deliverables:
 - Give 15-min presentation on 16/9/18
 - Send your slides via Line by 15/9/18, 10 pm
 - 20% credit penalty for late submission
 - 10 pts
 - Students are to grade others by themselves. 5 pts on contents and 5 pts on format and presentation.
 - 1st place 10 points and then in descendent order

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ASSIGNMENT - DJSI

- Pick one of the 17 Thai DJSI companies. First come, first served.
- Present about the company:
 - Its business
 - Its SD missions, practices and achievements
- Deliverables:
 - Give 15-min presentation on 30/9/18
 - Send your slides via Line by 29/9/18, 10 pm
 - 20% credit penalty for late submission
 - 10 pts
 - Students are to grade others by themselves. 5 pts on contents and 5 pts on format and presentation.
 - 1st place 10 points and then in descendent order