Power shortage in China

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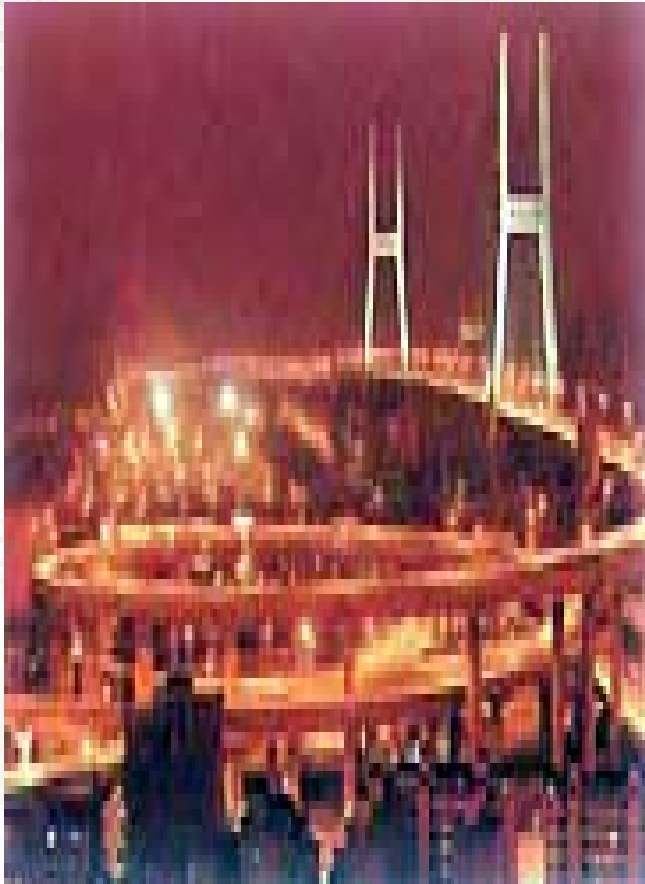
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Content

➢ General information about power shortage in China;

➢ Primary methods for load forecast;

➢ Case study – Shanghai;

➢ Conclusion and discussion.

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What can you imagine,
if there is power shortage?

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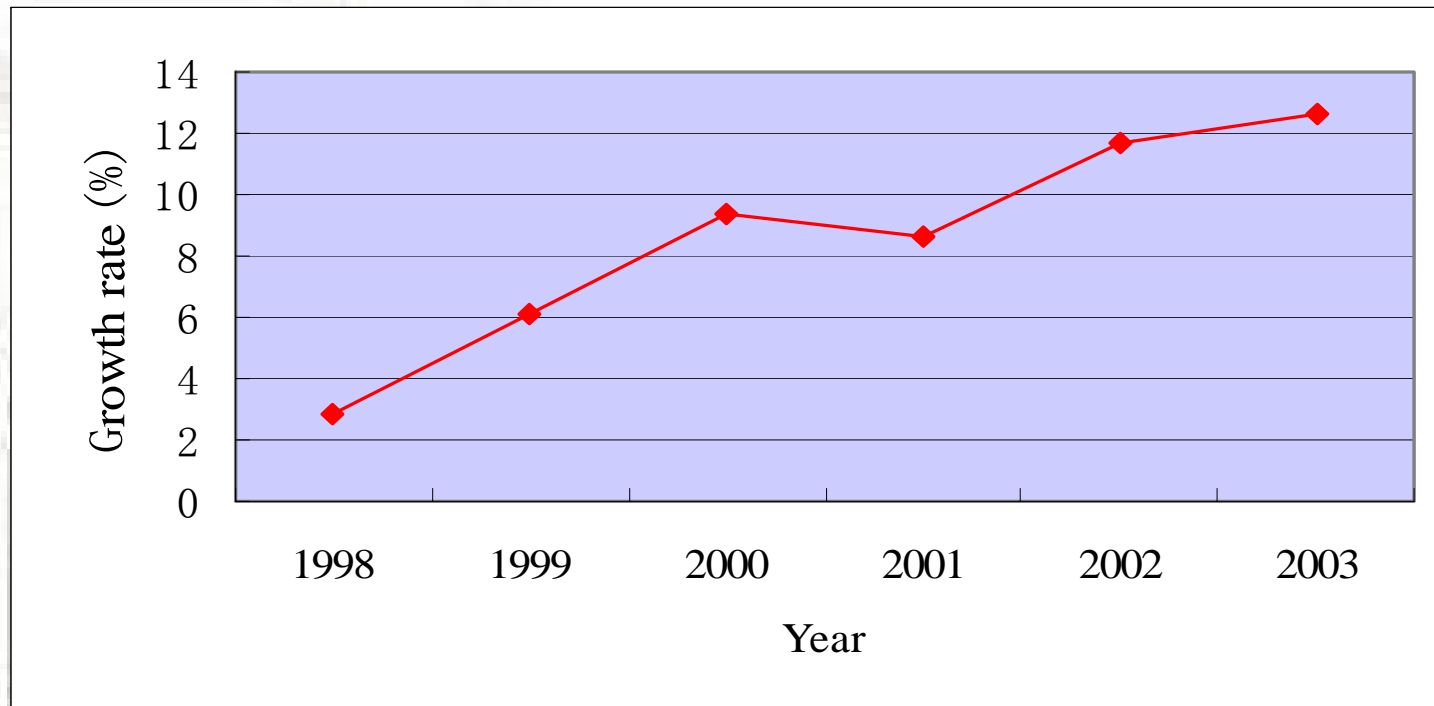
Status quo - 1

