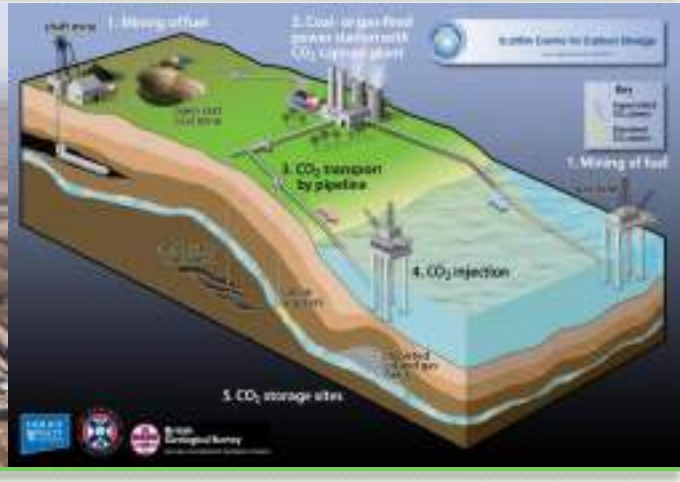
ADB's Energy Sector Operations in the PRC

Leveraging Knowledge and Innovation

AFDI Lecture Series Commemorating 30 Years of ADB–PRC Partnership



Shanghai, 6 May 2016

Ashok Bhargava
Director, Energy Division
East Asia Department

Contents

- Energy and Economic Growth
- Asia and PRC's Energy Challenges and ADB Strategies
- Innovation in ADB's Energy Projects
- Clean Energy Portfolio and Recent Innovative Projects
- Energy and Climate Change Work
- Forward Looking Priorities
- Questions and Answers

Energy and Economic Growth

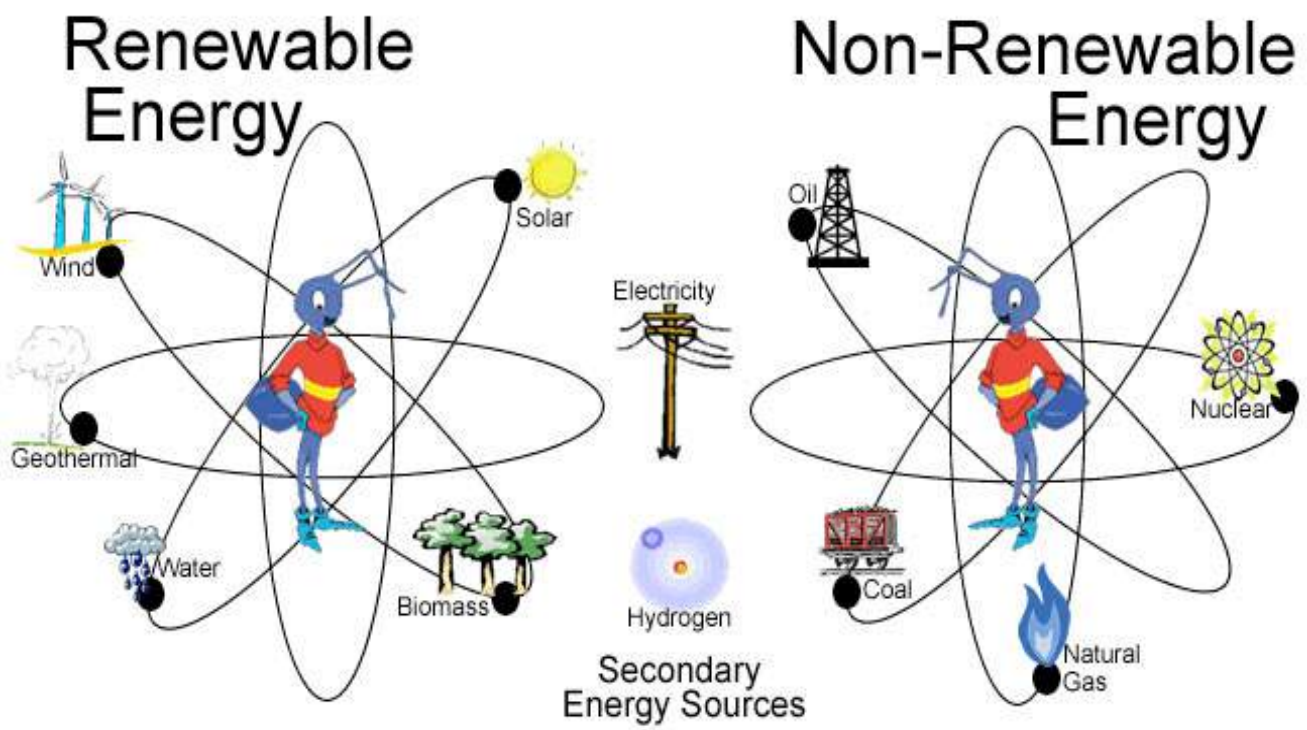
WHAT IS ENERGY?

Two basic concepts are important in understanding the sources of energy:

I.
Energy is the ability or capacity to do work.

II.
Energy cannot be created or destroyed.

Primary energy is an energy form found in nature that has not been subjected to any conversion. Primary energy can be renewable or non-renewable

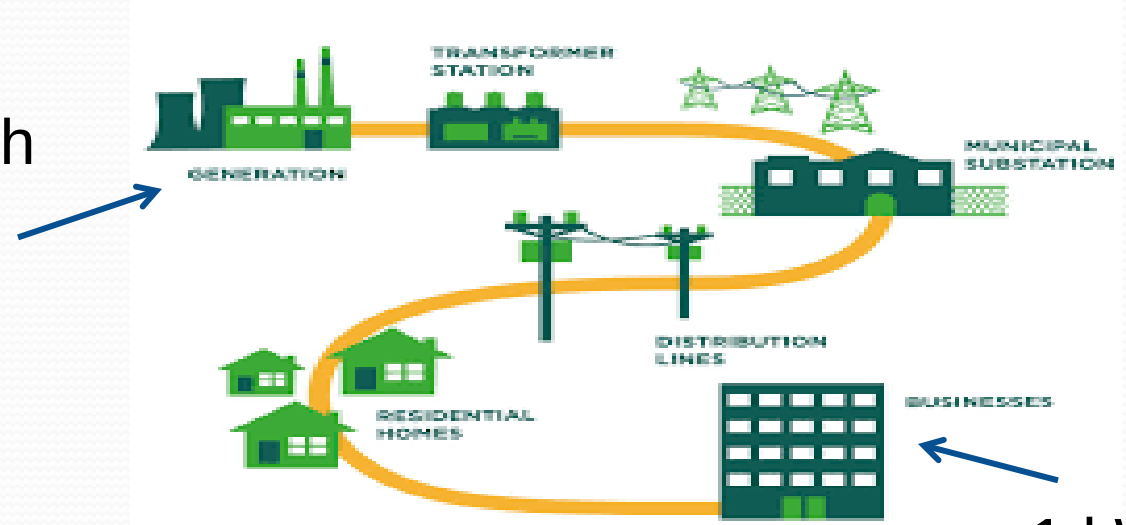


What is electric energy?

Electricity is a secondary energy that is generated using primary energy.

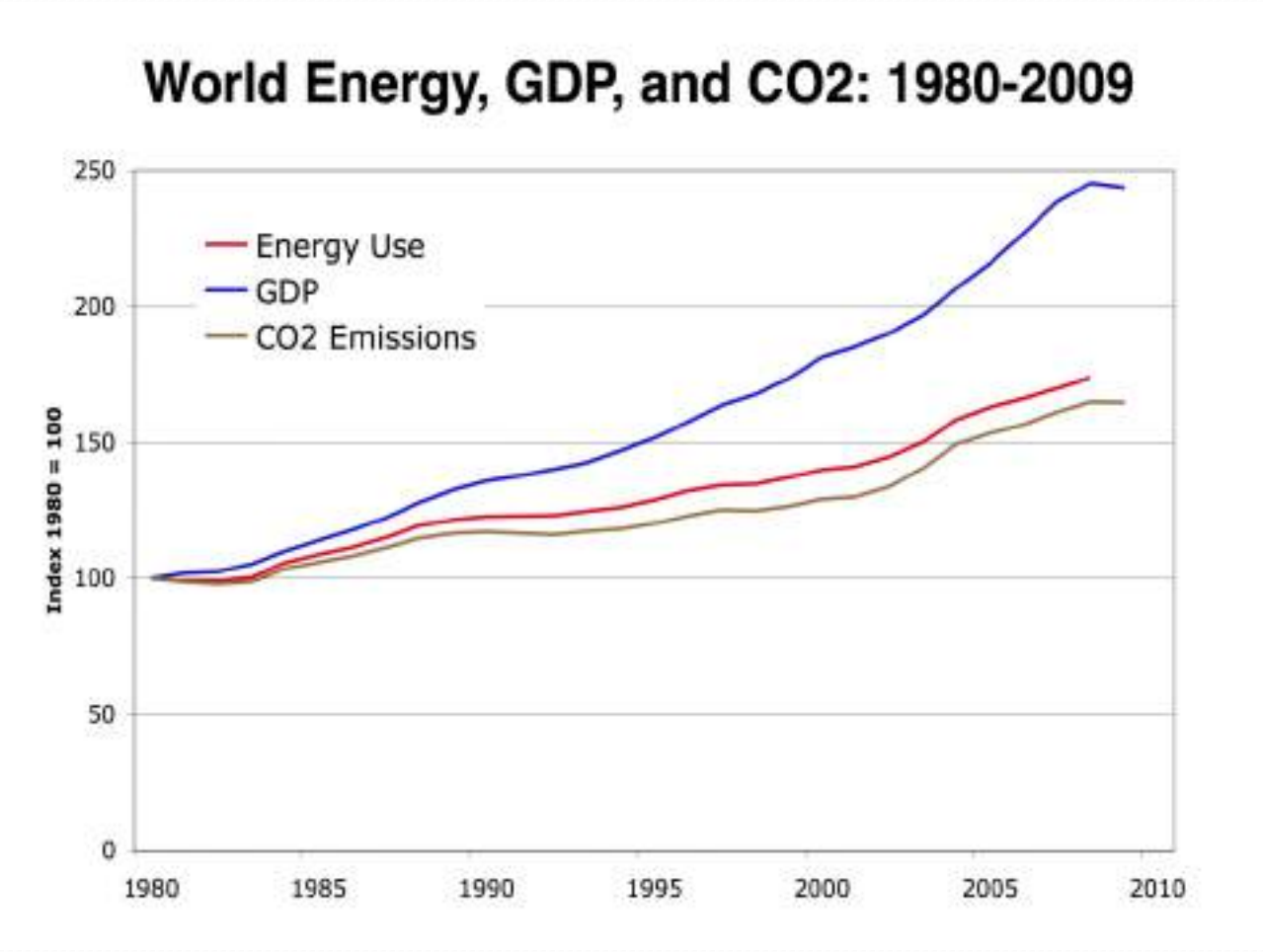
In traditional system, less than 30% of the primary energy used to produce electricity is converted into useable electric energy

2-3 kWh



1 kWh

How energy is related to economic growth?

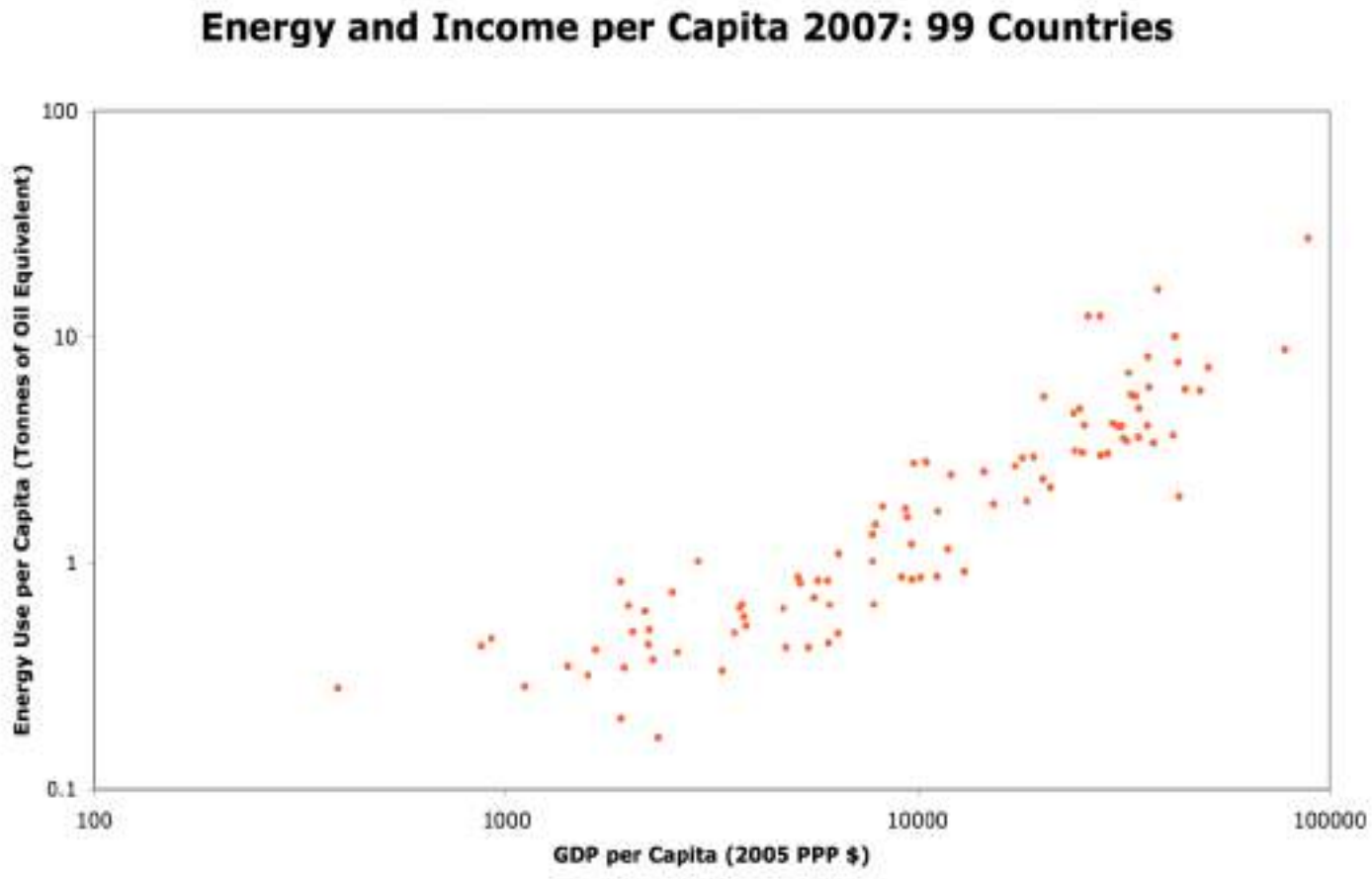


PRC: Electricity - Energy – GDP growth rate (1985 – 2010)

Year	Annual growth (percent)			GDP elasticity of	
	Energy consumption	Electricity consumption	GDP	Energy consumption	Electricity consumption
1985	8.1	9.0	13.5	0.6	0.7
1990	1.8	6.2	3.8	0.5	1.6
1995	6.9	8.2	10.9	0.6	0.8
2000	3.5	9.5	8.4	0.4	1.1
2001	3.3	9.3	8.3	0.4	1.1
2002	6.0	11.8	9.1	0.7	1.3
2003	15.3	15.6	10.0	1.5	1.6
2004	16.1	15.4	10.1	1.6	1.5
2005	10.6	13.5	11.3	0.9	1.2
2006	9.6	14.6	12.7	0.8	1.2
2007	8.4	14.4	14.2	0.6	1.0
2008	3.9	5.6	9.6	0.4	0.6
2009	5.2	7.2	9.1	0.6	0.8
2010	5.9	13.1	10.3	0.6	1.3
Average annual growth rate (percent)					
1978–2010	5.6	9.2	9.9	0.6	0.9
1978–90	4.7	6.8	8.4	0.6	0.8
1990–2000	4.0	8.0	10.4	0.4	0.8
2001–06	11.5	14.3	8.9	1.3	1.6
2000–10	8.4	12.0	10.5	0.8	1.1

Source: NBS, China Statistic Year Book 2010.

Energy Use and Prosperity



Source: International Energy Agency

Some related questions..

