

Electricity Industry Development and Global Warming Impact: Case Studies of Three Chinese Provinces

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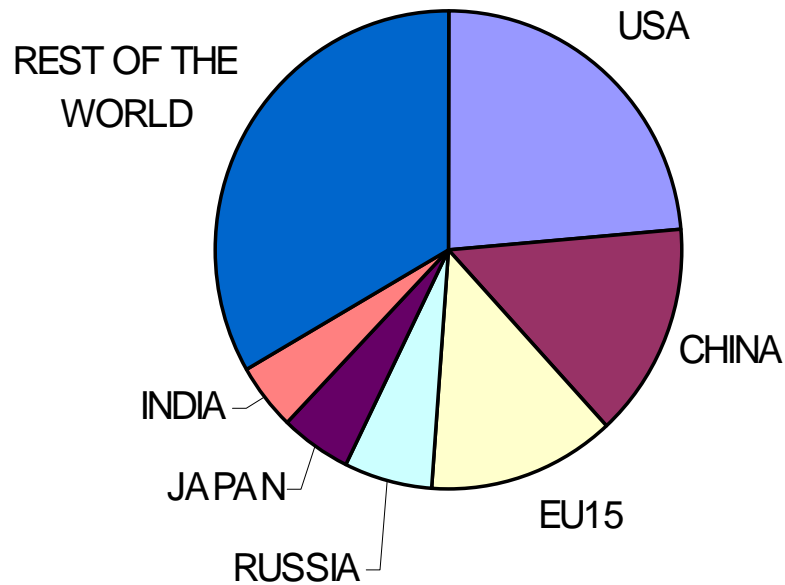
Outline

1. Introduction
2. Provincial electricity industry development
3. Economic and political factors behind the development
4. Future development assessment

Introduction

- Clean Development Mechanism
 - Emission reductions resulting from each project (under CDM) shall be certified ... on the basis of ... reductions in emissions that are additional to any that would occur in the absence of the certified project activity. – Article 12, Kyoto Protocol
- Difficulties of setting up a baseline
 - Incentives to set baseline high (Chomitz 1999)
 - Financial constraints (Shrestha, et al. 2002)
 - Institutional barriers (Heller, 1998)

Carbon emissions by country 1997



Introduction

- Purpose of the study
 - To project a baseline from our data for carbon emissions of the utility sector's development.
 - To understand the interplay between economic and institutional factors in determining electricity sector development.
- Methodology
 - Case study
 - Disaggregated approach
 - Economic and institutional
 - Focus on fuel structure and fuel efficiency of power generation

Provincial Electricity Development



Provincial Electricity Development

Table 1. Snapshot of Provincial Economies 1998

	<i>China</i>	<i>Guangdong</i>	<i>Liaoning</i>	<i>Hubei</i>
	(%)	(%)	(%)	(%)
Area (1k sq. km)	9600 100	178 1.9	148 1.5	186 1.9
Population (mil.)	1248 100	71 5.7	41 3.3	59 4.7
rural (%)	70	69	54	73
GDP (US\$ bil.)	946 100	96 10.1	47 5.0	45 4.7
GDP pc (ppp \$)	3026	5337	4518	3018
GDP growth (%)				
1980-1998	9.5	14.4	9.0	10.5
Economic Structure				
Primary industry	18.6	12.7	13.7	20.2
Secondary industry	49.3	50.4	47.8	47.3
Tertiary	32.3	36.9	38.5	32.5