Figure 1. The growth rate of electricity consumption in China

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Status quo - 2

Figure 2. Capacity & its growth rate

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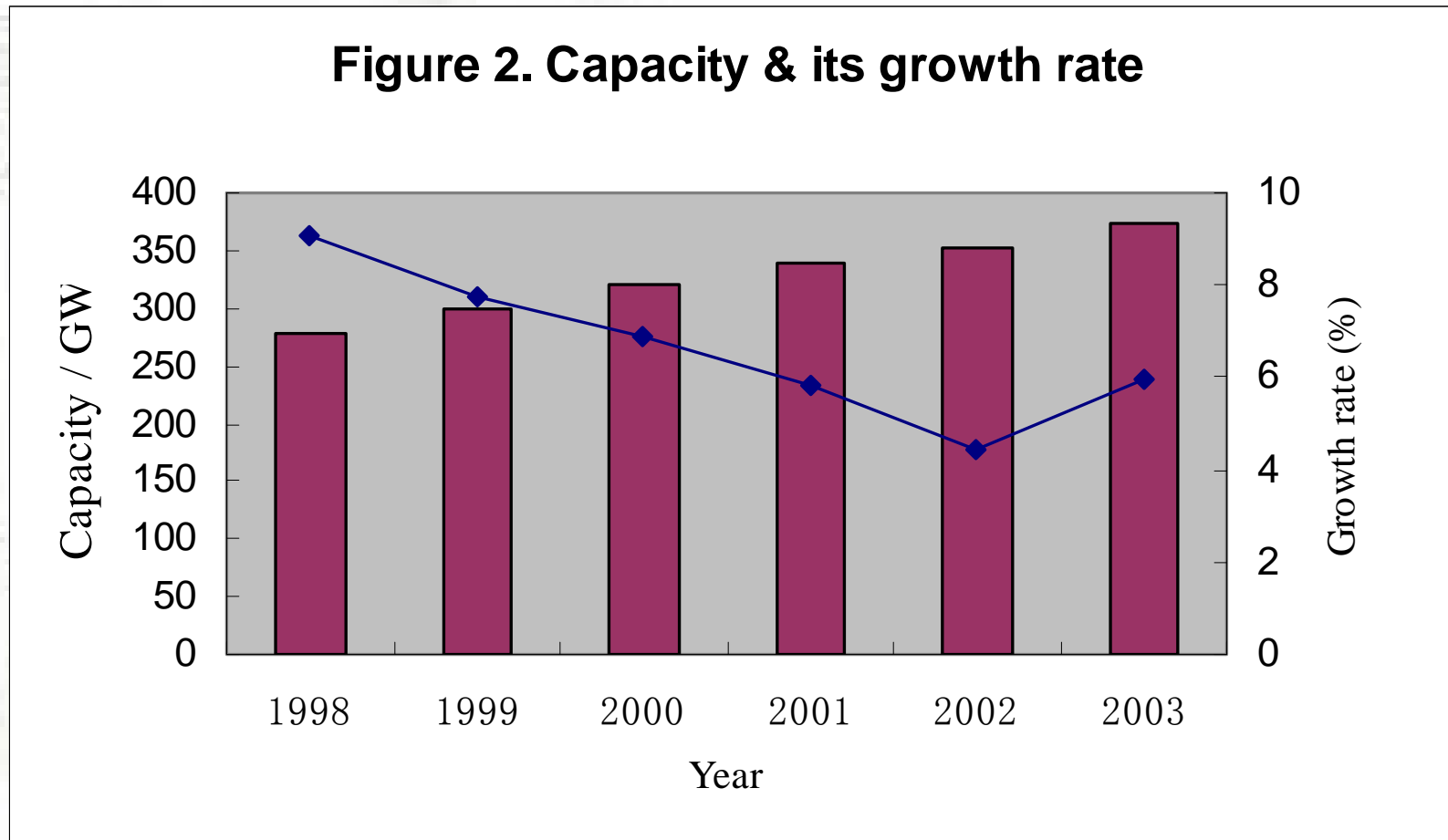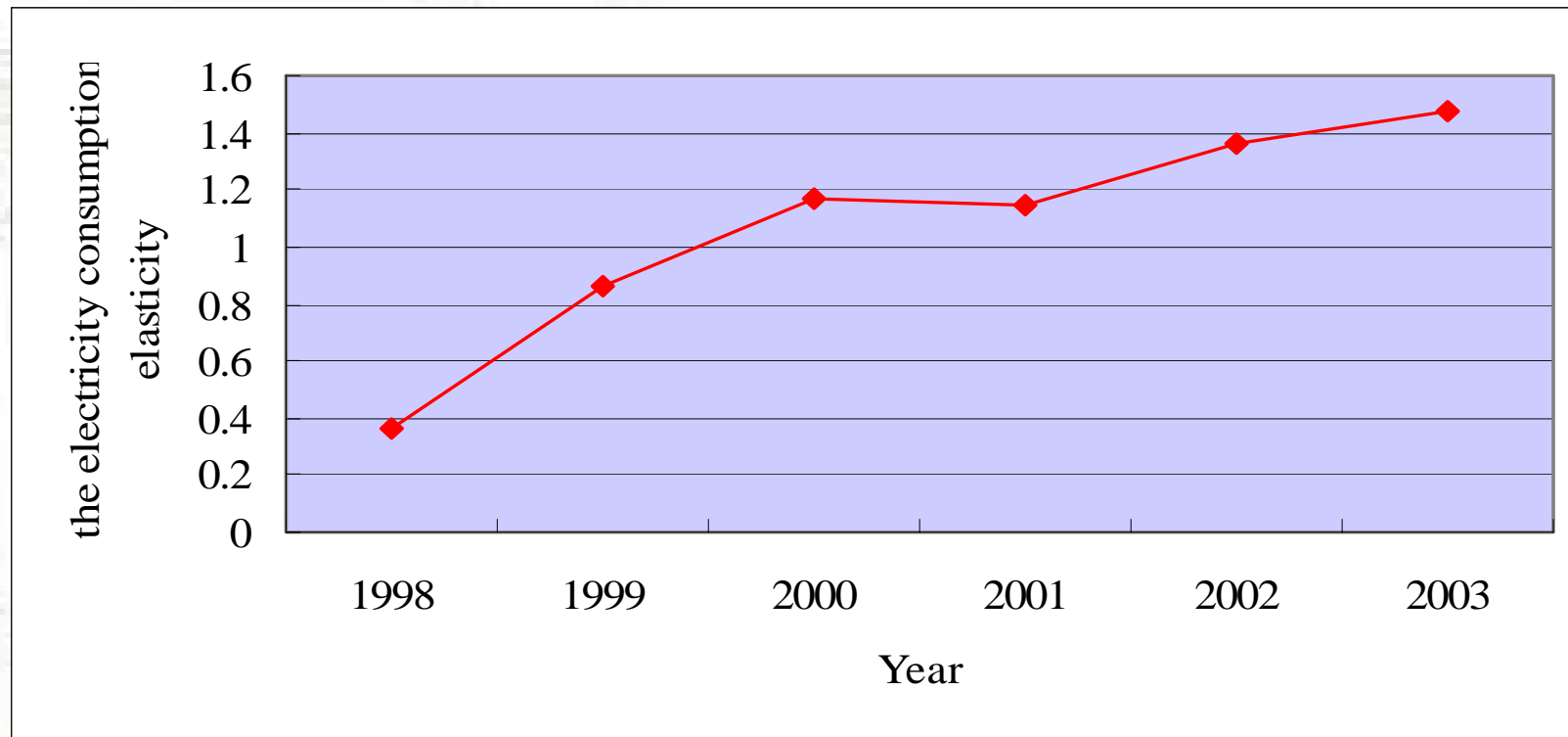
Status quo - 3

