Problems in China’s Wind Power Industry
Introduction

Wind & Wind Farm
Wind Farm
1. Rotating generator converts wind energy to electricity
2. Transformer increases voltage for transmission to substation
3. Substation increases voltage for transmission over long distances
4. Transmission to the grid
Wind Power Industry

- **Wind power in the world**
  - Booming Industry, started in July 1887
  - if growth continues, generate ⅓ world’s electricity in 2050

- **Wind power in China**
  - started in 1980, started late, developed fast
  - to reduce air pollution
  - long-term & high-development plan
  - add 7–10 GW new capacity every year
- Surpassed US to become the world's largest producer in 2010
- 80 GW in 2013
High idle rate

- industry officials believed idle rate less than 5%
- real idle rate: 18.7% in 2010, 25% in 2011
- waste money
Transmission Problem

- capacity of transmission line not enough
  - in 2008, produced 10 MW, only 8 MW were transferred, waste = $2 billion
  - in 2012, waste = $10 billion
  - at Jiuquan only 20% turbines connect to grid

- cannot upgrade transmission capacity
  - require high technology support (high voltage, steady, safety....)
  - very very very expensive
Figure 1-1 Distribution of Wind Power Resources in China

Source: China Wind Energy Network.
Expensive Energy

- Installation cost: $1,300 to $2,200 per KW
  - medium wind farm (500KW) costs $0.75 - $1.1 million
  - large wind farm (1000KW) costs $1.3 million to $2.2 million
- total 80 GW of capacity costs about $126 billion
  \(1\text{GW} = 1,000,000\text{KW}\)
Expensive Energy

- Maintenance: 3% of the original cost per year

  total annual maintenance fee in China:

  $126\ billion \times 3\% = $\ 3.78\ billion
Costs

Expensive Energy

- real cost of electricity:
  - from wind power: ¥0.61 ($0.08) per kwh
  - from coal-fire: ¥0.3 ($0.04) per kwh
Costs

- Unsteady
  - when wind strong: transmission problem
  - if no wind: turbines are idle
  - lose money in either case
Costs

- **Environmental issues**
  - Warm up the surface of the land
    - cause desertification
    - cause global warming
  - Noise
    - can be heard in 2.5 km
    - feel uncomfortable, stressful, can’t go to sleep
Benefits

- Green Energy
Electricity Emissions Factors (kg CO2e/kWh)

- Lignite: 1.21 kg CO2e/kWh
- Coal: 0.91 kg CO2e/kWh
- Oil: 0.77 kg CO2e/kWh
- Natural Gas: 0.51 kg CO2e/kWh
- Solar PV: 0.05 kg CO2e/kWh
- Wind: 0.03 kg CO2e/kWh
- Biomass: 0.03 kg CO2e/kWh
- Nuclear: 0.02 kg CO2e/kWh
- Geothermal: 0.02 kg CO2e/kWh
- Hydro: 0.01 kg CO2e/kWh

Note: Direct emissions are from fuel combustion, indirect emissions are from plant manufacturing and fuel supply processes. The biomass estimates assume the use of solid biomass feedstock.
Benefits

- **Green Energy**
  - reduce 570 million tons of carbon dioxide emission every year

- **Long-run Benefit**
  - renewable resource
  - price steady
  - as price of pollution increase, wind power becomes cheaper
Solution

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  - more productivity (40% more)
  - solve distribution problem
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Barriers

- **construction costs are high**
  - onshore wind farm: $1,300 to $2,200 per KW
  - offshore wind farm: $4,000 per KW
  - barrier from tax payers
Recommendation

- longer lifetime
  - onshore turbines: 20 years
  - offshore turbines: 50 years
- lower idle rate, more productivity
- save money in the long-run
Thank you for your attention!