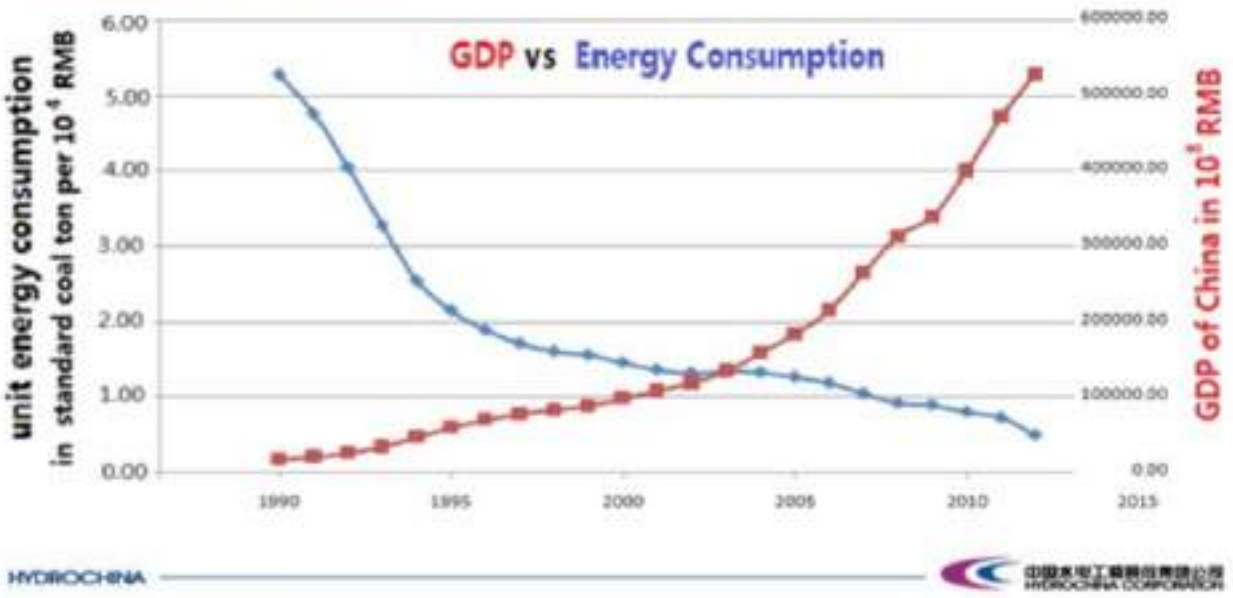
- Does energy availability and quality drives economic growth? Or is energy use merely a side effect of growth?

- Why energy intensity is important?

Energy Use Per Capita – GDP Per Capita

- **The economic development in China can't be realized without the support of energy sources**

For the past 30 years from 1980 to 2010, China's GDP has remained the annual average growth rate of 10% with energy annual average growth rate of 5.8%, and the energy utilization efficiency has been continuously improved.



Energy in Sustainable Development

Asia and PRC's Energy Challenges and ADB Strategies

Asia's Energy Related Challenges

4.2 Billion
Population in Asia

1.8 Billion
People without access to clean cooking

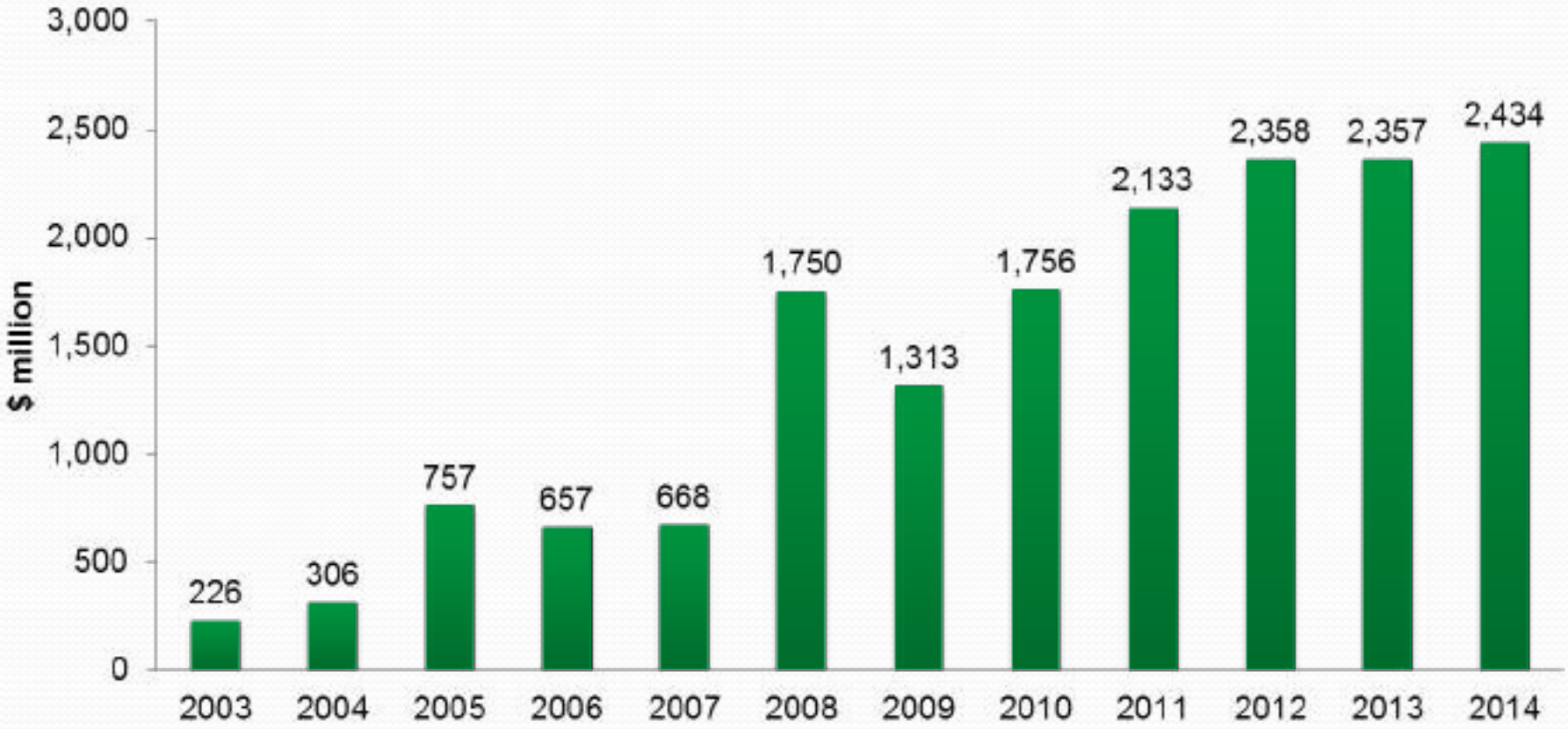
600 Million
People without access to electricity

Energy in ADB Operation – an important and large share

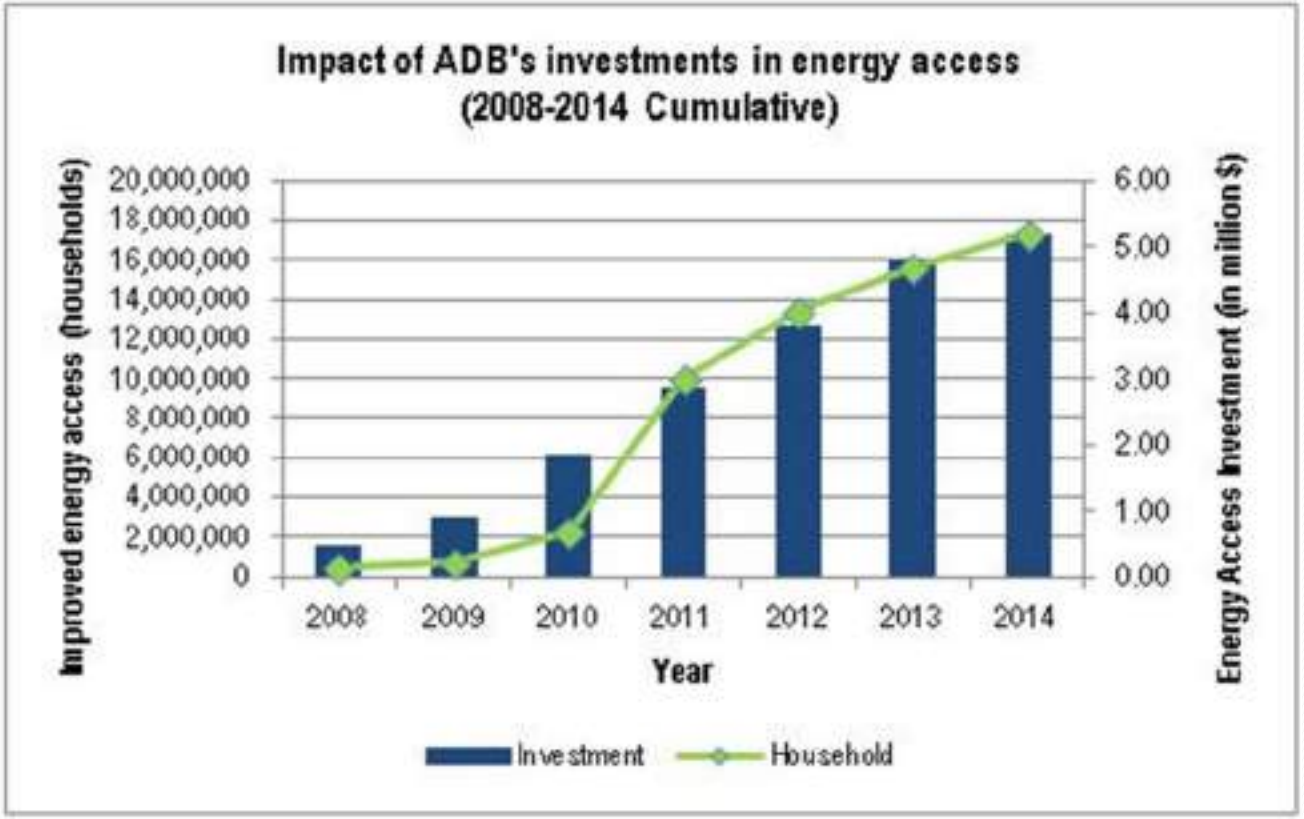
	2003–2007		2008–2012	
	Total ($ million)	Share of Total (%)	Total ($ million)	Share of Total (%)
Financing for Core Areas of Operation	31,574	85	53,499	82
Infrastructure	24,935	67	46,666	72
• Energy	5,818	16	16,840	26
• Transport and Communications	12,382	33	18,873	29
• Water	3,552	10	6,013	9
• Other Infrastructure	3,184	9	4,941	8

Source: Asian Development Bank. 2014. *Midterm Review of Strategy 2020. Meeting the Challenges of a Transforming Asia and the Pacific.* April. http://www.adb.org/sites/default/files/institutional-document/34149/files/midterm-review-strategy-2020-r-paper.pdf

ADB's Clean Energy Investments



ADB's contribution to energy access for all (2008 – 2014)



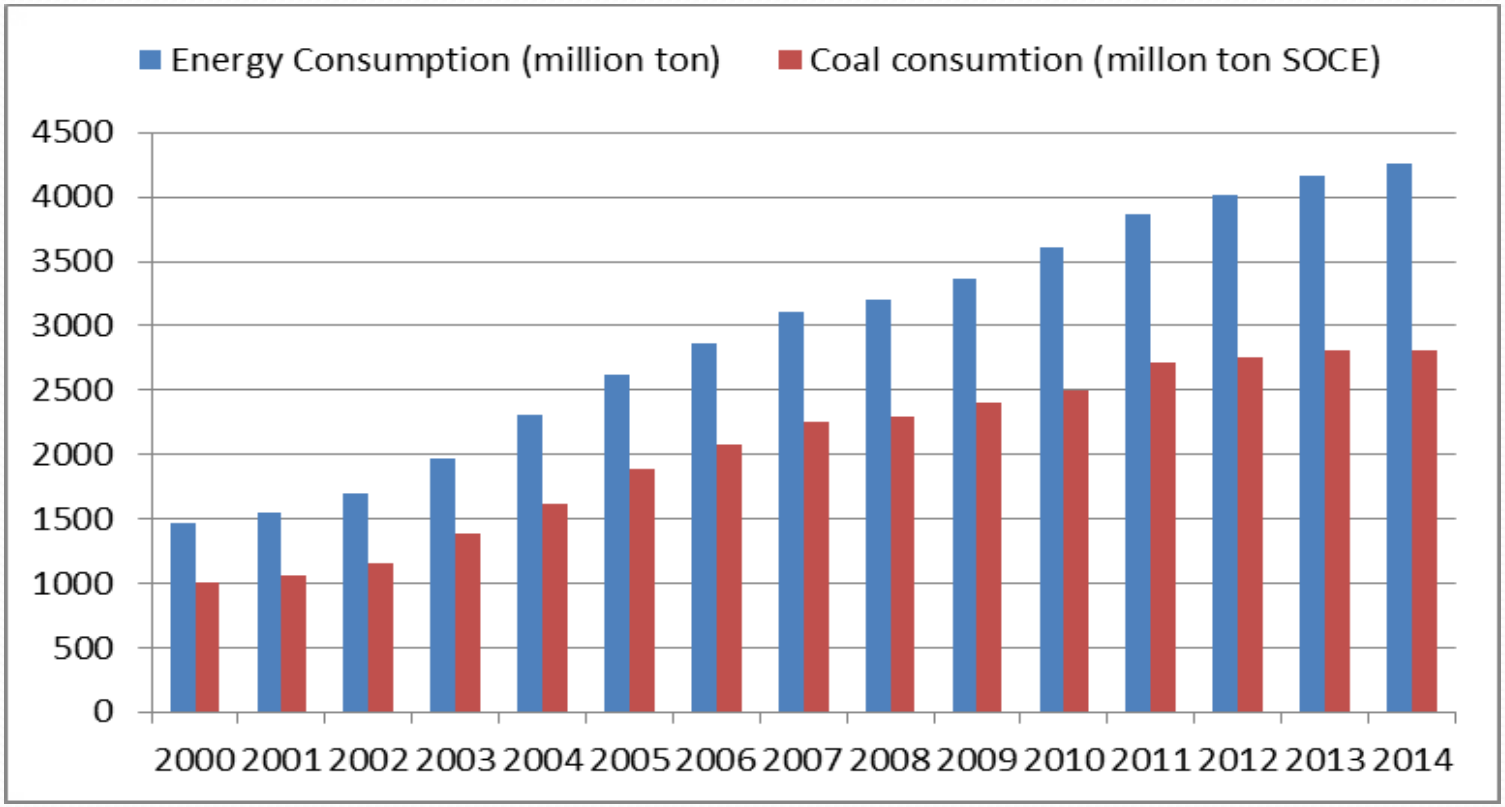
$5.2 billion
total ADB investment in energy access (2008-2014)

86.4 million
number of people benefiting from ADB's energy access investments

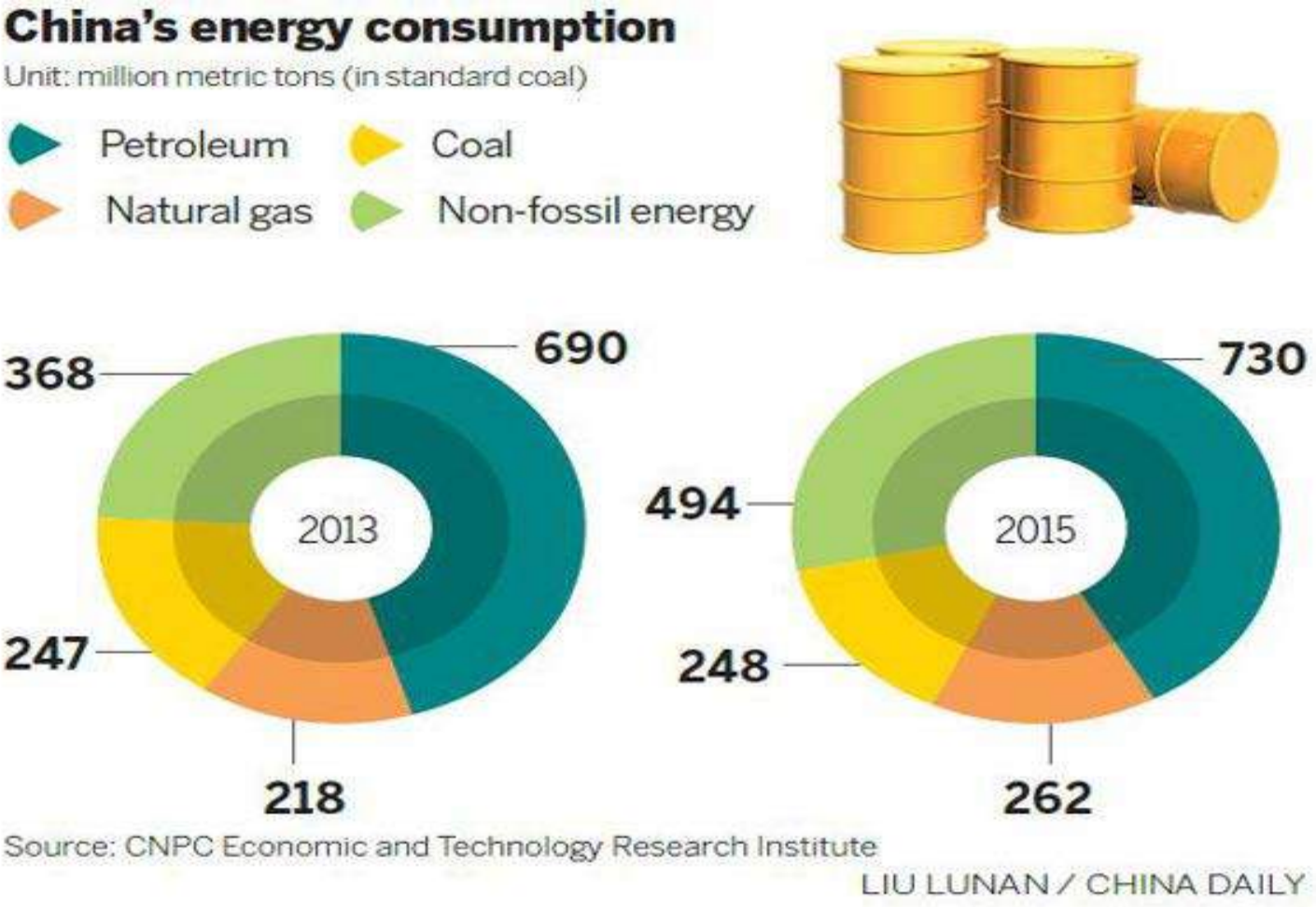
Energy in ADB's lending operation

- Energy sector lending in ADB is about 25% – 30% every year. Private sector operations are growing.
- Overall energy sector lending of about $3-4 billion/year will go up to $5 billion / year from 2017
- Clean energy lending will increase from $2 billion tow $3 billion per year from 2017