Figure 3. The change of the electricity consumption elasticity

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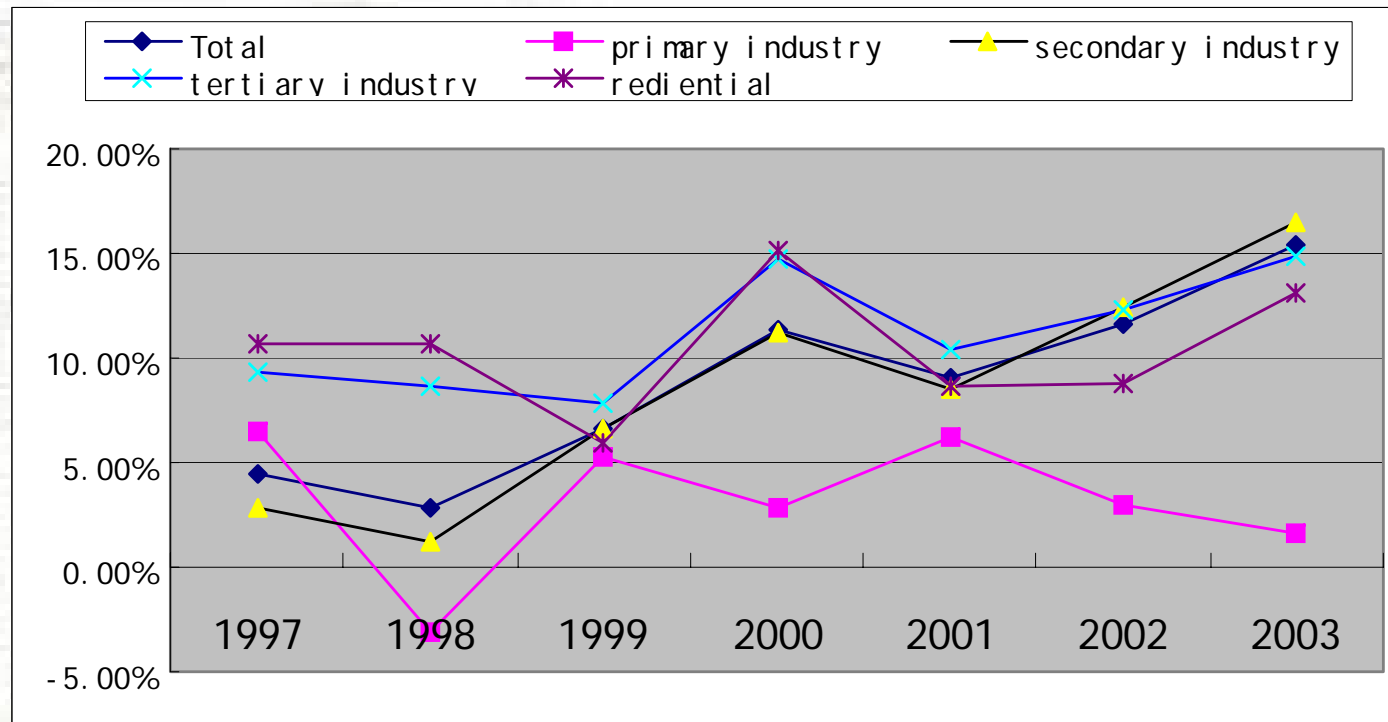
Status quo - 4