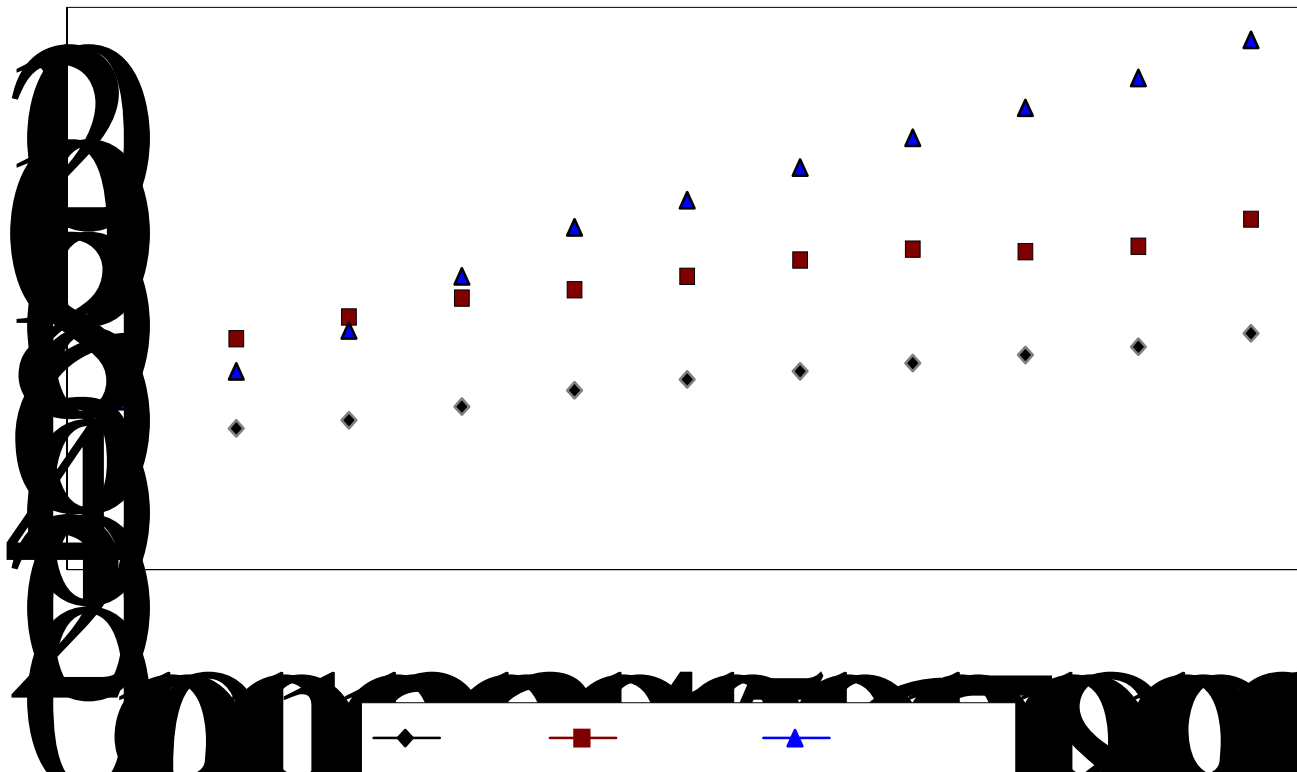
Provincial Electricity Development

Table 2 Provincial Energy Profile 1998

	China	Guangdong	Liaoning	Hubei
Energy sufficiency (%)	94	60	73	24
Energy production (mil tons sce)	1243	39	64	13
Energy consumption (mil tons sce)	1322	66	88	56
Coal (%)	69.6	54.4	72.9	76.6
Hydroelectricity (%)	6.7	15.3	0.3	5.7
Installed capacity (GW)	277	29	14	13
Power generation (TWh)	1157	104	60	50
p.c. capacity (KW)	0.2	0.4	0.3	0.2
p.c. power consumption (KWh)	929	1388	1653	769

