ENERGY STUDIES INSTITUTE

China's Shale Gas Ambitions

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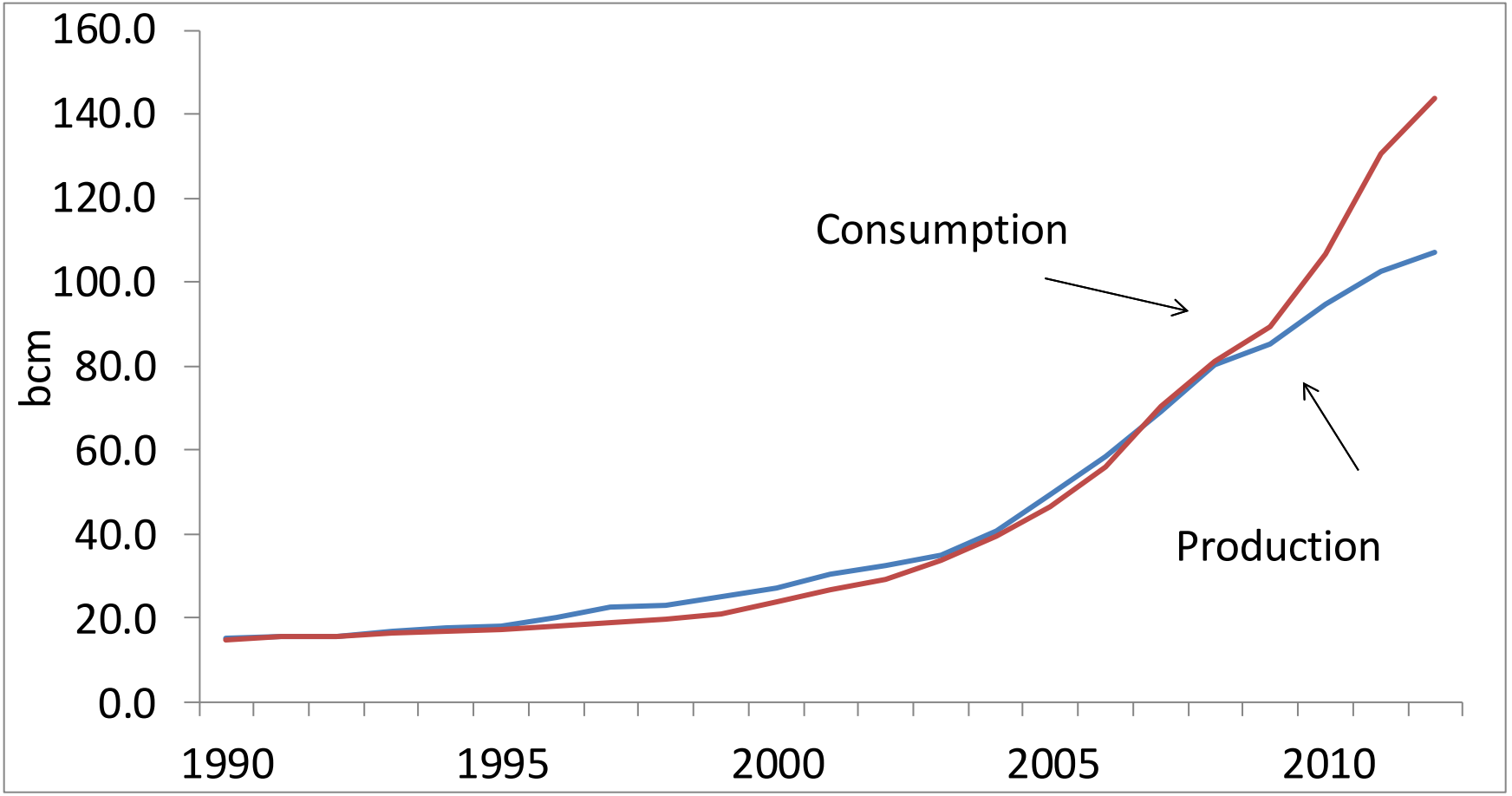
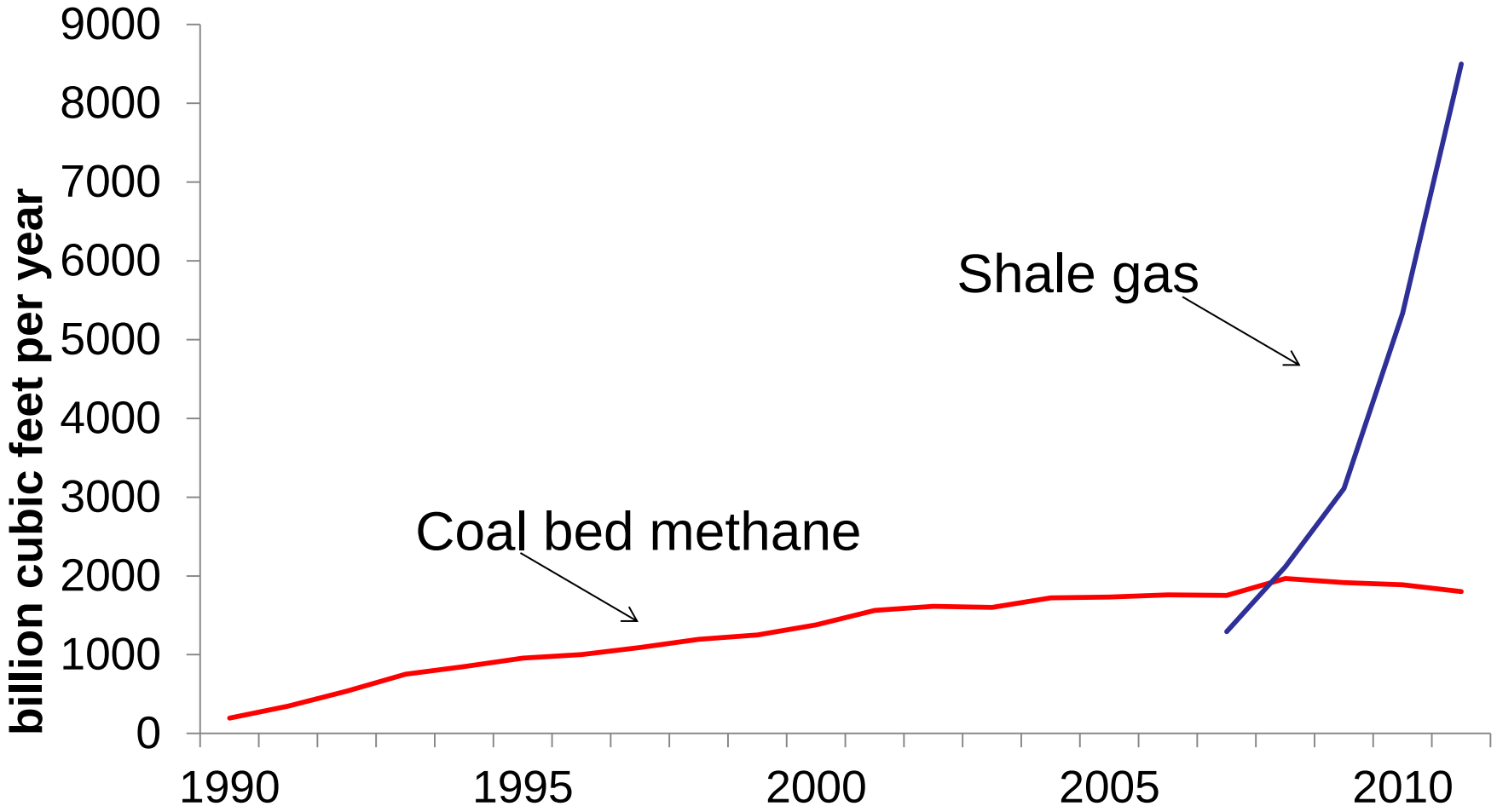
Outline