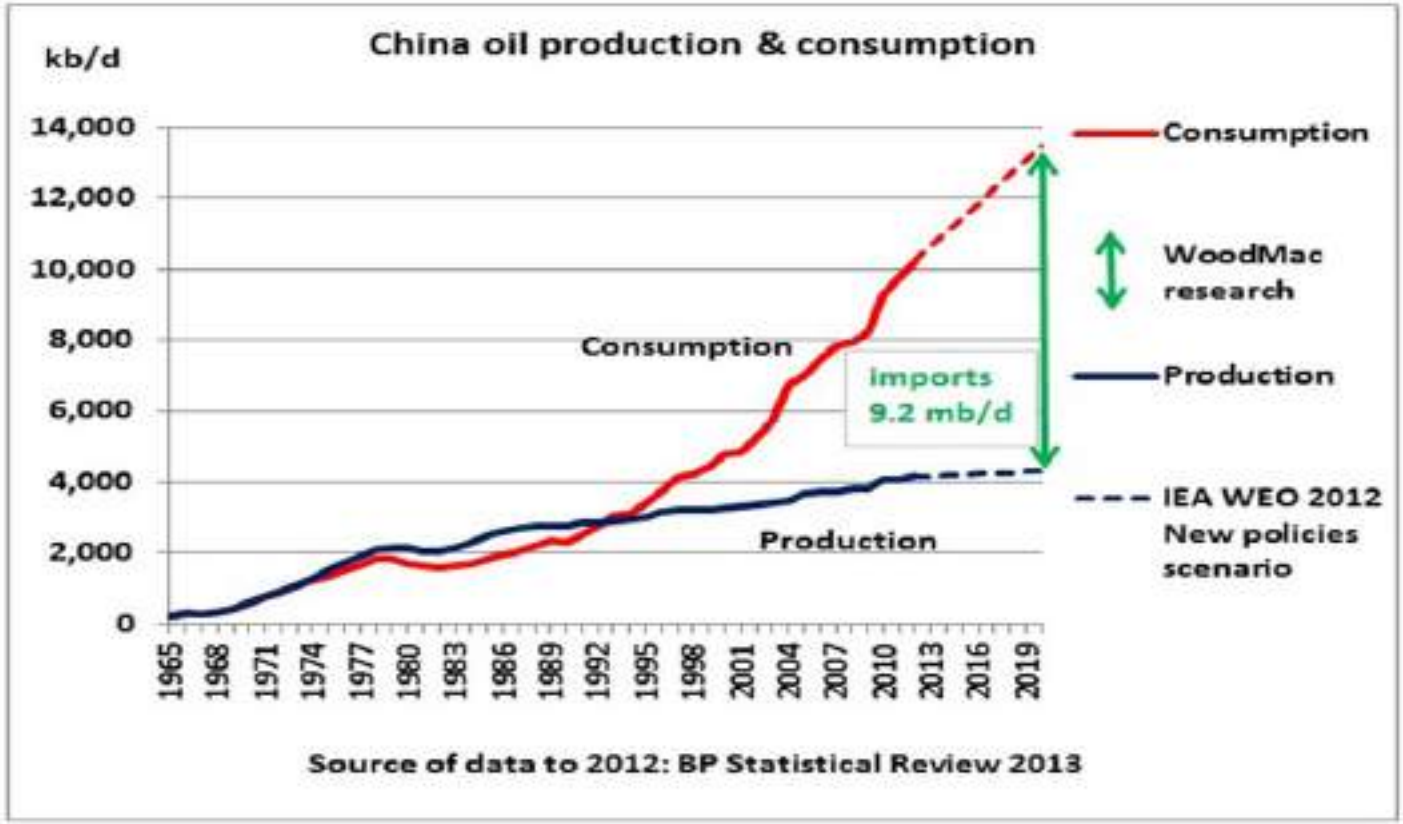
PRC's Energy Challenge
Rising Energy Demand; Continued Coal Dependency



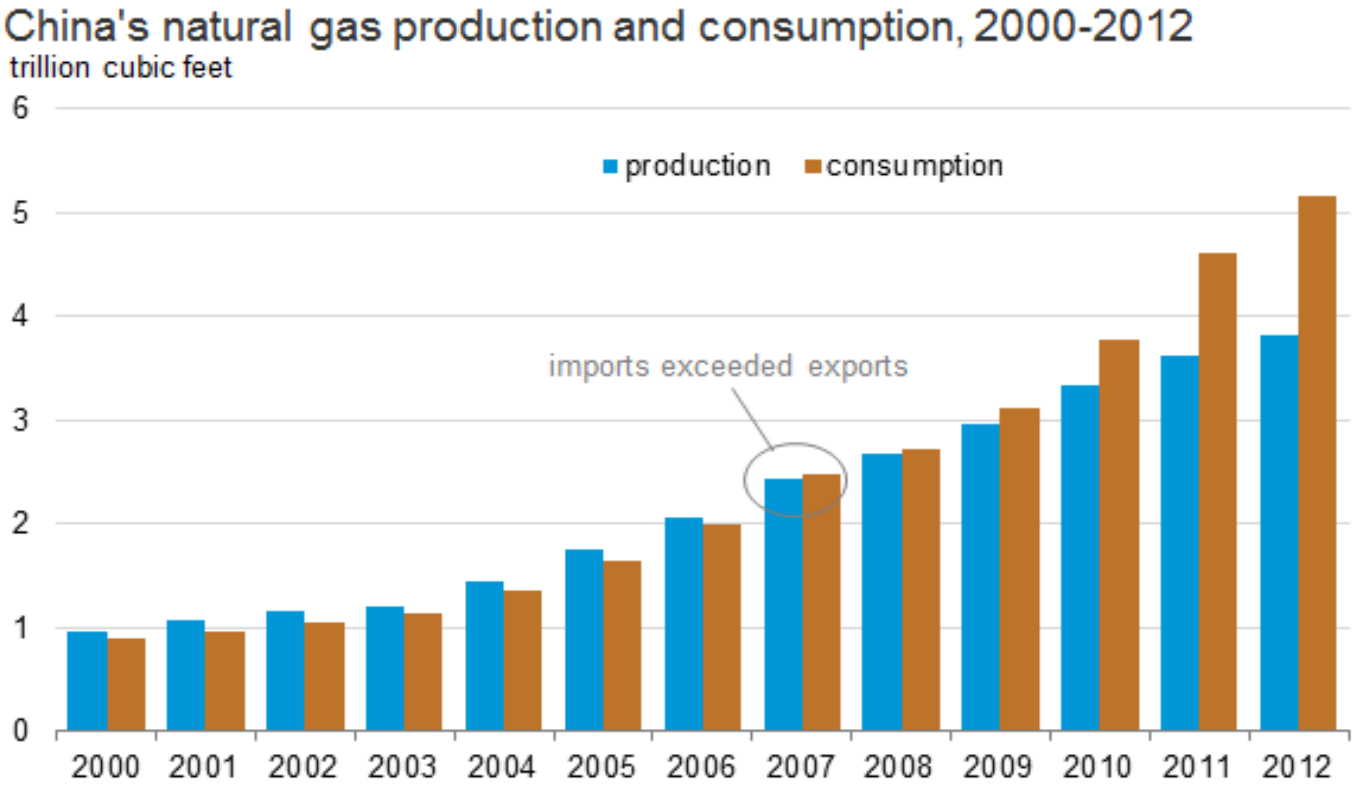
PRC : coal demand plateaued?



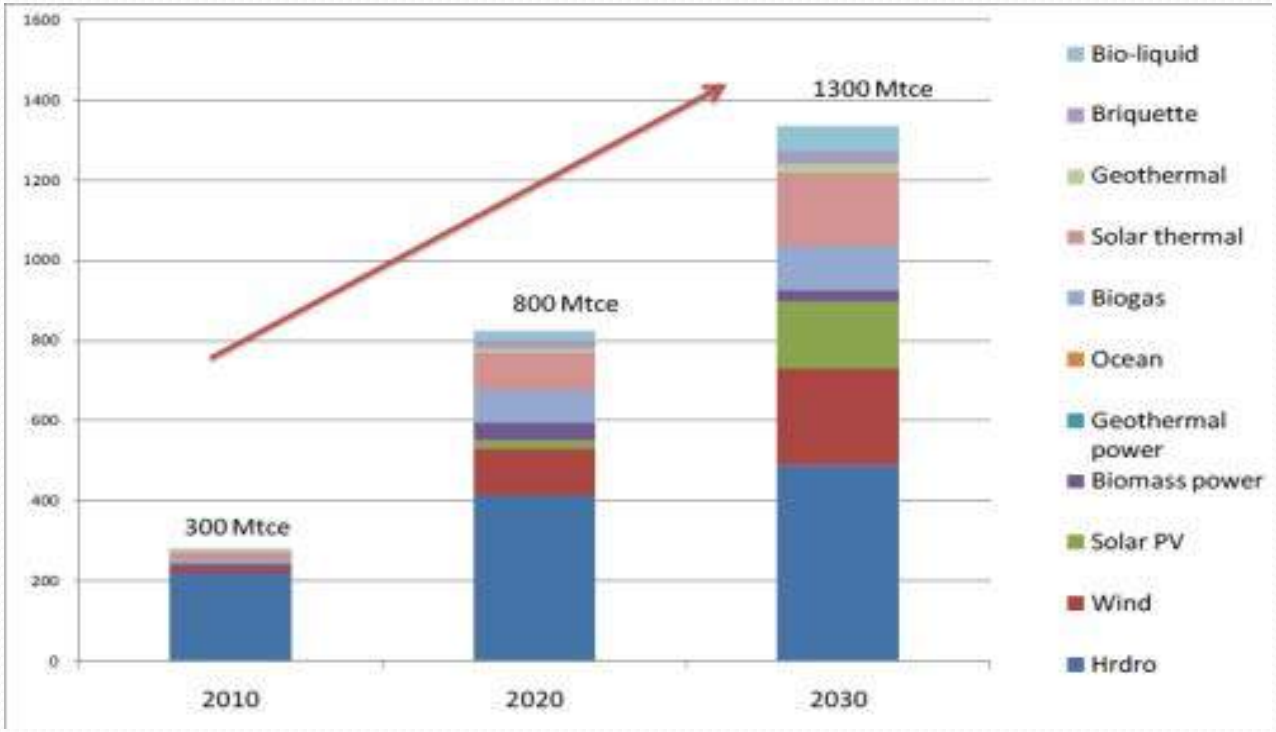
PRC energy security Concerns : rising oil imports



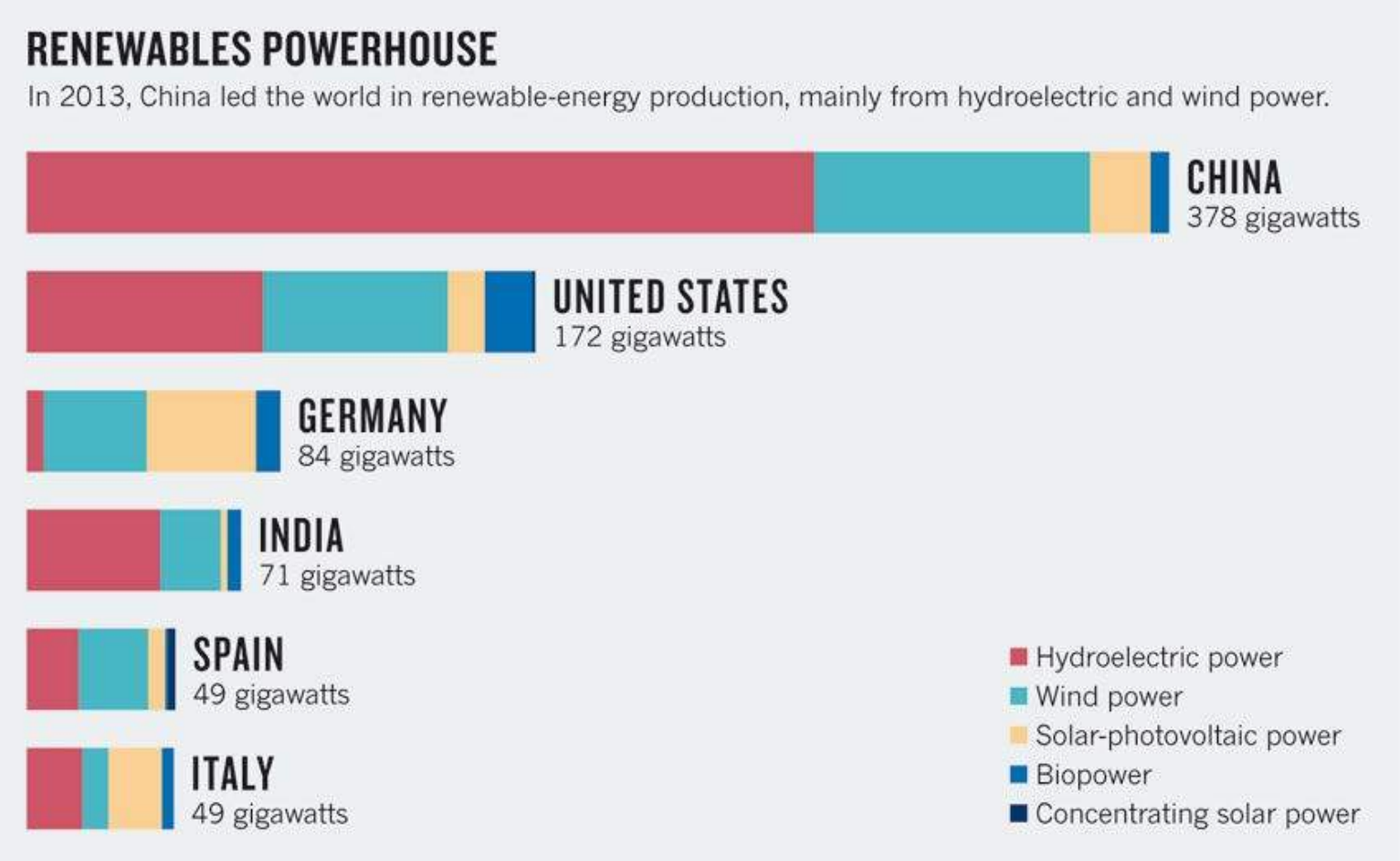
PRC energy security concerns : rising natural gas imports