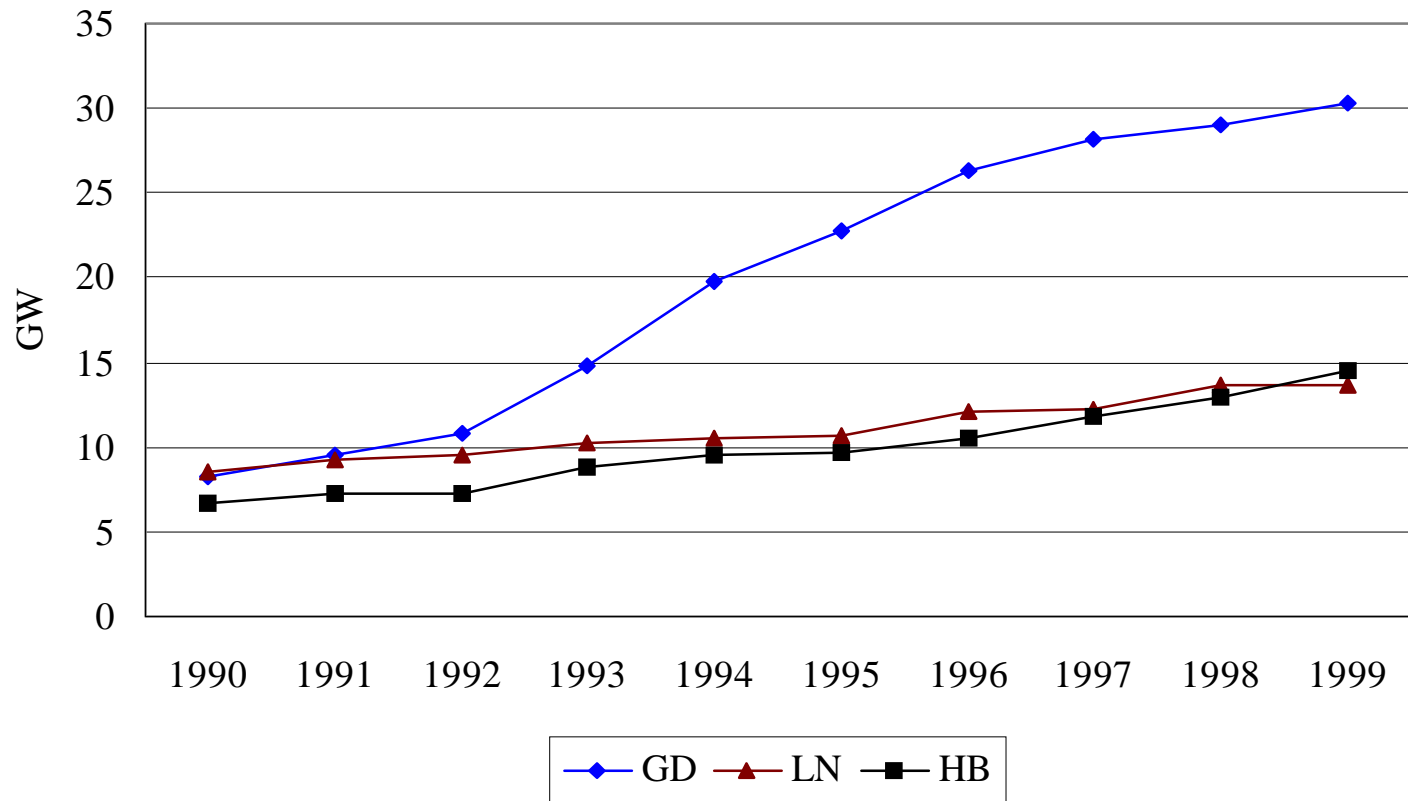
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Figure 1 Provincial Power Consumption



