International Experiences for Co-benefits Study

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Aug. 27, 2007 Beijing, China

Integrated Environmental Strategies Program (IES)

Quantifying the benefits of adopting integrating urban/global air quality management strategies

US EPA and the National Renewable Energy Laboratory (DOE)

Country Participants

- Current countries: China, India, S. Korea, Philippines, Argentina, Brazil, Chile, Mexico

Country Collaborators

Argentina: *Buenos Aires*
Secretariat of Sustainable Dev. and Env. Policy
Universidad Nacional del Sur

Brazil: *Sao Paulo*
CETESB
University of Sao Paulo

Chile: *Santiago*
CONAMA
P. Catholic University of Chile

India
MOEF, CPCB

China: *Beijing & Shanghai*
SEPA, China Council (CCICED) SAES, SMU
Tsinghua University, Beijing Medical Univ.

Korea: *Seoul*
MOE
KEI, KIST

Mexico: *Mexico City*
INE, CAM

South Africa
DEET, DTI, DMEA

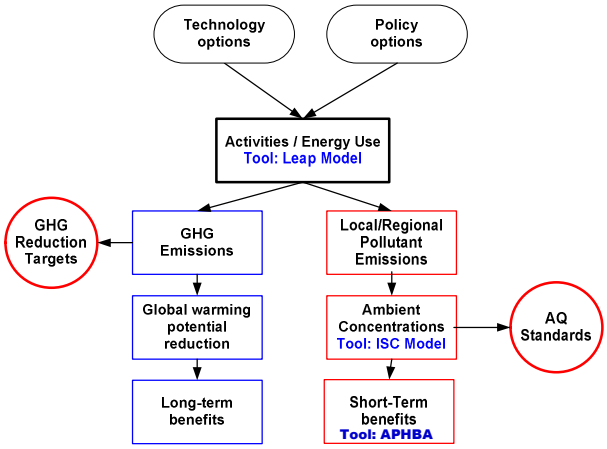
Background

- Integrated Environment Strategy (IES) program
  - **An international capacity building program by U.S.EPA**
  - **http://www.epa.gov/ies/**
- IES researches in China
  - **Shanghai Case Study**
  - **Beijing Case Study**
  - **National Assessment**
  - **National Co-control Research**
- Address research in co-benefit of energy and environmental policies

Objectives

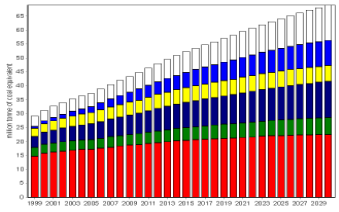
- **Establish a co-benefits analysis framework for Beijing**
- **Quantify the co-benefits of energy policies**
  - **Energy Demands and Supply**
  - **Local Pollutant Emissions Reduction**
  - **Air Quality Improvement**
  - **GHG Mitigation**
  - **and Health Benefits**
- **Provide scientific support for a comprehensive air pollution control policy making**
- **Provide useful inputs to Green Olympic Strategy**

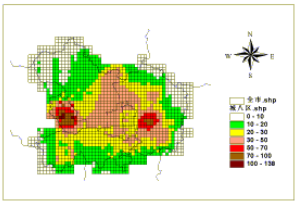
Methodology framework



Scientific Tools

- **Energy Scenarios**
  - ➢ LEAP Model
- **Air Quality Estimate**
  - ➢ ISC Model / CMAQ
- **Health Impact Evaluation**
  - ➢ Exposure-response Function
  - ➢ BenMAP





Mitigation Scenarios Definition

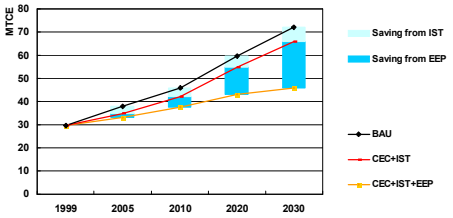
- BAU Case
- Clean Energy Consumption (CEC)
- Industry Structure Transformation (IST)
- Energy Efficiency Program (EEP)
- Green Transportation (GRE)