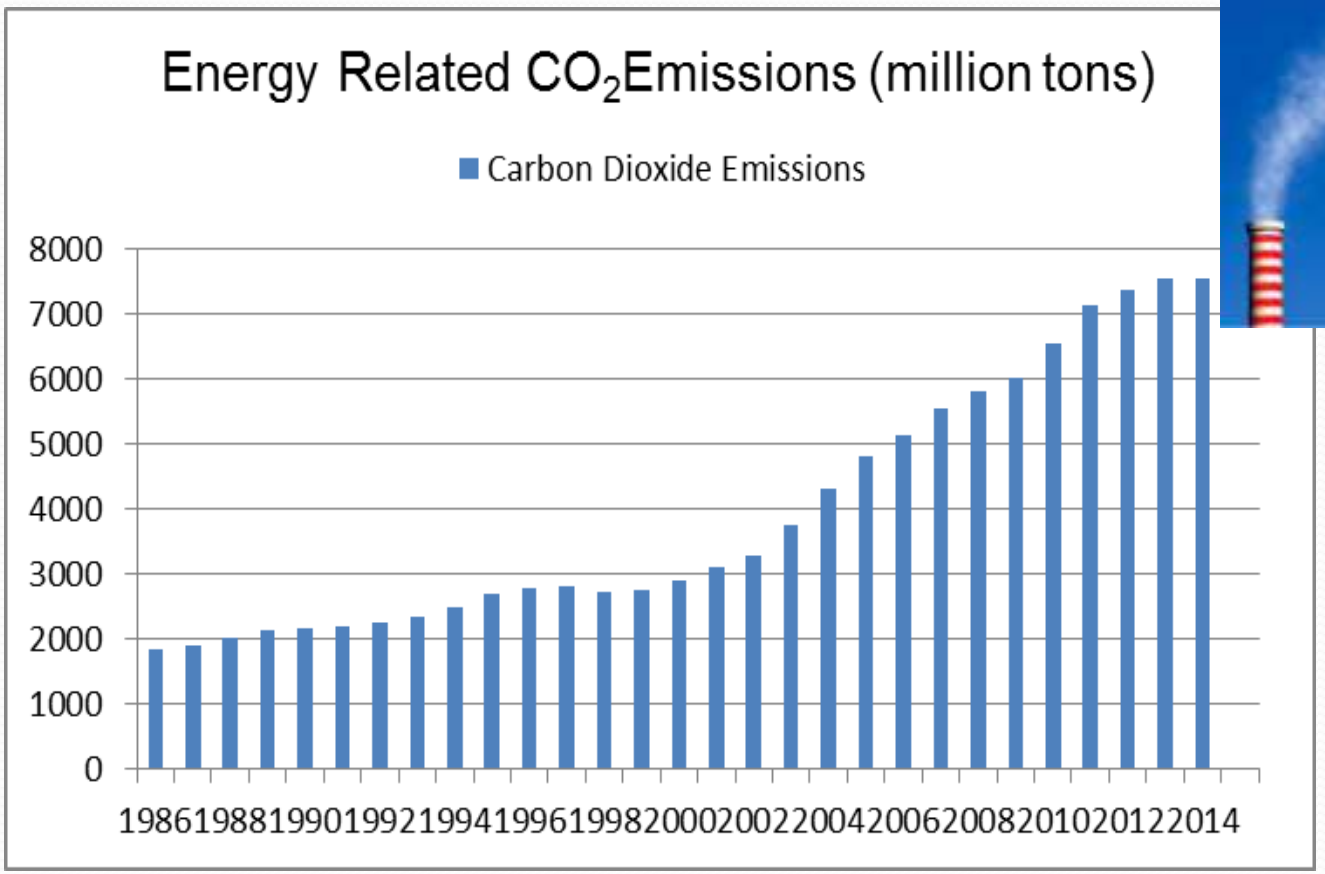
PRC : renewable energy is rapidly growing



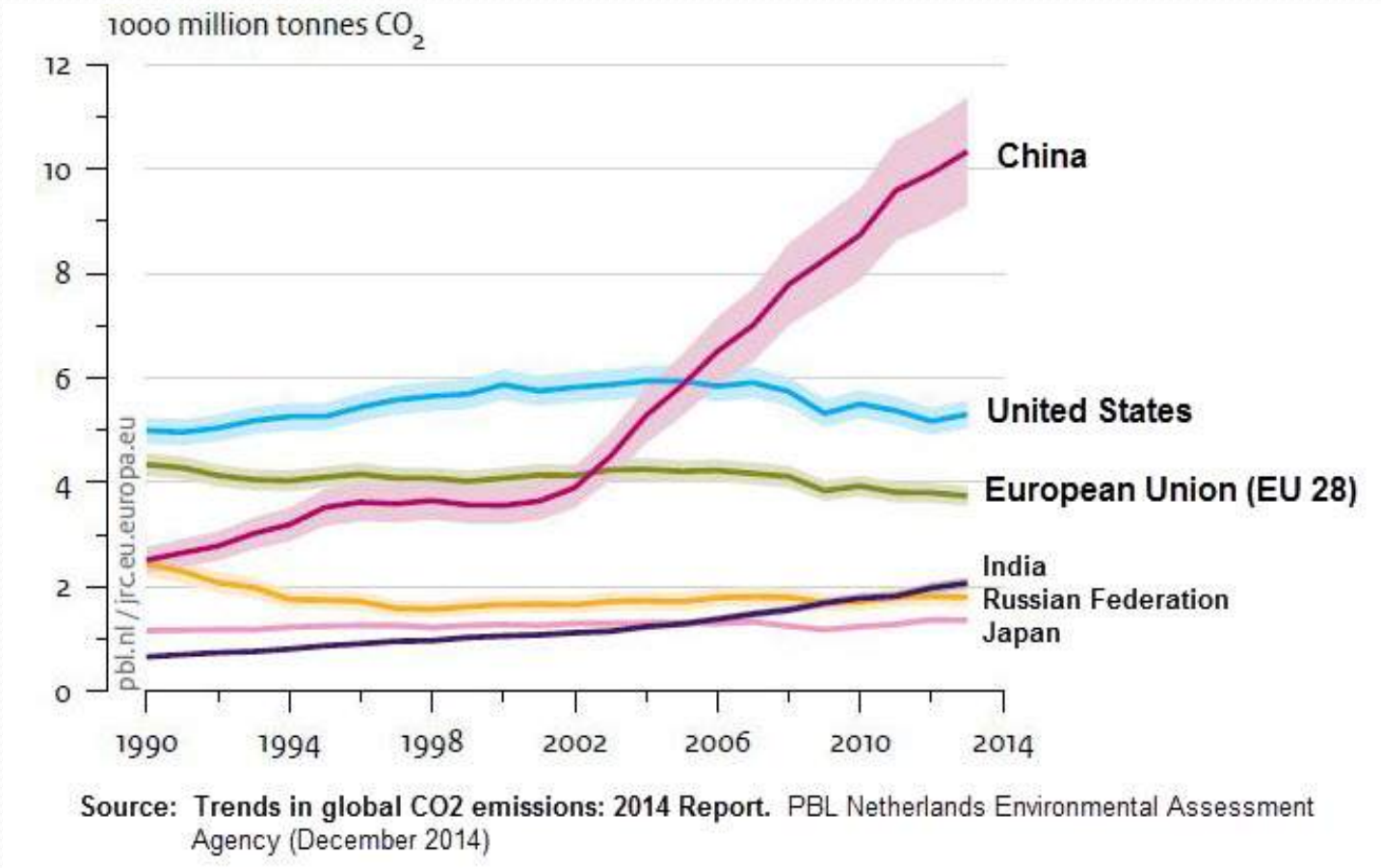
Renewable Energy – PRC is a global leader



PRC - Energy and Carbon Dioxide Emissions



Global CO_2 emission trends



Source: **Trends in global CO2 emissions: 2014 Report.** PBL Netherlands Environmental Assessment Agency (December 2014)

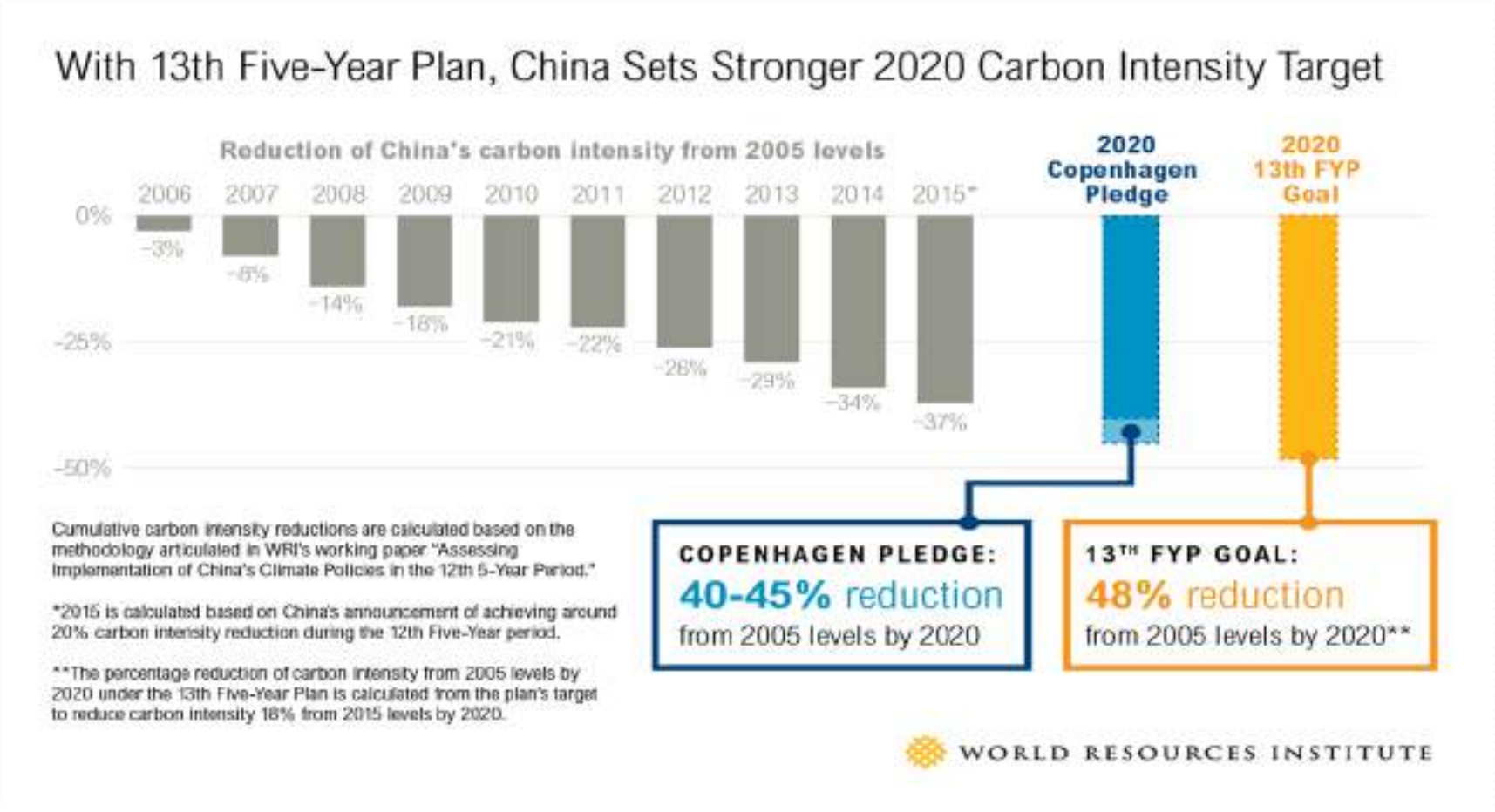
What were key Issues in the PRC's Energy Sector (2003 – 2013)

- Burgeoning energy demand;
- High energy and carbon intensity
- Coal dependency; rising oil and gas imports
- Weak sector regulation

PRC's response and Achievement – energy intensity reductions

Source: National Resource Defense Council (NRDC)

PRC's response and Achievement: carbon intensity reduction

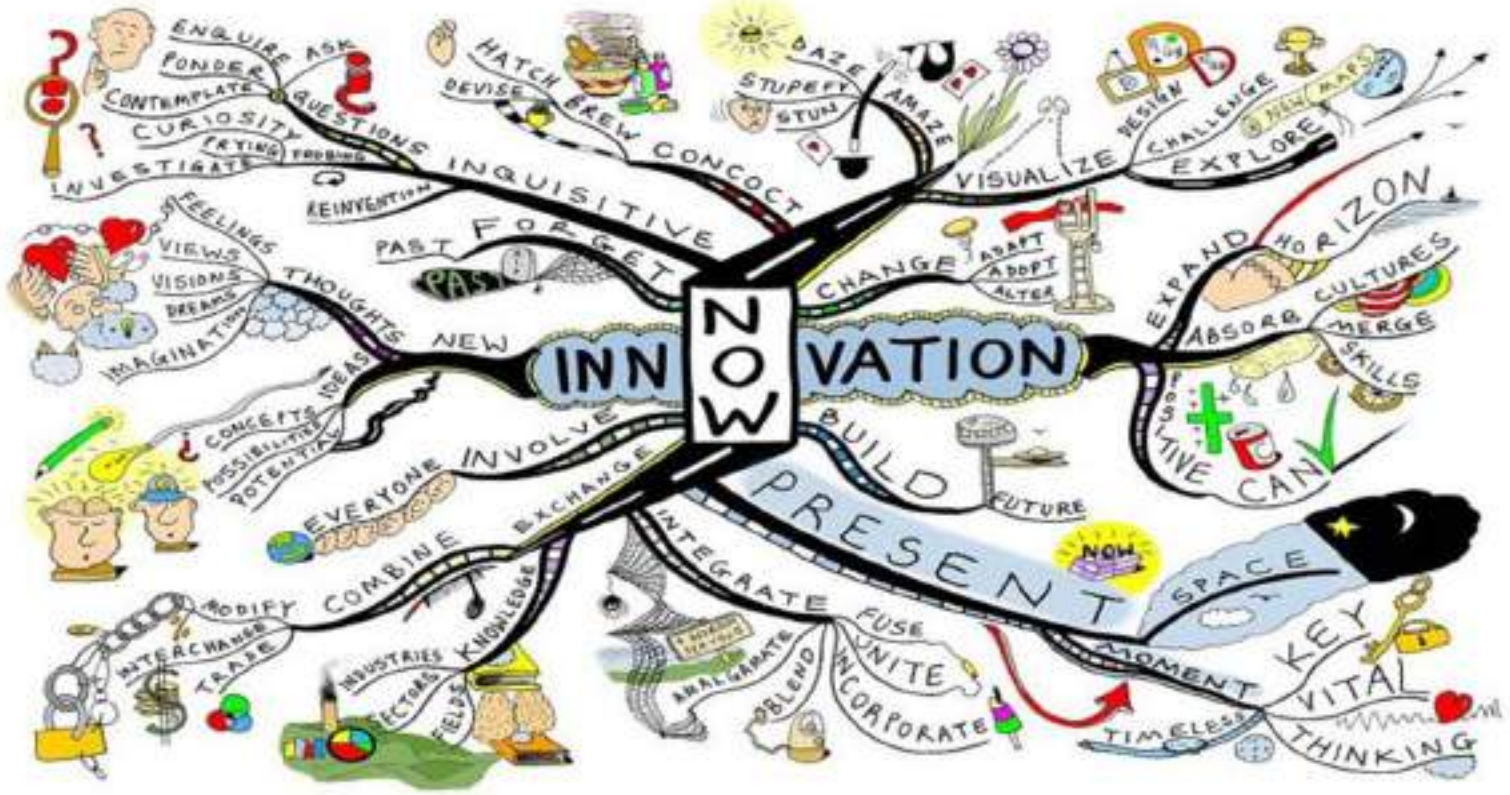


So, what ADB is doing in the PRC Energy Sector

- Active since 1986; targeting primarily lagging areas
- Reinforce the Government priorities through innovative projects that - a) field test new priorities; b) enable uptake and wider deployment of new technologies and approaches; and c) provide analytical support to formulate policies, undertake reforms and build capacity
- Cumulative sector lending > $4.5 billion; exclusive focus on clean energy to reduce emissions

Innovation in ADB Projects in the PRC

What is Innovation?



Innovation …..

- application of better or original solutions through more effective products, processes, services, technologies or ideas

CREATIVITY IS THINKING UP NEW THINGS.

INNOVATION IS DOING NEW THINGS.

It's Not The Idea, It's What You Do With It

ADB approach for innovative projects

Need driven.

In-country champion; strong support from government .