Figure 4. growth of electricity consumption by industry

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Status quo - 5

Figure 5. sub-industry analysis
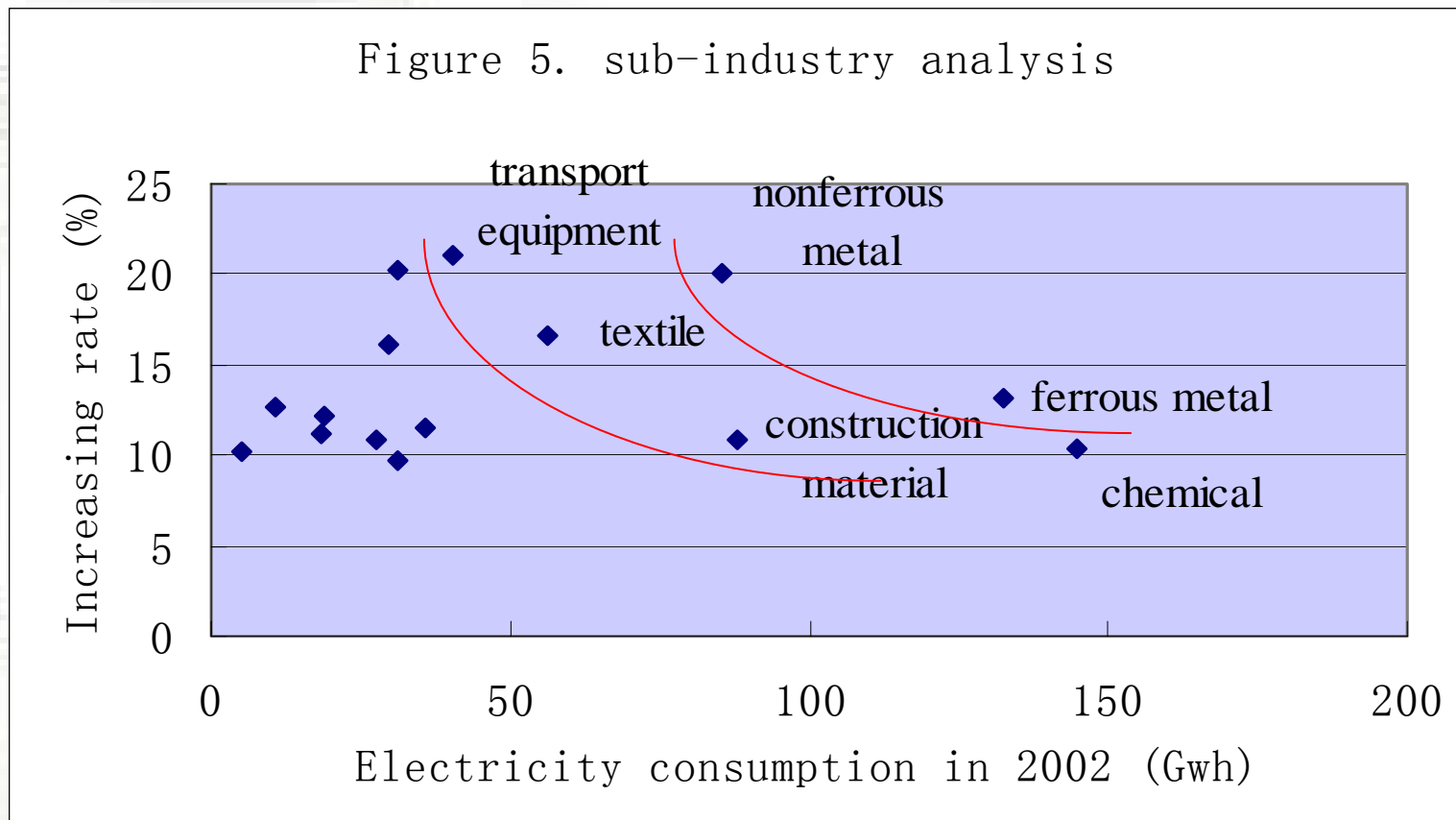
90% of power in industry is consumed by manufacturing!

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Reasons and the question

- ➤ Unmatched growth speed of electric power with demand increasing (less investment);

- ➤ Fast increasing air-condition load;

- ➤ High speed growth of industry and power consuming industry;

- ➤ Less rainfall to cause hydropower;

- ➤ High temperature; ……

So the question is:

How to forecast the load accurately?