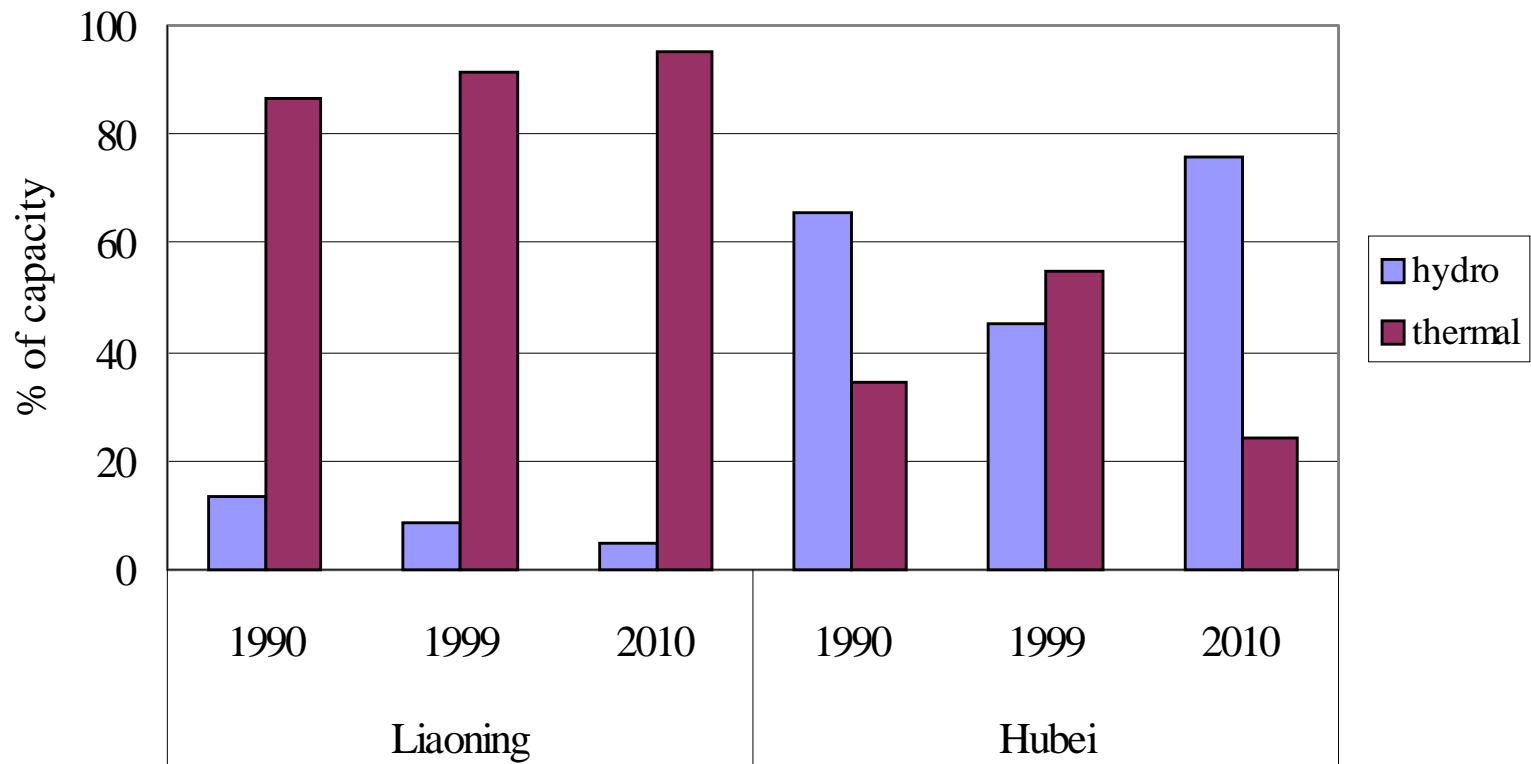
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Figure 3. Provincial Capacity