Capable agencies to implement them

Stepped up support during construction

But, Innovation is possible !
Some first-of-kind EAEN projects

Gansu Hydro	Guangdong EPP	Tianjin IGCC	Qinghai CSP
2003, 2005	2008	2010	2013
MFF	Energy Eff.	IGCC	CSP




ADB's Clean Energy Portfolio and Recent Examples in the PRC

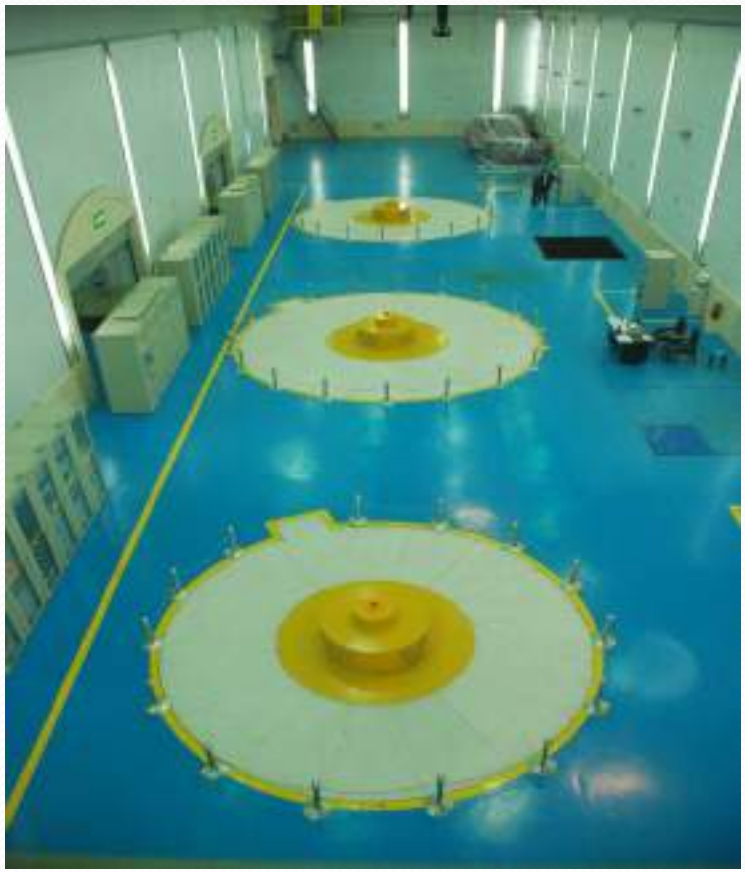
ADB's Knowledge and Innovation-Based Support to PRC's Clean Energy Development

Align sector strategies with PRC's FYP	• ADB sector priorities and strategies full aligned with FYP
Provide knowledge solutions to policy making and regulations	• New and emerging technologies targeted with upstream analytical work, tariff studies, policy papers and pilot testing
Improve risk profile by demonstrating high impact clean energy technologies	• Finance demonstration projects to build confidence in technologies and provide greater insight in to risks

Examples of Recent Innovative Clean Energy Projects– CMM Project in Shanxi (2004)

- Captures fugitive methane from one of the largest coal mines in Shanxi to generate electricity
- $117 million loan approved in 2004. The project is in operation
- It is CDM registered and generates more than 2.2 million tones of CERs/year
- One of the first and largest project of its kind

Examples of Recent Innovative Clean Energy Projects–Gansu Hydropower Projects (2003–2006)



- Three hydropower projects for a cumulative 220 MW capacity in remote rural Gansu
- $85 million loan; all three projects in operation
- All three CDM registered.

Energy Efficiency

Guangdong Energy Efficiency and Environment Improvement Investment Program.

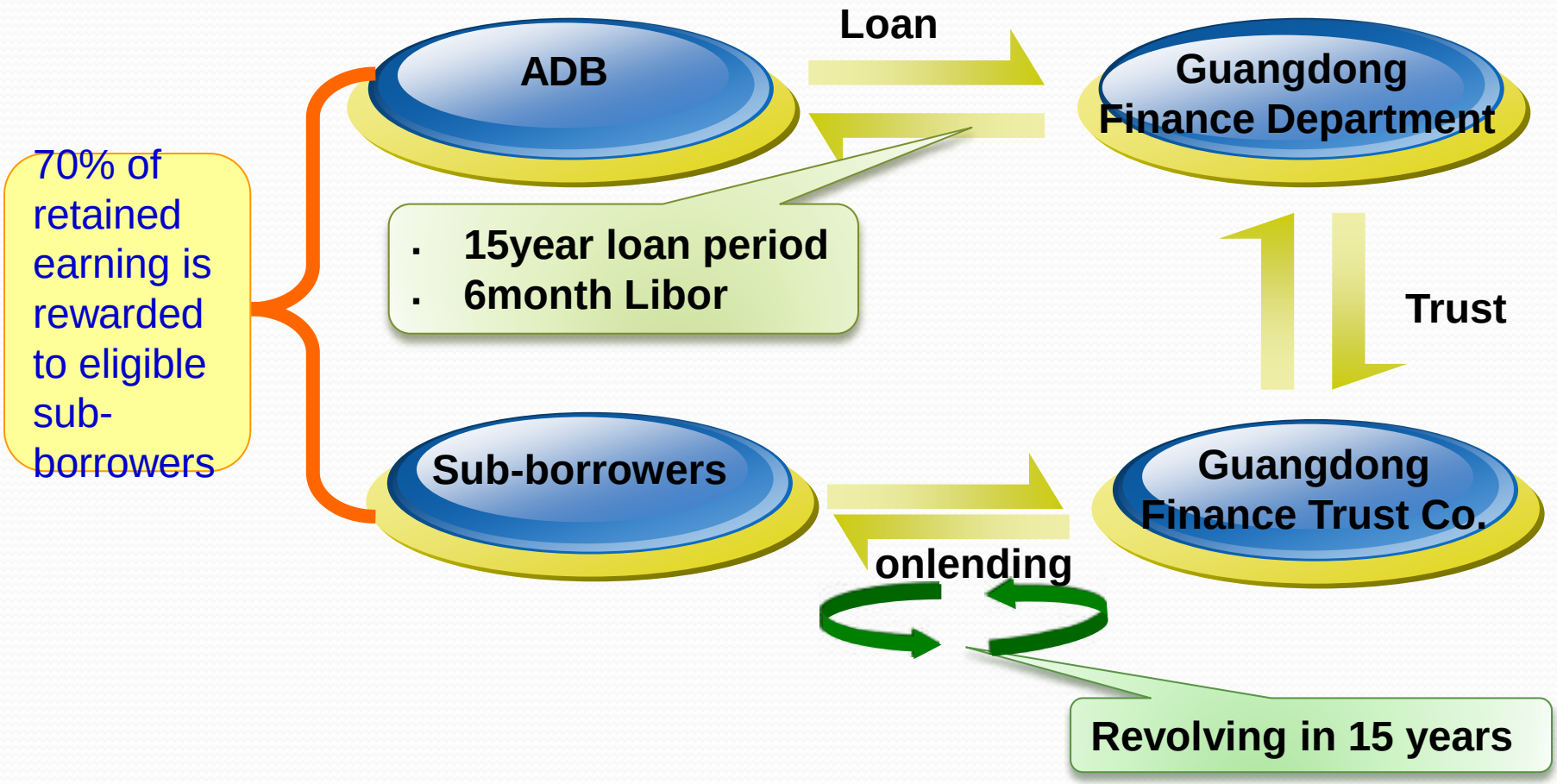
One of the first Efficiency Power Plants in country.

Some barriers to energy efficiency

icons from: www.iconfinder.com

- Limited access to financing
- Lack of awareness about energy efficiency technologies
- Focus on output growth
- Weak supply chain of energy efficient products
- Lack of understanding by banks how to evaluate energy efficiency benefits
- Lack of interest by commercial banks

Simplified On-lending Arrangements



Cumulative Outcomes of all 3 Tranches

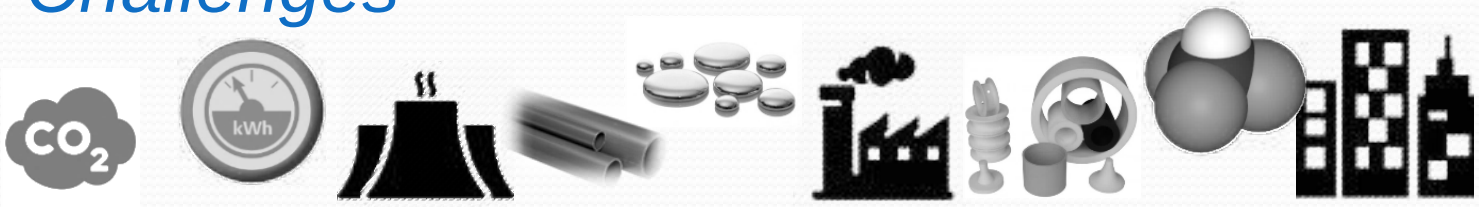
	Actual	Estimate at loan approval
# Subprojects	**20**	
Energy savings (GWh/year)	**1,212**	532
EPP capacity (in MW)	**242.3**	107
Coal consumption avoided (in tce/year)	**399,891**	175,813
Reduced emissions (in t/yr)		
CO_2	**945,197**	415,560
SO_2	**10,906**	4,795
NO_x	**2,424**	1,066
TSP	**4,241**	1,785

- **Electricity cost savings of about $117 million per year.**
- **For every dollar invested, about $4 of energy cost saved.**
- **ADB funded 40% of total investments.**

Chemical Industry Energy Efficiency and Emission Reduction Project

A development with outstanding innovative features

Chemical Industry in the PRC :
Key Challenges



icons from: www.iconfinder.com; www.innomould.be; www.koi-steppan.com: www.wikipedia.com: www.livescience.com: www.inerjy.com

- Coal dominated fuel and feedstock mix
- High energy intensity
- Major emitter of greenhouse gases and other toxic pollutants
- Need for technological improvements and R&D breakthroughs
- Significant barriers to scaling-up and disseminating important energy efficient innovations

- China National Chemical Group (EA),
- China Haohua Chemical Group (IA) HQ &
- Huatai (ESCO / PMO)
- China Construction Bank (FI & co-financier)

Subproject Location

PVC production process transformation

Dezhou Shihua Chemical

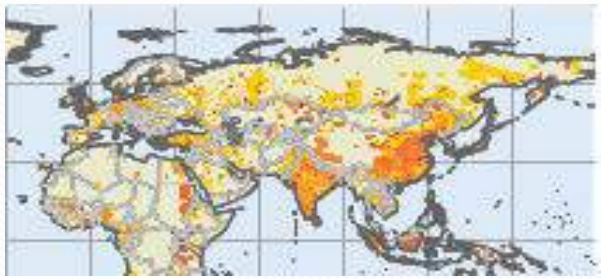
Package of energy efficiency & GHG abatement investments

Zhonghao Chenguang Research Institute of Chemical Industry

Subproject 1: Mercury-free PVC Process Transformation

- 80% of PRC's PVC industry applies coal-based process that uses mercury as catalyst
- Mercury used in this industry represents 50% of global demand—about 1,300 t in 2013
- PRC endeavored since 2010 to phase-out this process

First-of-its-kind commercial-scale demonstration of a pilot tested mercury-free technology transformation and is estimated to reduce energy intensity by more than 40%

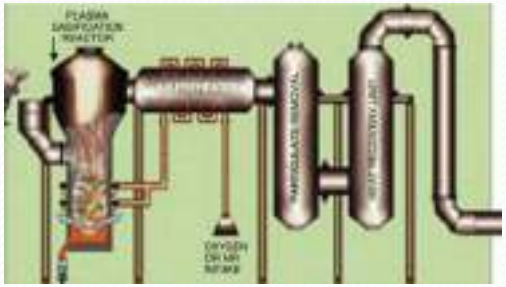


Subproject 2: Packaging EE with GHG Abatement

ESCO financing of

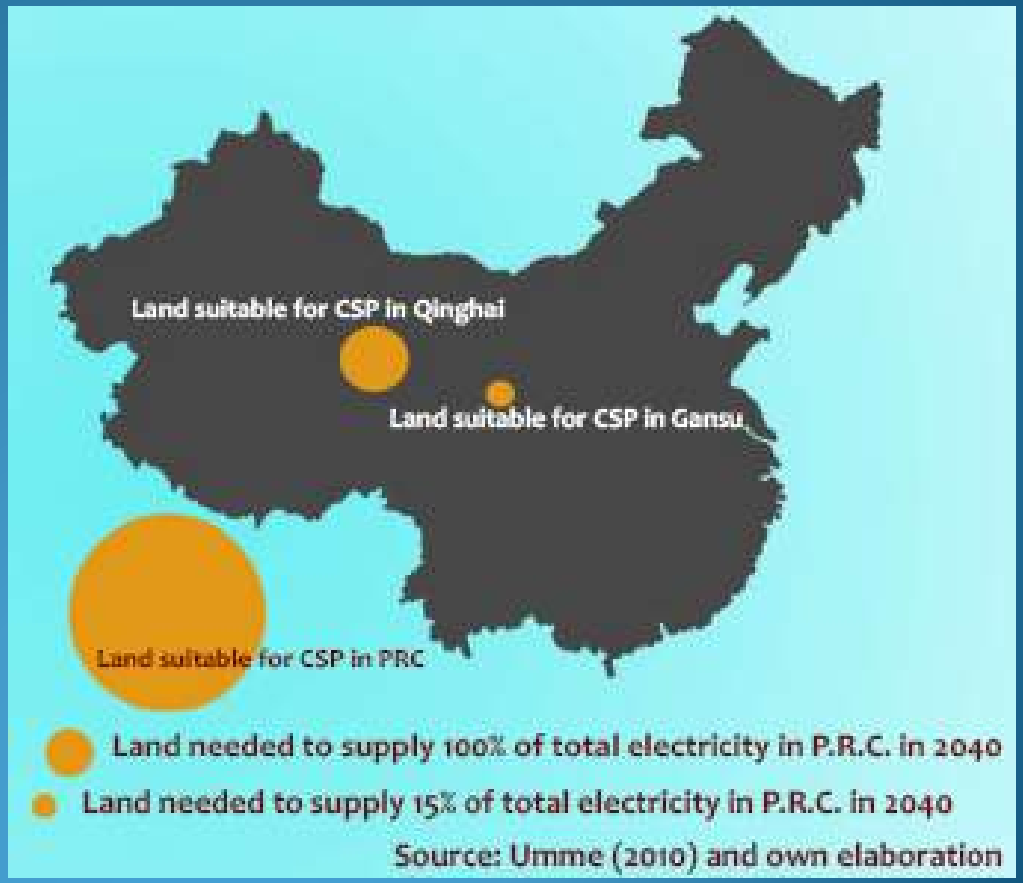
- comprehensive energy efficiency measures; and
- plasma gasification of HFC-23 emissions

Packaging makes GHG abatement project financially sustainable.

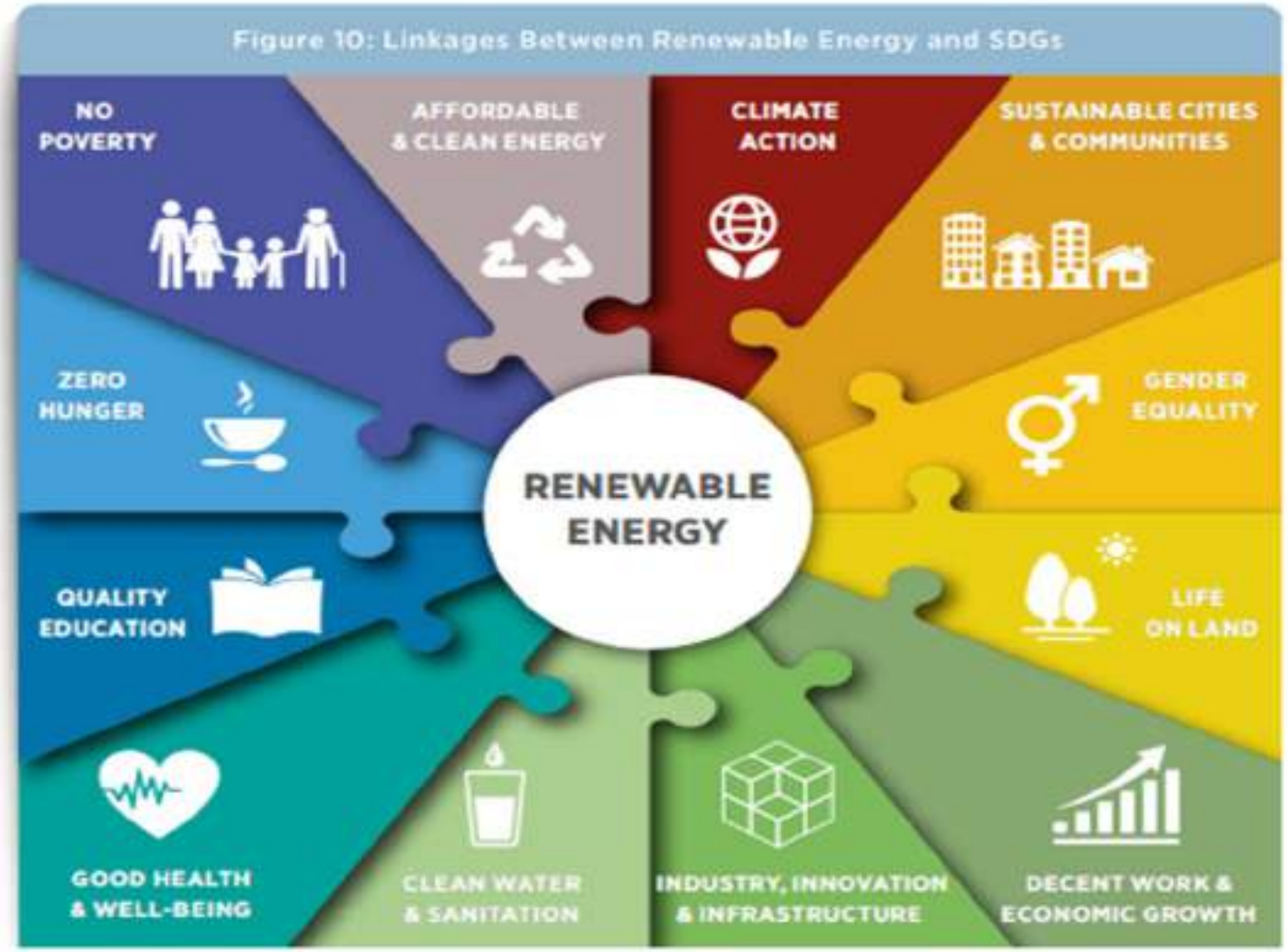


Project is expected to avoid more than 13MtCO_2e.