- Scenario 1: CEC+IST
- Scenario 2: CEC+IST+EEP
- Scenario 3: CEC+IST+EEP+GRE

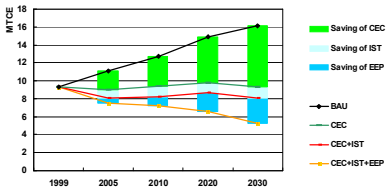
Policies in GRE scenario

Future Energy and Environment Policies	Indicators	Indicators in BAU
fuel economy standard for light-duty vehicles	50% improvement in 30 years	No change in future years
develop public transportation system	Subway travel will take 15% and 25% of total travel demand in 2010 and 2030.	Subway travel will take 12% and 15% of total travel demand in 2010 and 2030.
promote compressed natural gas (CNG) use in large buses and LPG use in taxis	The share of CNG in the large bus fleet will increase to 50% in 2010 and 70% in 2030, and the share of LPG in taxis will be 50% in 2010 and 2030.	The share of CNG in the large bus fleet and LPG in taxis will not change in future years.
stringent emission standards	Euro III in 2005 and Euro IV in 2010	Euro III in 2008 and Euro IV in 2012

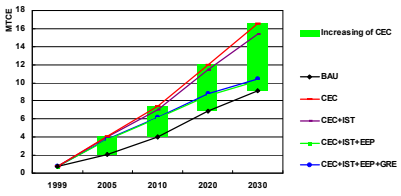
Final Energy Demands



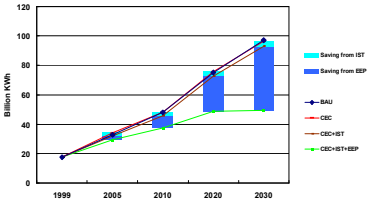
Final Energy Demands



Final Energy Demands：Coal



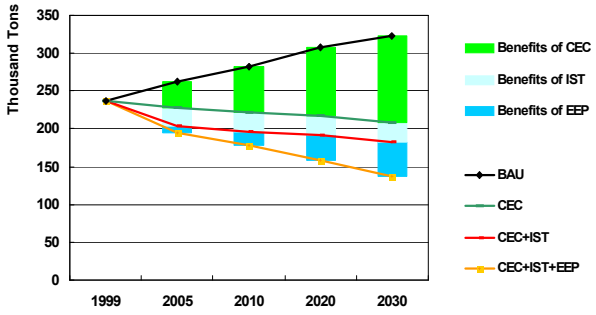
Final Energy Demands: Natural Gas



Requirements of Electricity Import

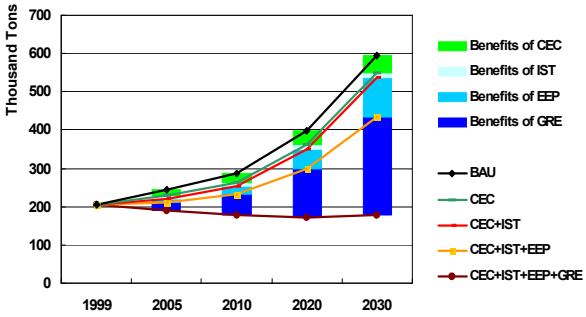
Local Pollutant Emissions : SO_2

- Large SO_2 reduction potential from CEC scenario, 60 kt in 2010, and 114 kt in 2030
- Large SO_2 reduction potential from industry sector, 56 kt in 2030 under CEC scenario



Local Pollutant Emissions : NO_x

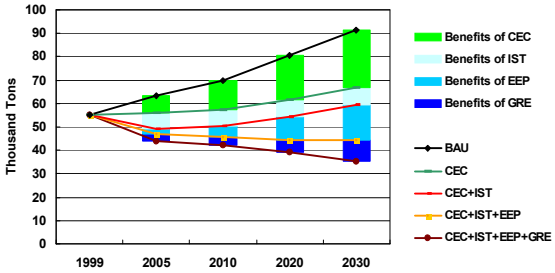
■GRE programs can reduce NOx emissions dramatically, 55 kt in 2010, and 254 kt in 2030



Local Pollutant Emissions : PM_{10}

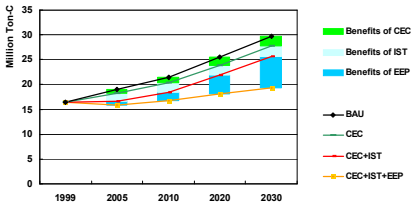
■All types of policies can reduce PM_{10} markedly, especially for CEC policies