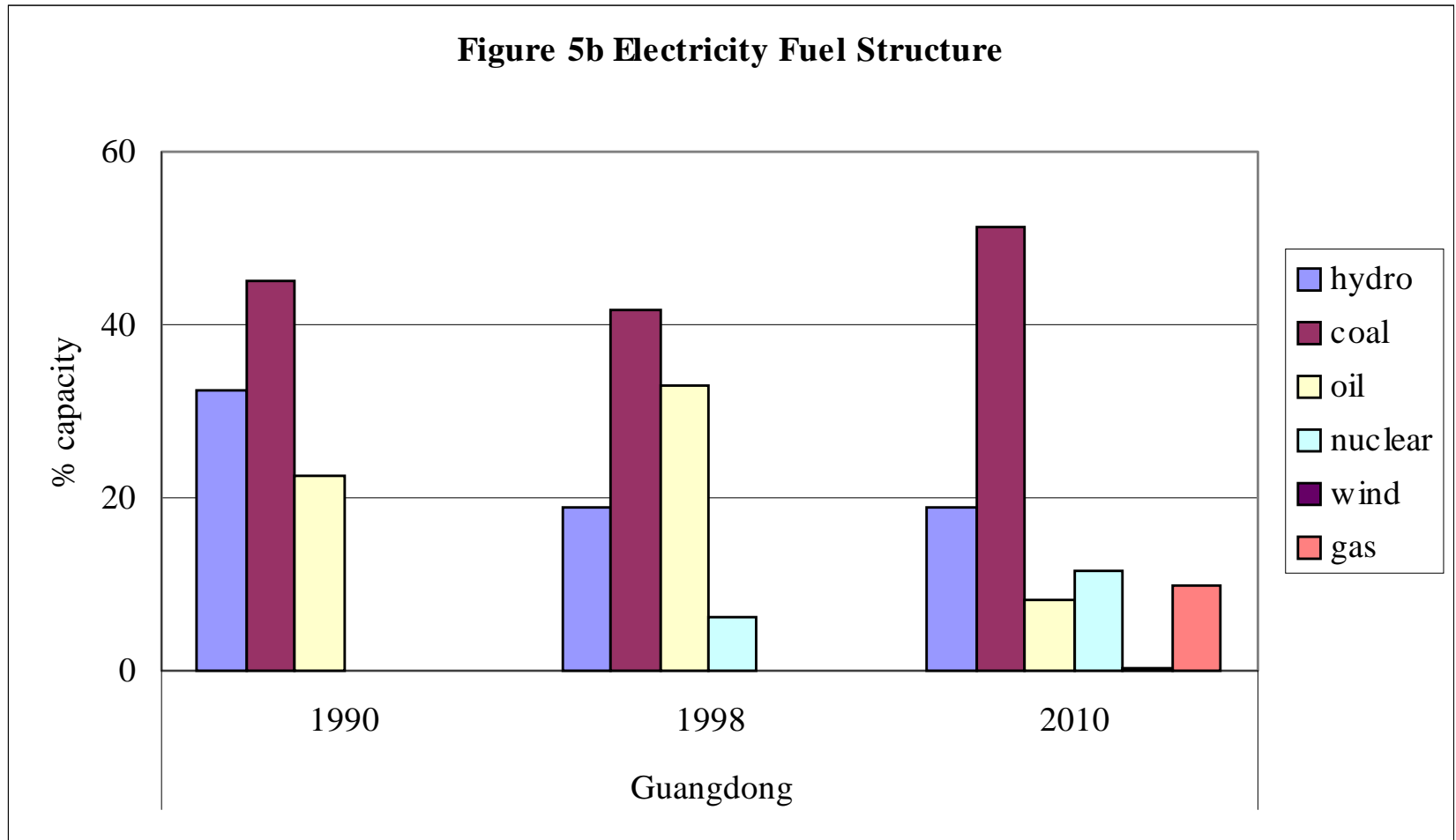


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Figure 5a Electricity Fuel Structure