Renewable Energy



Obvious benefits of renewable energy



CSP Development in the PRC

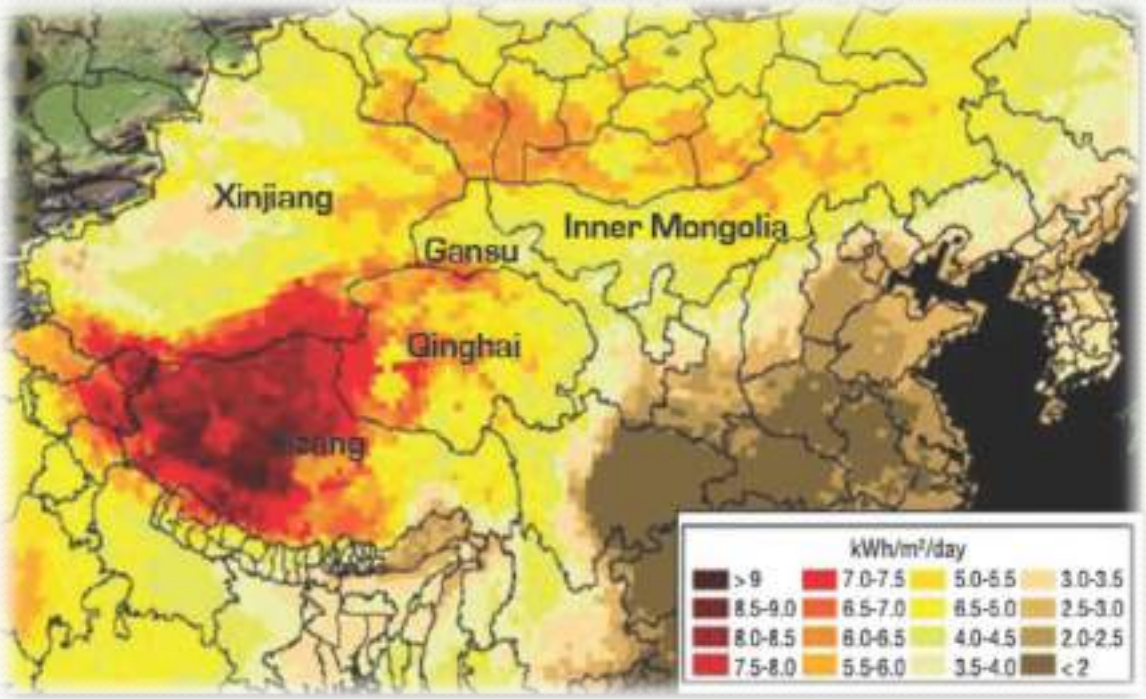
Why CSP in the PRC?

Perfect fit with the common mutual priorities

Abundant solar resources mainly in western provinces - 15% of total electricity production from CSP in 2040

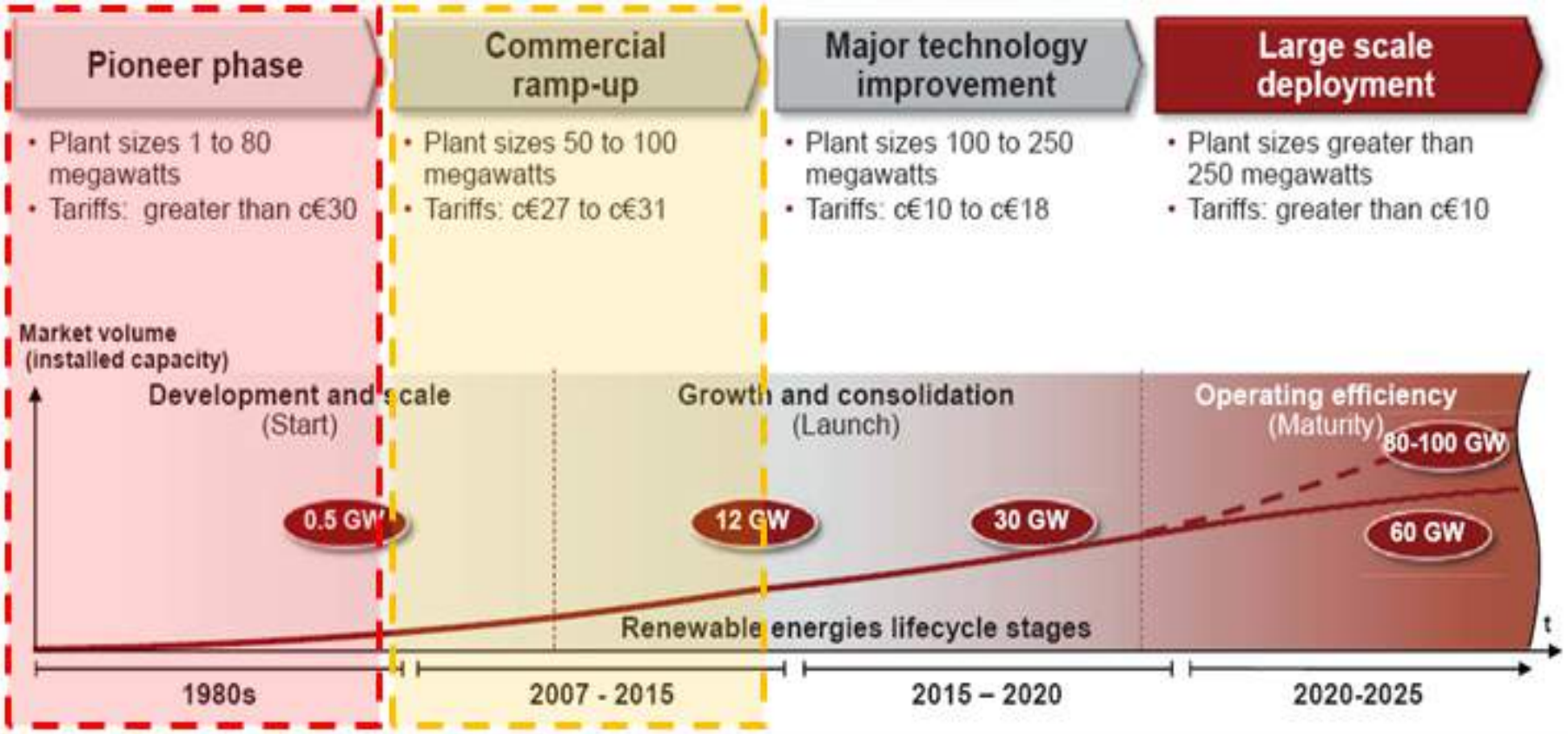
Reliable power supply and inherent storage i.e. when needed - any time of the day and night.

High share of local content in the CSP value chain.& job creation potential



- The Government targets 10 GW solar thermal power development by 2020

Status of CSP Development in the PRC



PRC

Global

Need to demonstrate immature renewable technologies through demonstration projects

ADB's Activities for CSP deployment in PRC

ADB has been promoting CSP technology in the PRC since 2009

Capacity Development TA ($1M) to China Huadian Engineering Co

- CSP roadmap for Gansu and Qinghai provinces
- Pre-feasibility study of 50MW CSP project in Gansu province
- $250,000 grant for 1.5 MW Dahan solar tower power plant near Beijing

Financing 2 of 4 first generation CSP demonstration projects:

- 50MW Jinta project in Gansu province
- 50MW Delinha project in Qinghai province

Gansu, Jinta CSP project

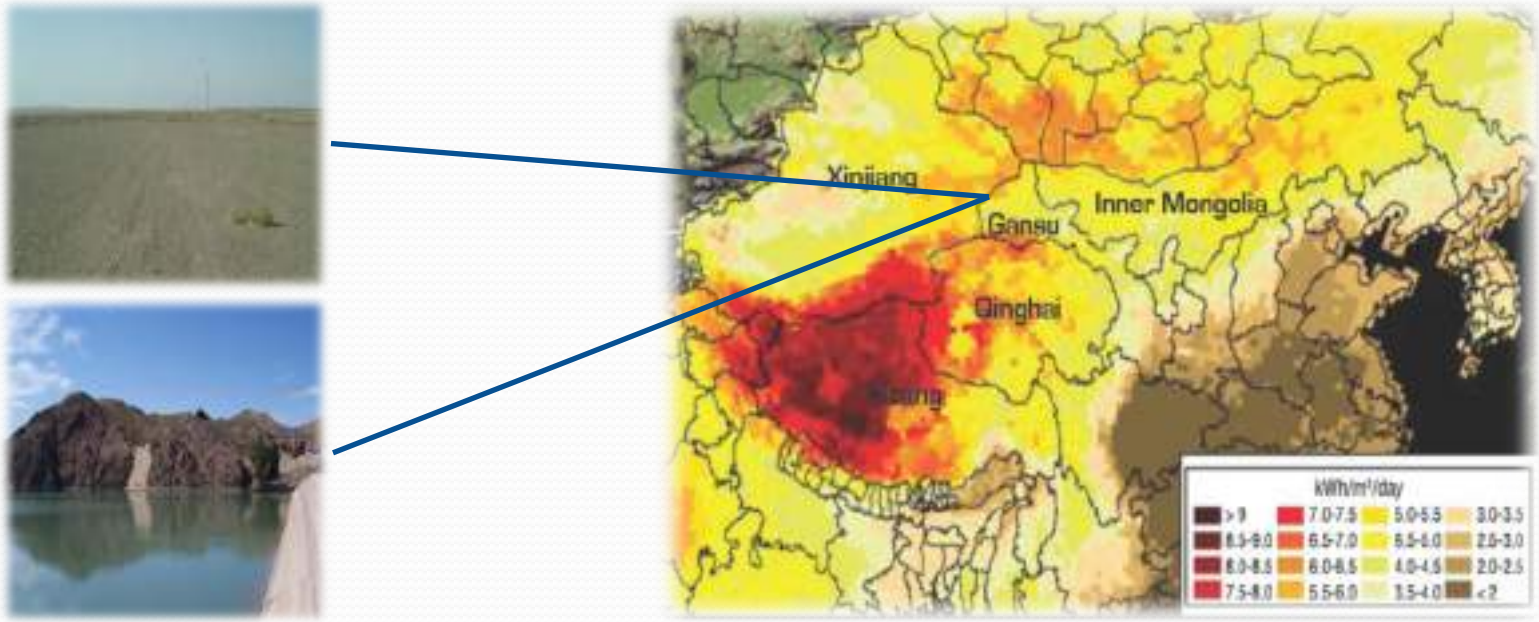
Capacity: 50MW

Technology: Parabolic trough +1 hours thermal energy storage

Developer: China Huadian Engineering Corporation

DNI: 1,900 – 2,000 KWh/m²/yr

Good infrastructure including land and **water availabilities**



Source: China Huadian Engineering Corporation

Qinghai, Delingha CSP project

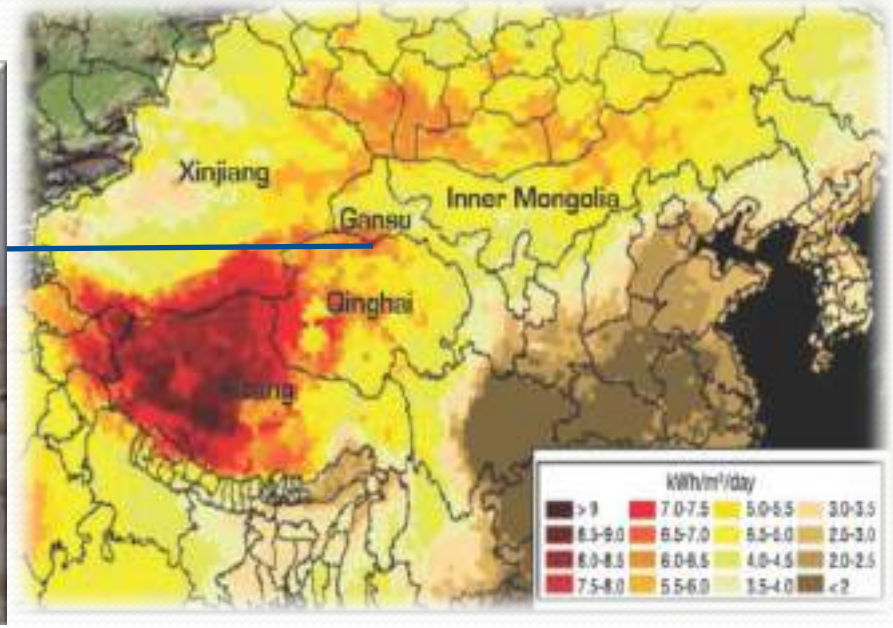
Capacity: 50MW

Technology: Parabolic trough with 7 hours thermal energy storage

Developer: China Guangdong Nuclear Solar Energy Development Co., Ltd.

DNI: 1,976 KWh/m²/year with over 3,100 day light hours per year

Site: Semi-arid condition with cold climate and water scarce condition.