■But the PM_{10} reduction potential from local combustions is still limited

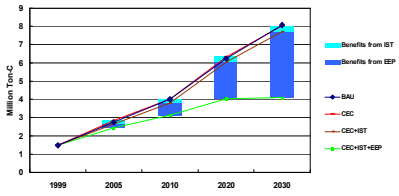


Carbon Emissions

- Industry sector will be the largest contributor of CO_2 emissions, also will have the largest mitigation potential, 10.4 Mt-C in 2030
- EEP programs have largest reduction potential on GHG, 6.3 Mt-C in 2030
- Expanded electricity import: Green for Beijing, but Gray for other regions
- EEP programs can reduce electricity import markedly

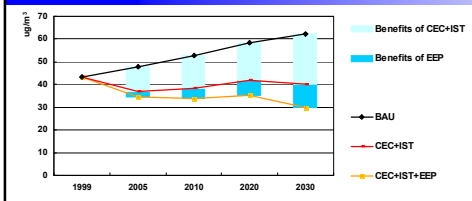


Emissions from Local Sources

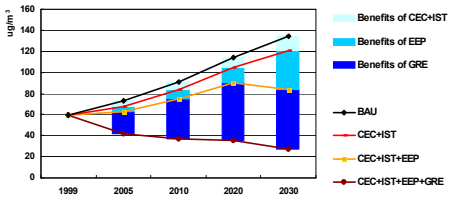


Emissions from Imported Electricity

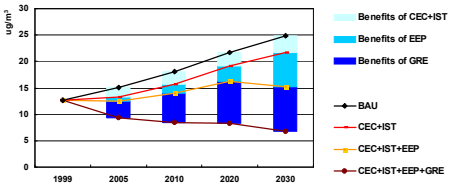
Average Exposure Level



SO_2



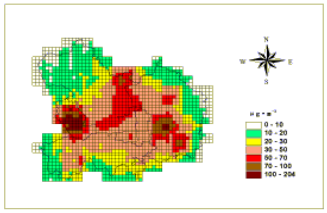
NOx



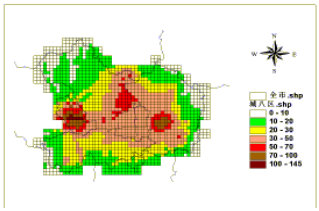
Energy Related PM_{10}

- SO_2 concentration could meet air quality standard before 2010 through CEC+IST policies
- NOx concentration could meet air quality standard before 2010 through CEC+IST+FEP+GRE policies
- PM_{10} concentration COULD NOT meet air quality standard if only relay on local energy policies

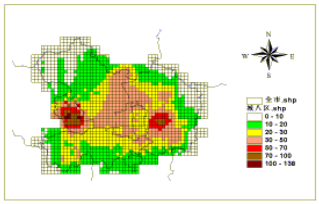
Exposure Level of SO_2, 2010



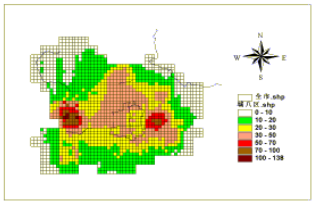
BAU



CEC+IST

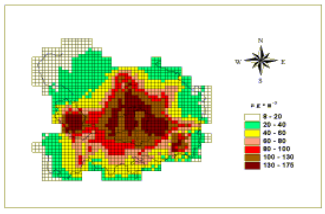


CEC+IST+EEP



CEC+IST+EEP+GRE

Exposure Level of NO_x, 2010



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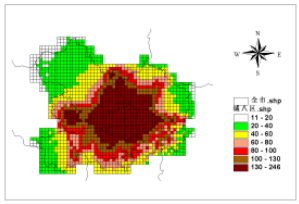
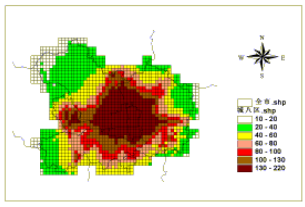
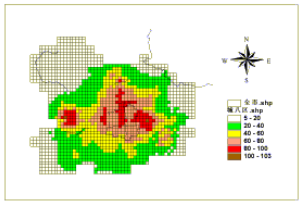