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Primary methods - 1
elasticity coefficient analysis

➢ $E = Ky / Kx$

Ky means the growth rate of electricity consumption;

Kx means the growth rate of economy.

NOT suitable for China (country level):

➢   The economy puzzle;

➢   The economic structure is not mature

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Primary methods - 2
trend analysis

electricity cosumption in China
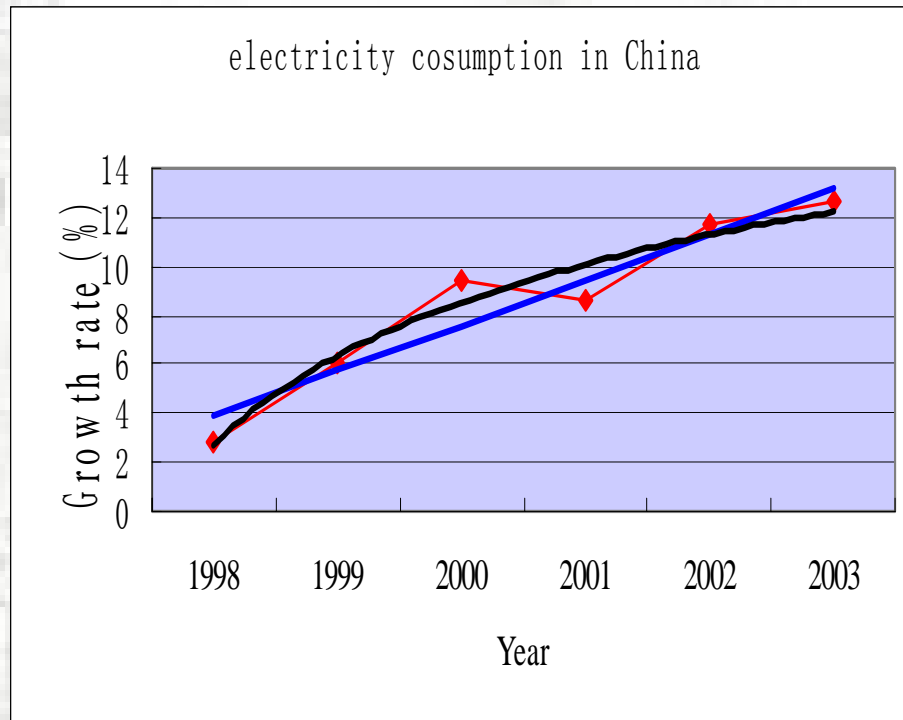
- ➢ Fitting a curve and forecasting according to the target year 2010, or 2020, and so on.

- ➢ Linear model, multinomial model, logarithm model, …
- ➢ Big difference exists in results from different models

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Primary methods – 3
regression analysis

- Variables selection, such as GDP, population, temperature, and so on.
- Regression:

$$y = b_0 + b_1 x_1 + b_2 x_2 + \ldots\ldots b_p x_p$$

The accuracy and effectiveness of data is also suspectable.

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Primary methods – 4
grey theory

G(1,1) model:

$$x^{(1)}(i+1) = (x^{(0)}(1) - \frac{u}{a})e^{-ai} + \frac{u}{a}$$

$$i = 0,1,2,...$$

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Other methods & why?