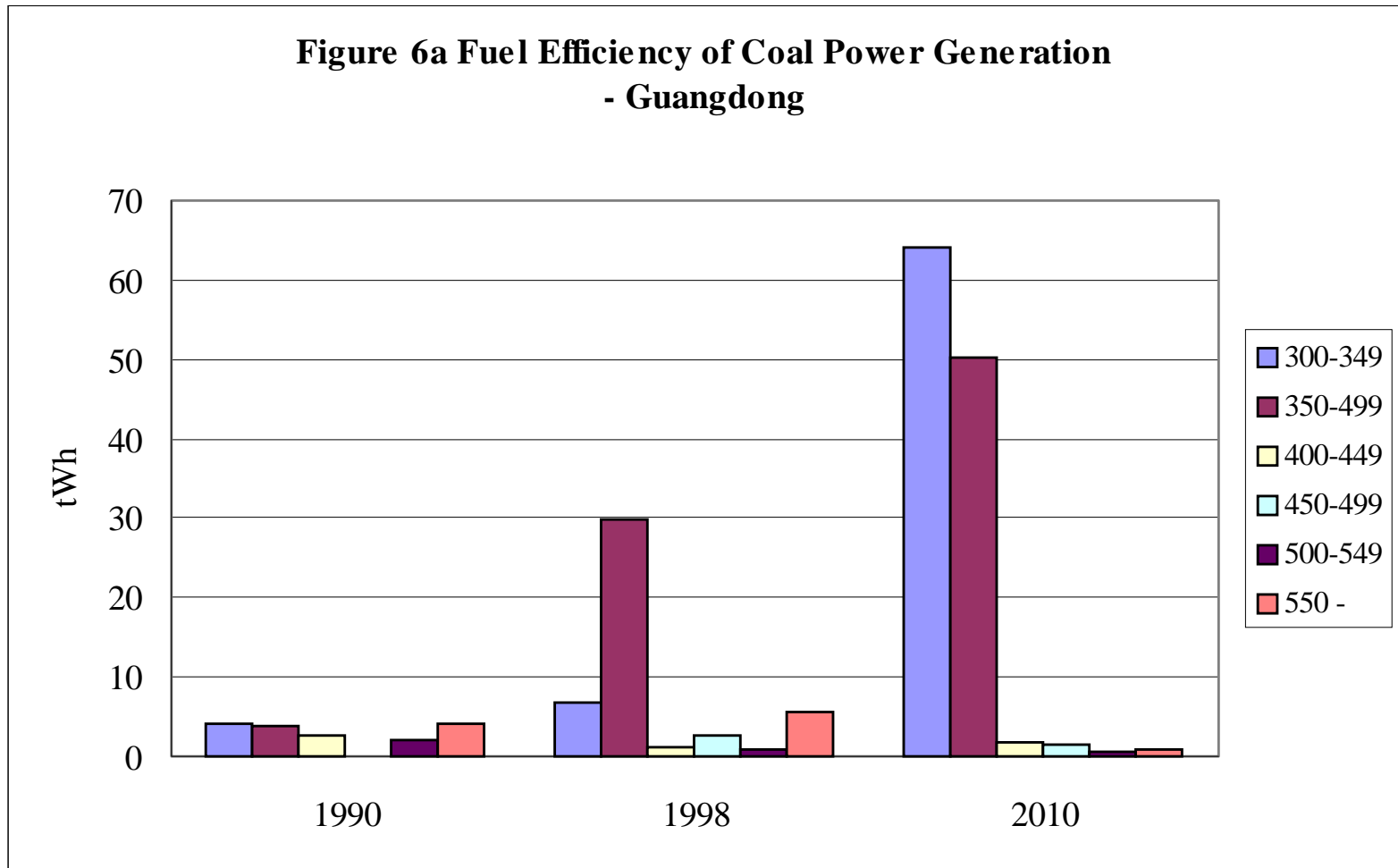


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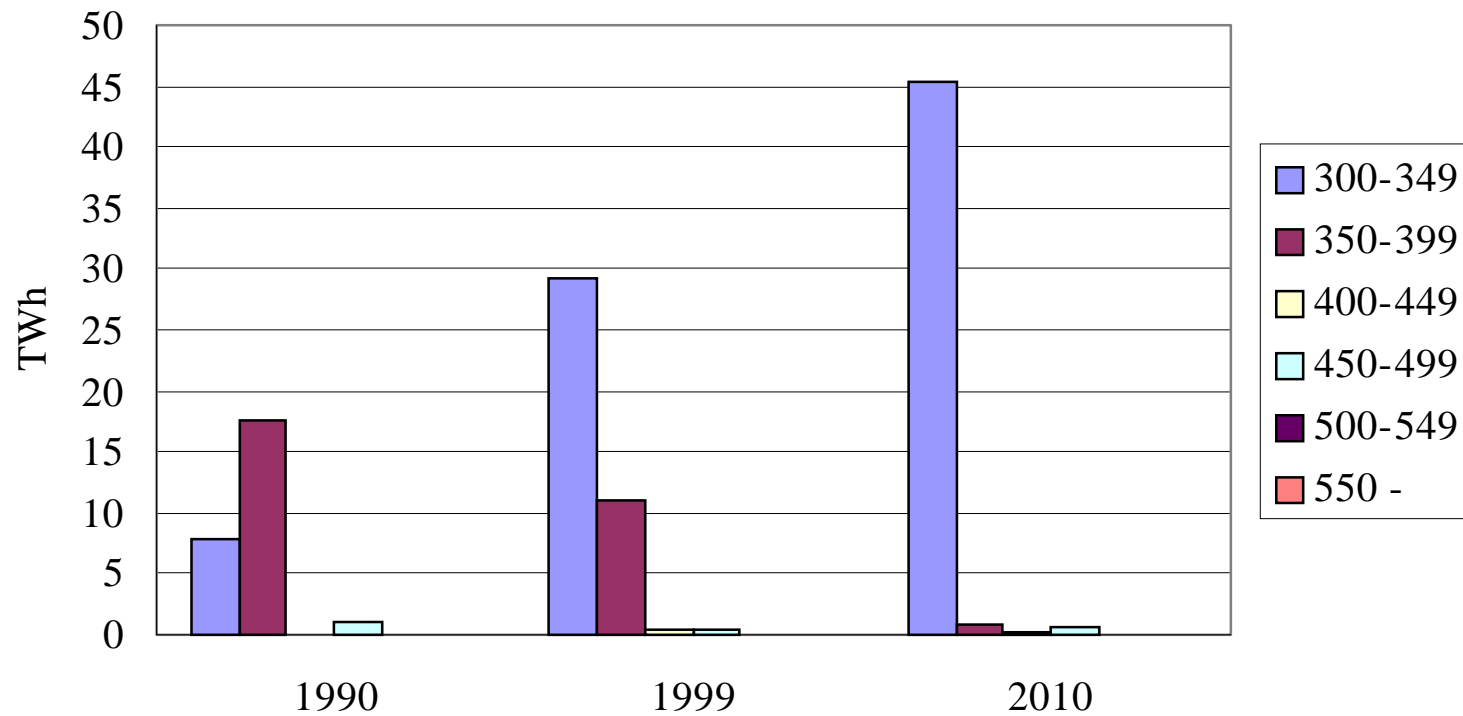
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**Figure 6a Fuel Efficiency of Coal Power Generation
- Guangdong**