CEC+IST

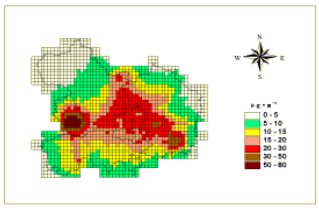


CEC+IST+EEP



CEC+IST+EEP+GRE

Exposure Level of PM_{10}, Energy Related



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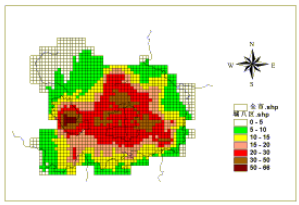
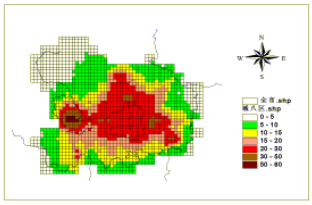
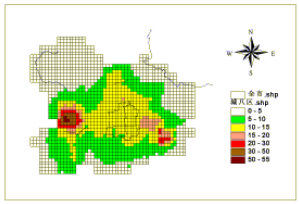


CEC+IST



CEC+IST+EEP



CEC+IST+EEP+GRE

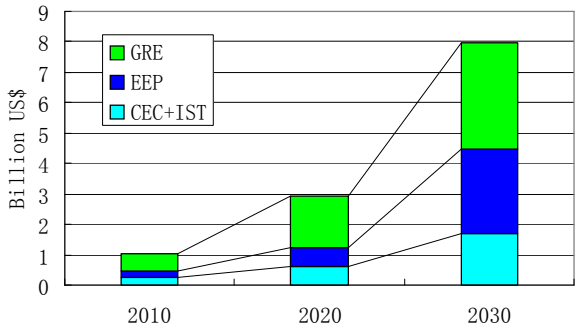
Health Benefits in 2010

	CEC+IST		CEC+IST+EEP		CEC+IST+EEP+FRE	
健康终点	PM_{10}	SO_2	PM_{10}	SO_2	PM_{10}	SO_2
死亡	29	237	53	331	152	331
慢性支气管炎	840	140	1590	265	4500	265
呼吸系统住院人数	186	225	349	314	990	314
心血管系统住院人数	202		379		1077	
内科门诊	5786	21284	10834	29734	30777	29734
儿科门诊	1999		3743		10632	
内科急诊	627	10183	1174	14225	3334	14225
成人哮喘	1512	1199	2833	1686	8063	1686

Health Benefits in 2030

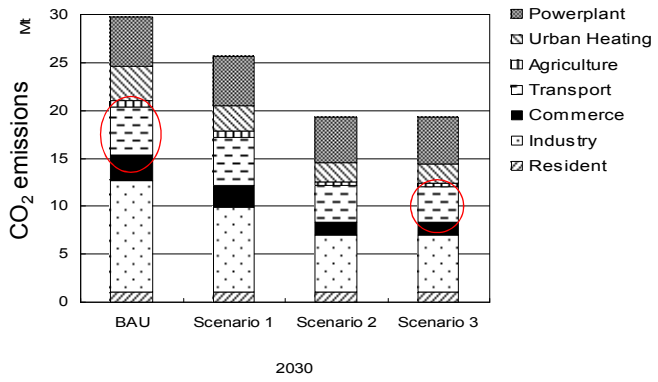
	CEC+IST		CEC+IST+EEP		CEC+IST+EEP+FRE	
健康终点	PM10	SO2	PM10	SO2	PM10	SO2
死亡	39	400	141	554	287	554
慢性支气管炎	1155	193	4185	698	8520	1420
呼吸系统住院人数	253	379	921	525	1872	525
心血管系统住院人数	275		1001		2036	
内科门诊	7851	35863	28623	49719	58183	49719
儿科门诊	2712		9888		20099	
内科急诊	850	17158	3101	23787	6303	23787
成人哮喘	2051	2033	7508	2816	15260	2816

Monetary Health Benefit



- ~8 Billion US$ (Current Value) of health benefit in 2030
- GRE has more significant health benefit than the other policies

CO_2 mitigation



•GRE policies will reduce 20% of CO_2 Emissions in 2030

Most Effective Policies on

- Energy Saving: EEP
- SO_2 emissions and concentration: CEC
- NO_x emissions and concentration: : GRE
- PM_{10} emissions: CEC
- PM_{10} concentration: GRE
- GHG mitigation: EEP

Most Effective Policies on Reduction of

- Deaths: CEC
- Chronic bronchitis (慢性支气管炎): GRE
- RHA (呼吸系统住院) : GRE
- CHA (心血管系统住院): GRE
- OPVc for internal medicine (内科门诊): CEC
- OPV for pediatric (儿科门诊): GRE
- Emergency room visits (内科急诊): CEC
- Asthma attack (成人哮喘): GRE

Thank you!