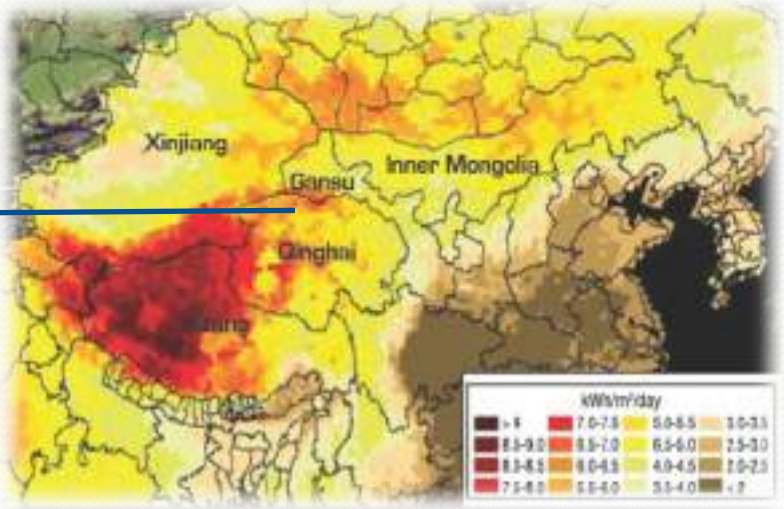
Qinghai, Delingha CSP project

Energy yield: 199 GWh/year

Emission reduction: 100,000 tCO2e/year

Project implementation: 2012-2014

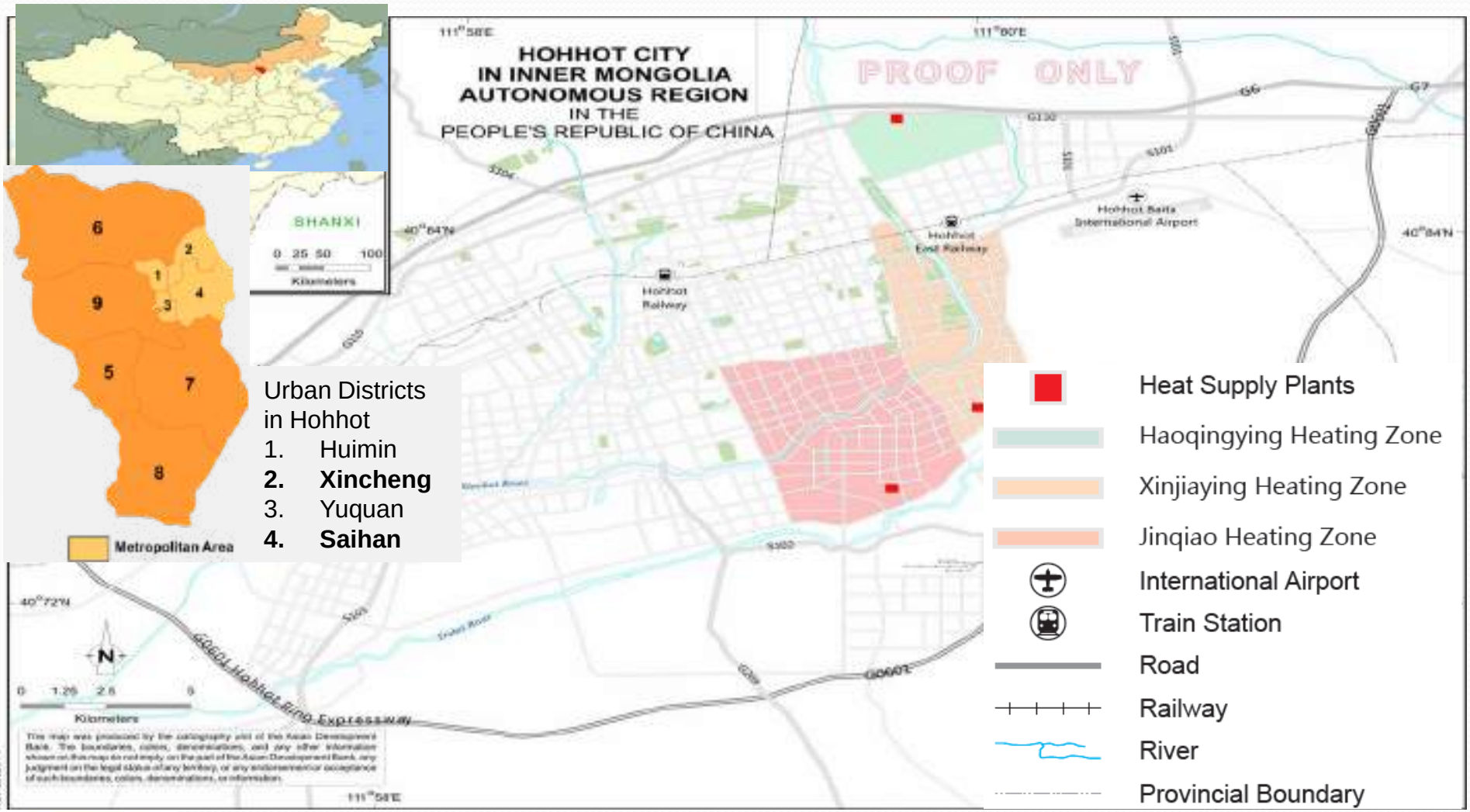
Commercial operation (Tentative) : October 2014



(Source) China Guangdong Nuclear Solar Energy Development Co., Ltd.

Low-Emission, Highly Efficient Urban Energy Systems

IMAR Low-carbon district heating project



Project Rationale

- Heating is essential, yet district heating coverage remains low.

- Coal-based district heating is dominant in Hohhot causing poor air quality.

The project will construct a low emission and highly efficient district using natural gas and excess wind power

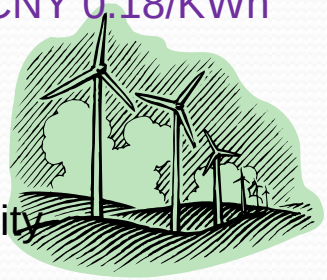
Innovative features

- First-of-its-kind large scale natural gas and wind-based district heating in Hohhot City, where coal-fired heating is dominant.
- $162.4 million collaborative direct value-added co-financing.
- New business model enables the use of excess wind energy in district heating.

New Business Model

Renewable energy fund (CNY 0.2/KWh subsidy)

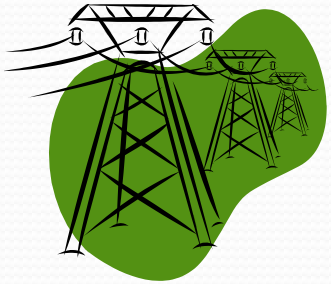
Profit: CNY 0.18/KWh



CNY 0.51/KWh (wind generated electricity "feed in tariff")

Electricity

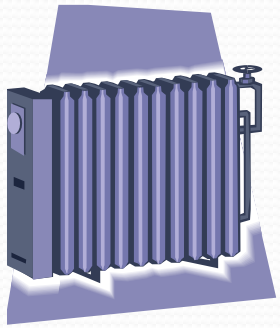
CNY 0.33/KWh (support to heating company)



Profit: CNY 0.12/KWh

Electricity

CNY 0.43/KWh (regular price for electricity price)



Actual power purchasing price: CNY 0.10/KWh

Policy-Based Loan to Improve Air Quality in JingJinJi

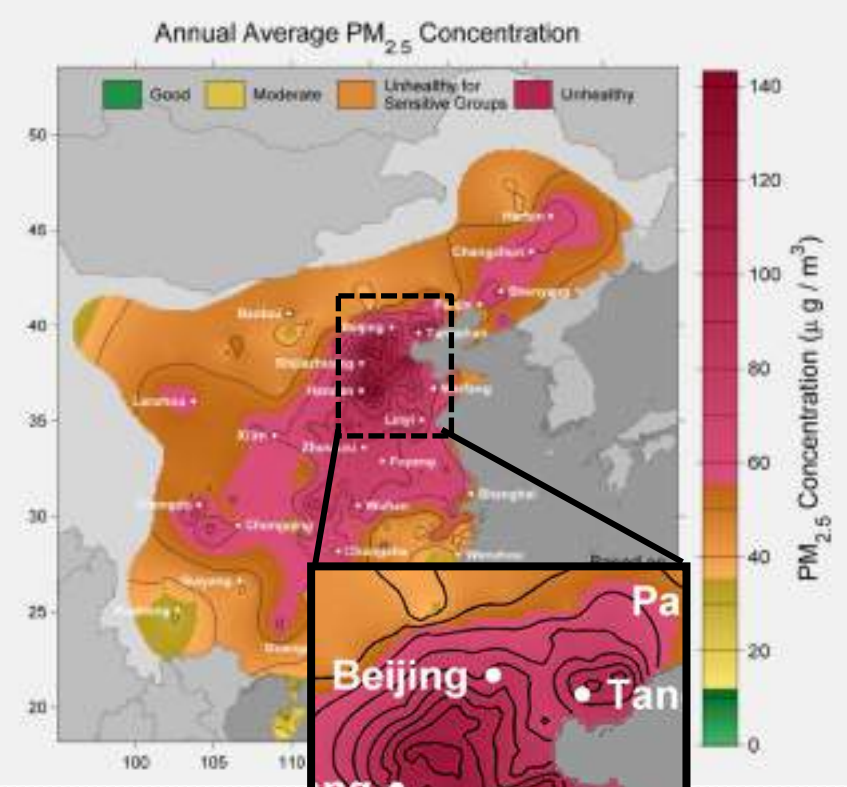
- To formulate and implement policy reforms
- First such policy based loan by any MDB in the PRC

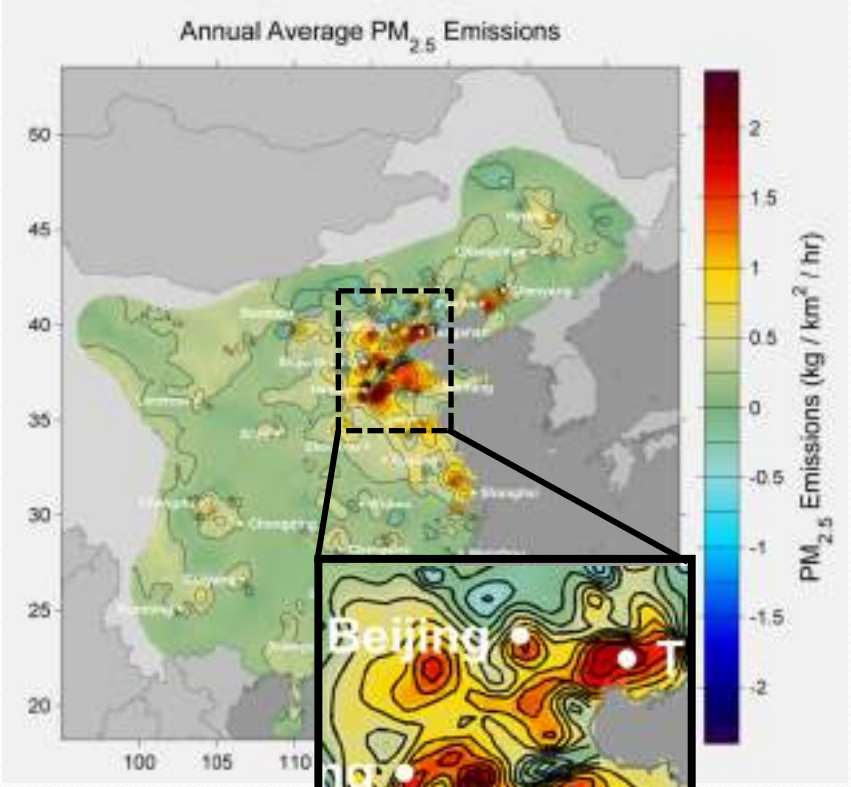
Air Pollution Impacts in the PRC

Study	Pollutant	Impact
WB and SEPA (2005)	PM10 (2003)	$82 billion* (current price)
MIT (2007)	PM10 (2005)	$154 billion** (current price)
Max Plank Institute et al. (2015)	PM2.5 + O3 (2010)	1.36 million premature death

*** direct health cost only**
**** health cost and welfare loss**

Air Pollution in the BTH Region





Apr. 2014–Apr. 2015

Data Source: Berkeley Earth and Dept of Physics, University of California, Berkeley

Reform Approach in Hebei

ISSUES	REFORM APPROACH
Fragmented and short-term air pollution control policies	Comprehensively support industrial transformation and adjustment of energy structure and urban and rural services
Weak environmental policy and institutional framework to support effective pollution control	Strengthen regulatory framework, enhance monitoring coverage and quality, and increase enforcement capacity at different levels
Incomplete coverage of social protection and training program to support industrial transformation	Provision of quality training and support for reemployment of skilled and unskilled workers

Policy Actions (1)

Output 1: Pollution from Key Sectors Fundamentally Reduced		
Constraint	**Strategy**	**PBL Policy Action**
Energy structure and existing system heavily rely on coal	Fuel Switch (supply side)	Natural gas network action plan Policy on synthetic natural gas recovery from coking industry
	Fuel Switch (demand side)	Quantitative targets of coal replacement from all municipal governments in 2015–2017 Coal-fired boiler management action plan Development of incentive schemes to promote clean energy heating service
No policy to effectively promote public transport	Promotion of public transport in urban area	Policy incentive for increasing urban public transport

Policy Actions (2)

Lack of alternative policy for biomass burning/ Low energy recovery from biomass	Promotion of clean energy and reduce biomass burning in rural area	Policy on biomass burning ban and promotion of agricultural biomass waste Higher energy recovery targets for biomass utilization Financial subsidy policy to promote biomass use for energy
Output 2: Environmental Policy and Institutional Framework for Implementation Strengthened		
Constraint	**Strategy**	**PBL Policy Action**
Incomplete legal and policy framework	Enhancement of legal and policy framework	Updated regulation on Hebei Air Pollution Prevention and Control New volatile organic compounds emission standard for key industries Explore options to develop strategies for heavy diesel trucks emissions control

Policy Actions (3)

Limited scope and coverage of the monitoring network to analyze pollution	Development of comprehensive monitoring and analytical system	Upgraded ambient air quality monitoring capacity Increased capacity and coverage of industrial emission standards compliance monitoring
Weak regulatory enforcement for effective policy implementation	Enhancement of regulatory enforcement capacities	Policy on environmental accountability for decision makers Training plans on (i) air quality monitoring, modeling, and forecasting, and (ii) regulatory enforcement in counties and townships
Output 3: Employment Promotion for Inclusive Industrial Transformation Enhanced		
Constraint	**Strategy**	**PBL Policy Action**
Incomplete policy on reemployment support	Provision of quality training and supports for reemployment	Policy on employment and entrepreneurship for local skilled and unskilled laborers

Advance Low Emission Coal, including Carbon Capture and Storage

Why coal–based electricity? Why more power plants?

No practical alternative for base-load electricity; continued demand –supply gap in many countries in Asia

Coal deposits fairly widespread across Asia; coal is also easier to transport and import

Gas is not readily available, is 3 – 4 times more expensive and is subject to greater price volatility

Nuclear is not an option in most countries

ADB's selective approach for financing coal plants

Need to demonstrate overwhelming economic rationale

As a minimum supercritical plant, more efficient plant than the last commissioned plants (3 years average)

Ongoing sector reforms and conducive environment for other competing electricity generation technologies

Established CCS dedicated fund (UK and AUS supported) and supporting preparation of demonstration projects

Examples of Recent Innovative Clean Energy Projects– Tianjin 250 MW IGCC Project (2010)

- PRC's first IGCC plant as part of its GREENGEN program
- $135 million loan and $5 million grant approved in 2010
- Project is expected to be in operation in 2012
- A pilot CCUS project to capture and store 100,000 t CO_2 per year is being assessed

CCUS–Pipe Dream or Reality

Boundary dam project illustrates the potential drivers for CCUS

PRC, Indonesia and Malaysia have “ready opportunities” but CCUS is seen as aggressive mitigation response rather than clean energy solution

HELE + “CCS-ready” in large economies will be a hedge against locking in to high emission path

Despite many low-cost opportunities, CCUS is treated as a technology of last resort delaying its demonstration.

Towards, making a business case for CCUS

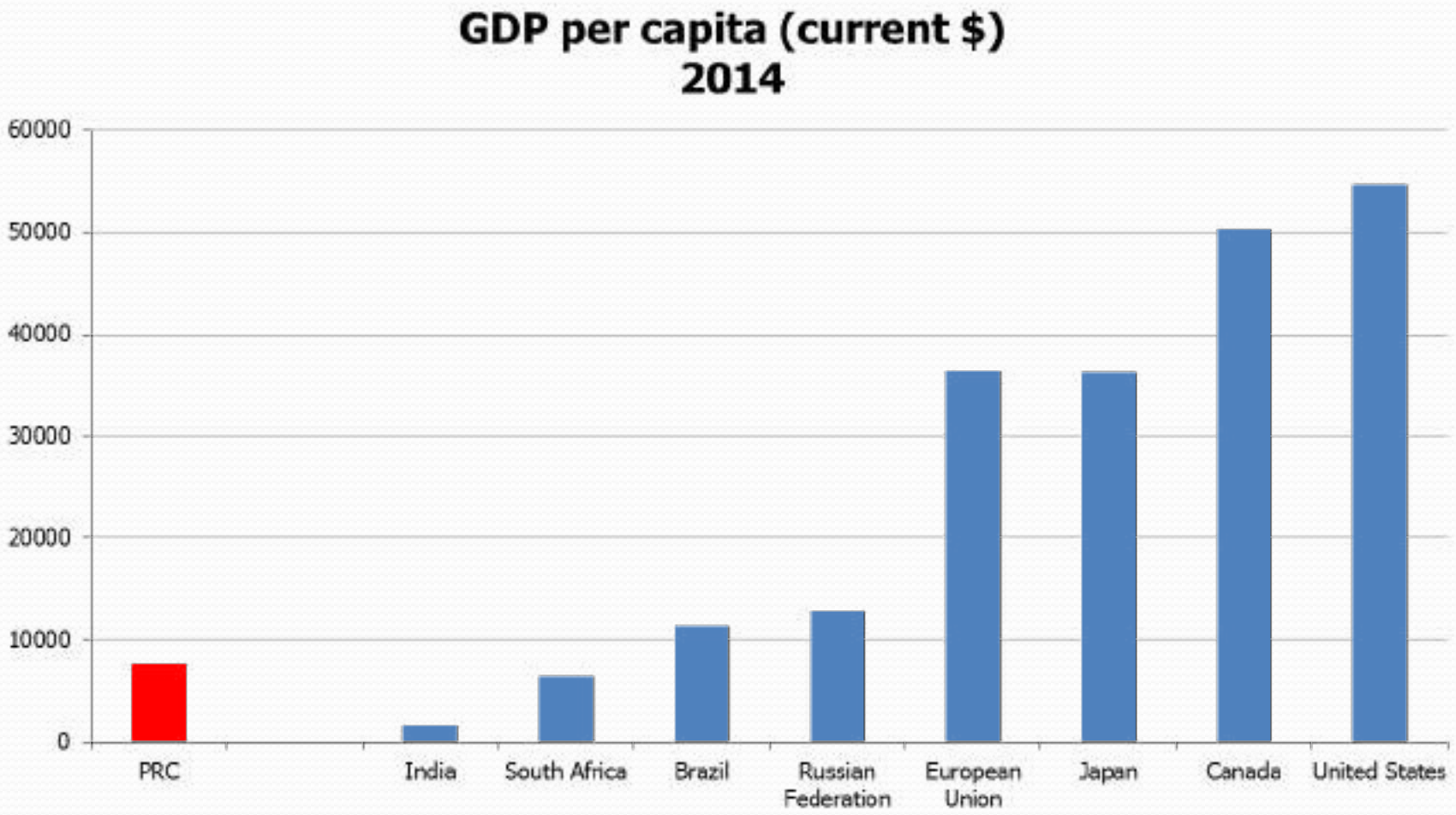
CCUS Roadmap for the PRC

CCS Roadmap Launch in COP 21 by ADB President Nakao, Minister Xie Zhenhua and DDG Yang