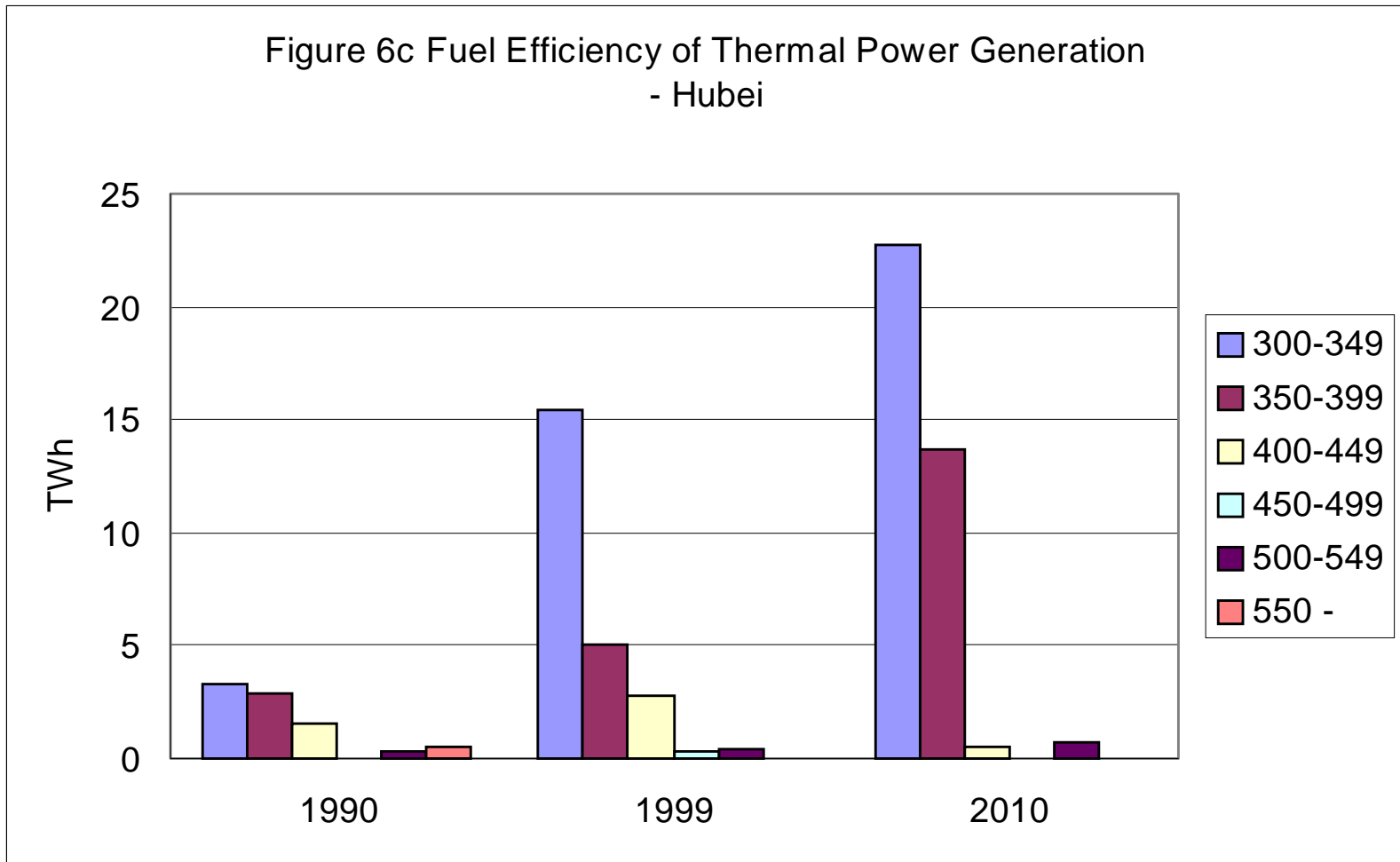
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**Figure 6b Fuel Efficiency of Thermal Power Generation
- Liaoning**