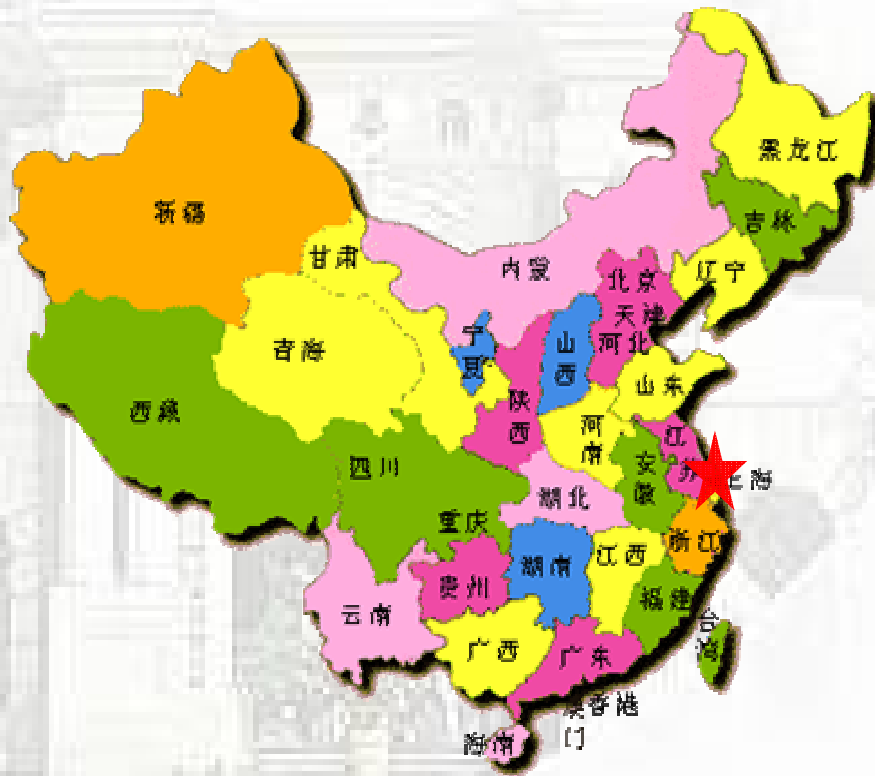- ➢ Neural network method;
- ➢ Software package with many parameters;
- ➢ ……

Then, the question changes to be:

Why we cannot forecast the load accurately?

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Shanghai case study - 1

➢ The center of Yangtze Delta Area;

➢ Fast economy developments, especially manufacturing;

➢ Belonging to East China Grid, which has 20 GW shortage (China total: 30 GW).

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Shanghai case study – 2

economic background

	2001	2002	2003
GDP（billion Yuan）	495.08	540.88	625.08
Increasing rate of GDP	10.2%	10.9%	11.8%
Electrical and mechanical products exported (billion US dollar)	14.21	16.83	29.25
Increasing rate of electrical and mechanical products	17%	18.5%	73.8%
Percentage of total products exported	51.4%	52.5%	60.3%

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Shanghai case study – 3
electricity consumption classification

	Increasing rate from the end of 2001 to the end of 2003
Total	25.80%
industry	22.66%
Construction material	38.19%
Metal product industry	49.74%
Business	13.94%
Residential consumption	45.41%
Agriculture	-38.80%

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Shanghai case study – 4

general information of electricity consumption

Year	Total consumption (GWh)	Increasing rate	Peak load (MW)	growth of peak load	Elasticity of electricity consumption
2001	59.30	6.00%	11.11	9.8%	0.59
2002	64.57	8.89%	12.35	11.14%	0.82
2003	74.60	15.53%	14.50	17.40%	1.32

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Shanghai case study – 5
this summer

- Nearly 17 MW (peak load);

- About 8 MW (50%) of peak load comes from air-conditioner;

- 1.3 air-conditioners per household;

- High temperature (over 35℃) for two weeks.

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Shanghai case study – 6
measures taken

- ➢ Propaganda for energy saving;
- ➢ Temperature limits for air-conditioners in public areas;
- ➢ Increase output of power plants during peak load time;
- ➢ Price regulation (higher time-related price);
- ➢ Brownout & blackout;
- ➢ Nucleation (artificial rain);

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Shanghai case study – 7

the future

- The demand will increase fast and continuously because export pushes.
- Peak load regulation is very important (random factor)!
  - gas-fired air-conditioner system is a good choice, but:
  - who will pay?
- Long term strategy: nuclear power for East China (coal supply from west to east).
- Industry structure regulation.

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Conclusion & discussion -1:

➢ **A theory question or a decision question?**

  – actual method taken in the report of East China grid
  – Information dissemination
  – power plant, grid, government & consumer (decision model);

➢ **Pay more attention to details:**

  – investor's action ;
  – power shortage hint from periodical
  – market is effective (futures?)

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Conclusion & discussion -2:

➢ Adjusting the relationship between the period of this industry and the "Five-Years Plan"?

   − How about revising the plan for power industry annually?

➢ Shanghai is a future scenario for most seaside cities.

A difficult question is:

Power surplus for tomorrow ?

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Thank you!

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