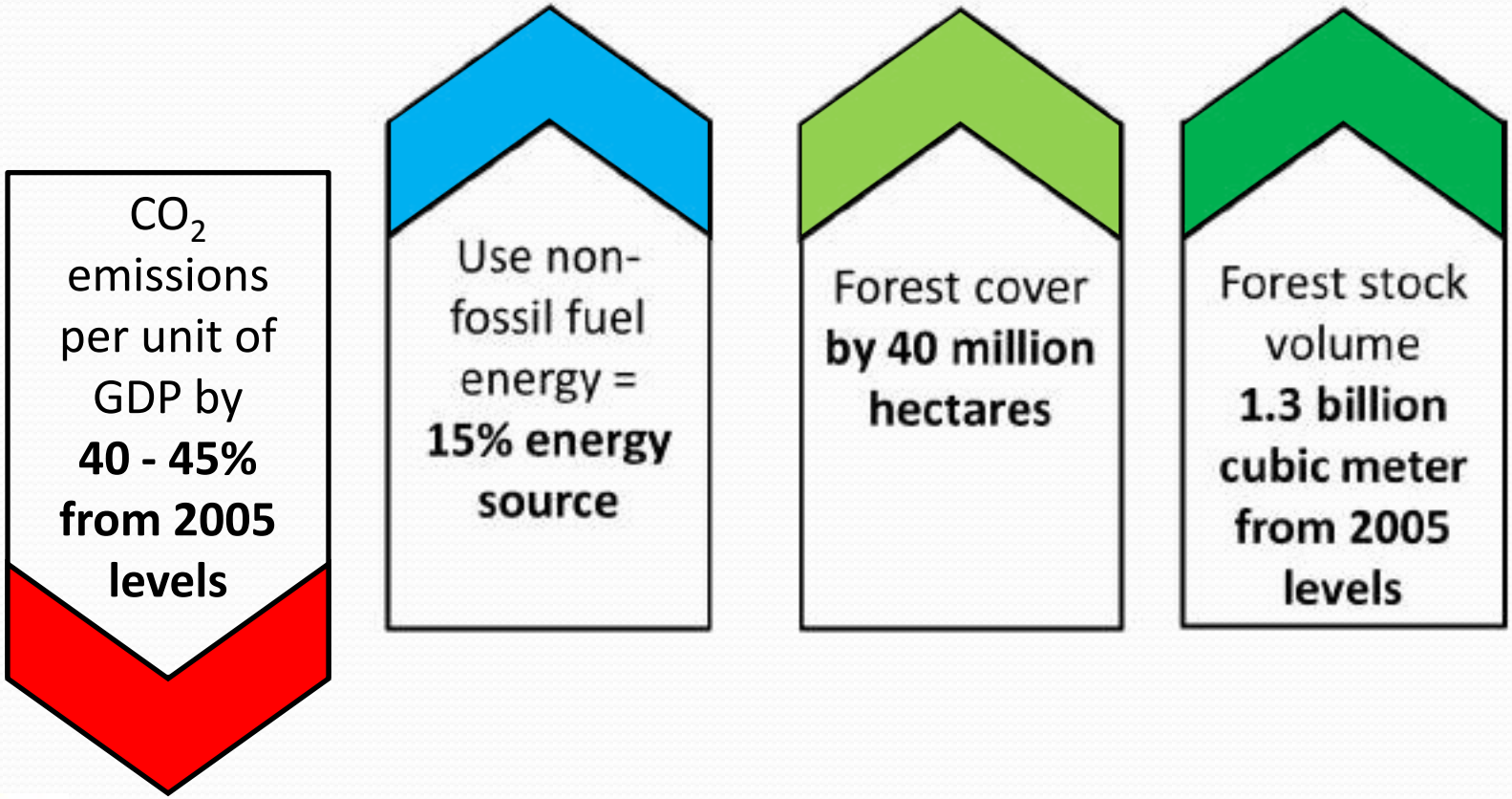
Key messages

- CCS is essential
- PRC has readiness
- Unique low-cost opportunity exist that can be take up during 13th FYP
- Policy and regulatory issues should be addressed in parallel to demonstration

Energy and Climate Change


GDP per capita (current $)
2014
60000
50000
40000
30000
20000
10000
0
PRC
India
South Africa
Brazil
Russian Federation
European Union
Japan
Canada
United States

By 2020, China has committed to:



Challenges faced by China

1. To achieve peaking of CO_2 emissions by 2030

2. CO_2 emissions/unit of GDP

60 - 65%
2005 levels

3. Share of non-fossil fuels

20%
primary
energy
source

4. Forest stock volume

4.5 billion
cubic
meters
2005 levels


WORLD RESOURCES INSTITUTE
Climate Action in China
Over the Last Five Years
2011
Sets carbon intensity and non-fossil energy targets in 12th Five Year Plan
2012
Becomes world's #1 investor in renewable energy
2013
Bans new coal plants in three key economic regions
BY 2014
12 provinces set coal limiting targets
2014
Commits to peak carbon emissions around 2030 or earlier
2014
Coal use plateaus for first time
2015
Overtakes Germany as #1 in solar capacity
2015
Pledges $3B+ for climate action in developing countries
2016
RELEASE OF 13TH 5 YEAR PLAN
FIND OUT MORE AT www.chinaiaqs.org
WORLD RESOURCES INSTITUTE

Climate Resilience

Energy Sector Investments in Developing Asia

- Annual investment of US $150 billion + up to 2030
- ADB's annual energy sector investments > $5 billion
- Energy investments usually have a life time > 30 years

Ensuring the resiliency of this large investment to risks of adverse impacts of climate change is essential.

Climate Change Impacts on Energy Investments

Increased air temperatures

- thermal generation less efficient
- increased cooling water requirements
- increased energy demand

Increased water temperatures

- reduced electric power generation
- reduced cooling efficiency

Extreme weather events

- damage generation and grid infrastructure
- interrupt fuel supply

Water scarcity

- reduced electric power generation
- reduced cooling efficiency

Changes in cloud cover, windspeed

- reduced viability of renewables (solar, wind)

Sea level rise

- flooding of power plants, oil refineries and fuel storage facilities located in coastal areas

Adaptation Options for Climate Resilience

Thermal Power Facilities:

- convert once-through to recirculation cooling
- convert to dry cooling towers
- increase volume of water treatment works
- use waste water and brackish water for cooling
- waterproof facilities where increased flooding is expected
- decentralize generation

Hydropower Facilities:

- divert upstream tributaries,
- build new storage reservoirs
- increase existing storage
- improve catchment cover
- modify spillways
- install turbines better suited expected conditions

Adaptation Options for Climate Resilience

Wind Energy Facilities:

- taller towers
- new turbines better able to capture increased wind speeds

Solar Energy Facilities:

- solar modules with a higher temperature coefficient
- string or micro inverters (cool down easily)
- more robust structures, tracking motors and mountings

Biomass and Biofuels:

- more robust feedstock
- expanded or more efficient irrigation systems

All Coastal Facilities:

- assure robust protection from sea level rise, floods, tsunamis, or other extreme events

Planning Options for a Climate Resilient Energy Sector

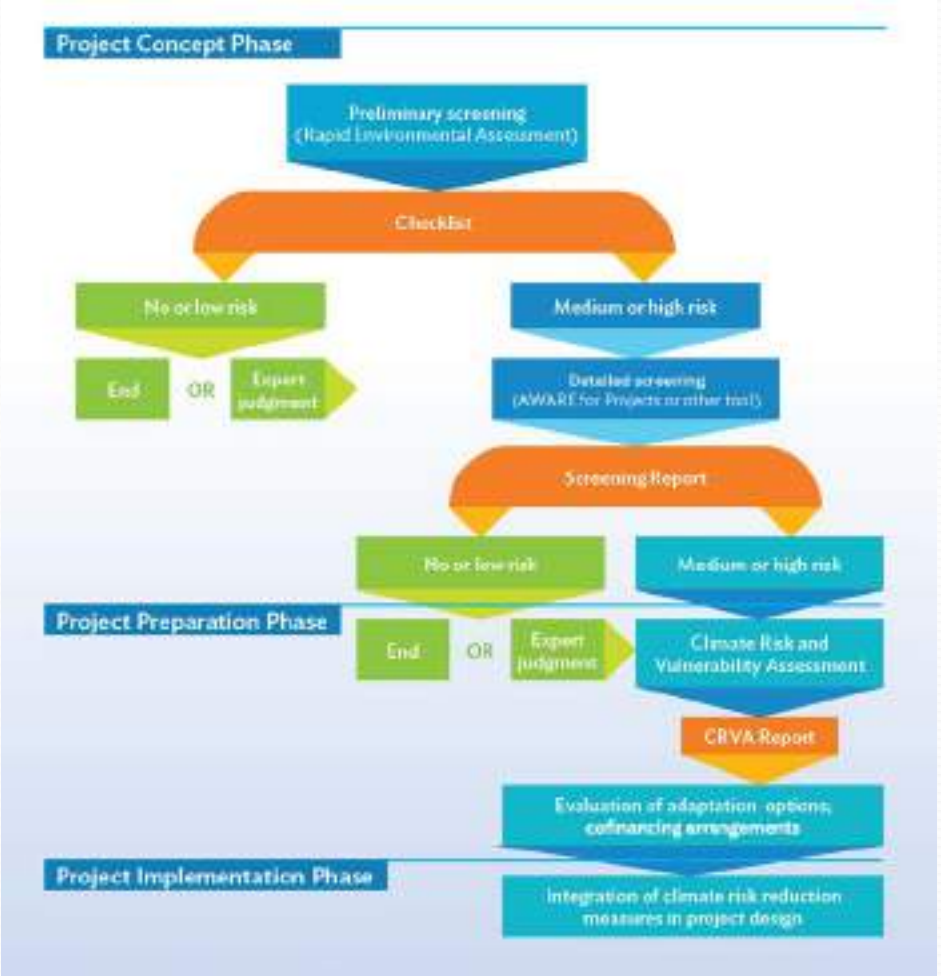
- Improved modelling of vulnerability of energy sector to low probability–high impact climate events
- Greater redundancy to ensure reliability of energy supply
- Sector wide assessment to identify climate vulnerability and improve cost-benefit assessment of resilience measures
- Diversify energy supply mix and greater use of decentralized supply options
- Integrated resource planning that takes into account cross sector issues such as water-energy-food nexus in the context of climate change
- More robust assessment of climate vulnerability of new investments in energy infrastructure

What ADB is doing ?

- Embed climate risk assessment in projects' planning and climate proofing of projects at risk
- Capacity building in energy sector planning
- Regional integration of energy networks to enhance redundancy and reliability

Climate Resilience in ADB Projects

- Climate risk management embedded in project cycle:
  - **Climate risk screening** at the concept development stage
  - **Climate risk and vulnerability assessment** in the preparation of projects at risk
  - **Technical and economic evaluation** of adaptation options
  - **Monitoring and reporting** of climate risk ranking and adaptation spending

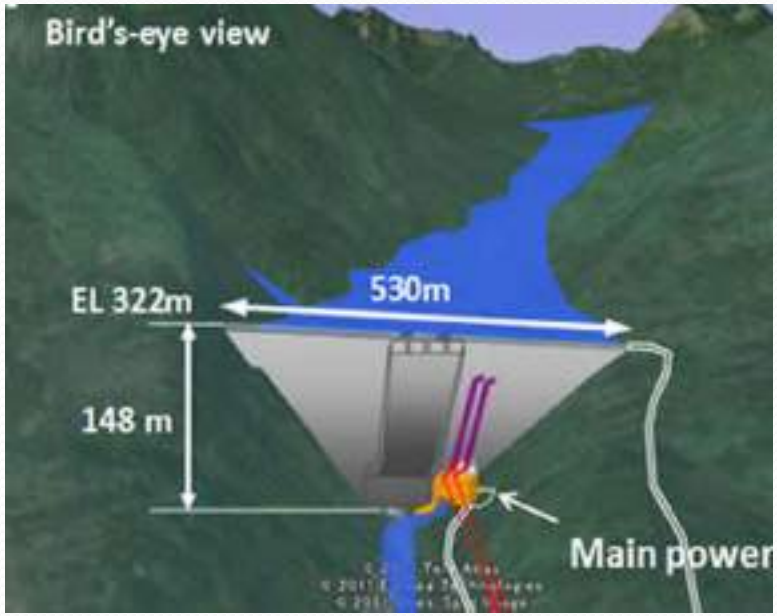


PNG Town Electrification Investment

- $71.6 m investment; 2 run-of-river hydros
- Anticipated impacts: more severe rainfalls and floods, prolonged and intense droughts
- Adaptation measures integrated in the project design
  - A new stream gauge and rain gauge installed to provide long term monitoring of catchment.
  - Design flood level calculated to allow setting of the power station floor at an appropriate elevation.

Hydropower Project on Mekong Tributary

- $982 million project; $144 million: ADB
- 290 MW hydropower plant
- Anticipated scenarios :Increase in air and water temperatures, precipitation, and more frequent floods
- Climate change impacts: degraded water quality, increased catchment erosion; sedimentation of reservoir; increase in spillway discharge; damage to spillway



- Potential benefits in increased inflow and hydropower generation
- Adaptation recommendations: (i) monitor cc risk parameters (temperature, DO, …), (ii) catchment management to reduce erosion; (iii) adaptive capacity for increased wet season electricity production; (iv) flood early warning

Samoa Renewable Energy Development and Power Sector Rehabilitation Project

- $23.9 million project budget
- Rehabilitation to increase resilience of the power sector damaged by a major cyclone
- Three small hydropower plants (SHPs) on Upolu and construct three new SHPs on Upolu and Savai'i

- Training on operation and maintenance of the SHPs
- Climate risk and vulnerability assessment showed potential negative impacts of extreme weather events (e.g., cyclones) throughout the life cycle of the project
- Adaptation integrated in project design
  - erosion protection to prevent scour around the intakes
  - level of the powerhouse discharge outlet increased to prevent flood induced backflow

Insights from ADB

- Risks need to be identified at the early stage of project development
- **Context of vulnerability** (what is the project vulnerable to and what are we trying to adapt to) is key
- Climate risk and vulnerability assessment can be undertaken within a reasonable timeframe and limited resources
- Adaptation is not cost neutral but may not always expensive
- Adaptation is context specific–no 'standard cost'
- A large menu of engineering and non-engineering adaptation options are available
- Continued *learning* process

Source: ADB. Forthcoming. *Building Climate Resilience in Asia and the Pacific: Insights from ADB Experience*. Manila

Forward Looking Priorities

Non-Lending / Knowledge Work
Policy Advisory and Capacity Development Activities

- Emerging but relevant area were targeted
- Work with key relevant agencies
- Support analytical and pilot work as well as policy and regulatory framework

- Smart grid–assist State Grid to integrate larger wind power generation in the grid
- Energy Regulation–work with NEA to refine regulatory regime
- SO_2 Trading–work with MEP to consider market-based approach
- ETS–work in Tianjin, Beijing and Shanghai with relevant agencies
- CCS–assist major energy companies with different technology routes; assist NDRC to prepare a CCS roadmap.

Priorities and Areas of Interest for Lending Operation

- Offshore Wind–assist demonstration of first few projects to assist rapid future deployment
- Innovative Energy Efficiency–more market-based lending leveraging commercial financing
- Low-Carbon District Energy System –natural gas-and renewable based ultra efficient and low-emission heating, cooling and electricity
- CCS Demonstration–support FEED studies and financing first CCS demonstration projects
- Scale-up CSP–pilot and demonstrate next generation CSP plants such as ISCC

Areas of Interest for Non-Lending Operation

- Target emerging technologies and areas of interest
- Move towards more market-based approaches
- Carbon price setting

- Shale gas–assist in setting up best practices guidelines to govern early stage projects
- Fossil-Fuel Power Plants–analyze and set up emission performance standards
- Tariff Studies–more transparent and market-based approach in tariff setting fro offshore wind
- Energy smart regulations–regulations to encourage large energy efficiency investments
- ETS–assist pilot testing and implementation of emission trading system in key cities

For further information

abhargava@adb.org

Questions and answers