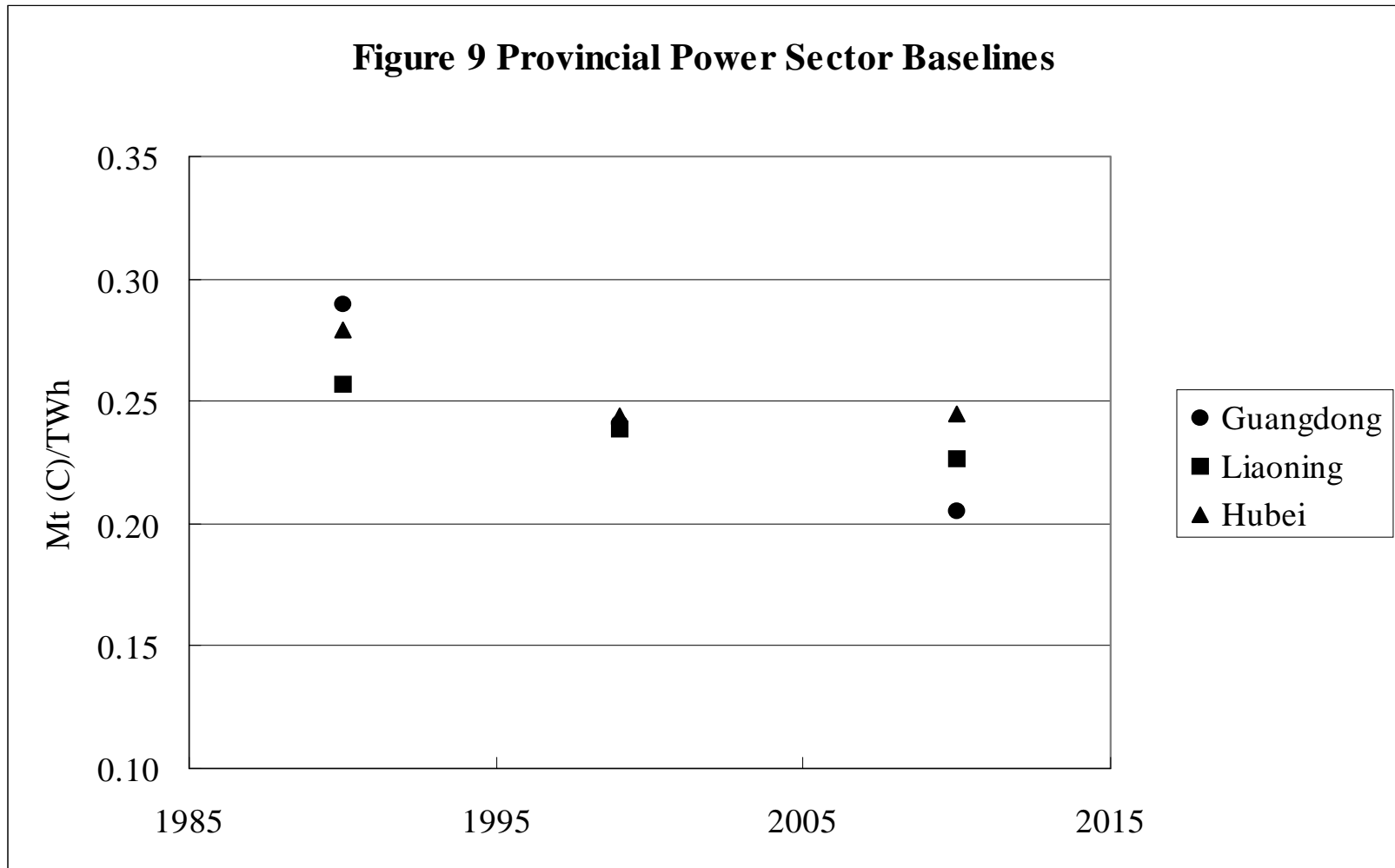
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Figure 6c Fuel Efficiency of Thermal Power Generation
- Hubei



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Figure 9 Provincial Power Sector Baselines



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- Varied power industry development associated with different income growth experience
- Coal dominance with variations among provincial fuel structures
- Bifurcation of system development
- Future baseline carbon emissions based on government planned figures

Political Economy of Power Development

Case studies find 6 drivers of utility industry changes

1. Continued central planning which stressed energy security and favored domestic coal.
2. Emergence of dual track development with central planning at the core and disorganized growth at the periphery.
3. Pervasive influence of general balance rule in both project development and daily dispatching. The rule favors political stability and strives to balance politically determined quantities of demand and supply in various levels of govnmnts.

Political Economy of Power Development

4. Inadequate financial market development, and shortage of long-term financing.
5. Political/economic importance of locally controlled plants.
6. Murky definition and lack of legal protection of ownership which make electricity production easily subject to government manipulation.

Future Development Assessment

- Future utility development will continue to be influenced at its core by central planning.
- Government is determined to proceed with market reform and introduce competition in power supply.
- Future development needs huge capital investment, and yet financial market and rule of law are slow in coming.
- Institutional reforms will be more difficult and significantly slower. Little sign of future infrastructure to facilitate power market development.

Future Development Assessment

- The first three factors are likely to remain important, but their potential in influencing resource allocation is likely to give way to market forces gradually.
- Financing will continue to challenge the industry development.
- The last two institutional factors will continue to politicize electricity sector reform and hamper market function in supplying electricity.

Concluding Remark

Findings of our case studies corroborate existing arguments that greenhouse-gas emission baseline settings in developing countries may be subject to severe financial constraints and institutional barriers to project development.