- Natural gas supply & demand
- Shale gas resource base & targets
- Milestones
- Drivers
- Constraints
- Outlook

China's gas supply and demand



US: production of CBM & shale gas



Resource base, targets, progress

- Resource base:
  - Ministry of Land & Resources (2012); 25 bcm
  - EIA (2013) technical recoverable, risked: 31 bcm
- Output targets in 5-year plan:
  - 2015: 6.5 bcm
  - 2020: 60-100 bcm

China's shale gas basins

Source: ARI, 2013.

Estimated shale gas reserves (EIA, 2013)

Basin	Reserves	Depth	Gas
Sichuan	17.6	3,000-4,000	Dry
Yangtze Platform	4.2	3,500-4,000	Dry
Jianghan	0.8	1,700-4,000	Dry & wet
Subei	1.3	1,800-4,500	Dry & wet
Tarim	6.0	3,300-4,500	Dry & associated
Junggar	1.0	3,000-3,500	Associated

Milestones 2005-2012

- 2005: early technical studies
- 2008:
  - first research well in Sichuan basin (PetroChina)
  - US-China agreement on shale gas cooperation
- 2010: Shell, BP, ConocoPhillips in discussion with Chinese NOCs
- 2010: Sinopec and PetroChina set production targets
- 2011: first licensing round: 2 blocks awarded
- 2012: 2nd licensing round: 19 blocks awarded

Milestones 2013

- Shell PSC approved
- >8 foreign companies with joint study agreements
- Foreign service companies getting involved
- PetroChina and Sinopec active exploration, especially in Sichuan Basin
- 129 wells drilled by September 2013
  - 38 wells > 10,000 m^3/day
  - 8 wells > 100,000 m^3/day
- Third round to be held ‘at end of year’

Drivers

- Good geological potential
- Great need for new, cleaner energy supplies,
- Large oil and gas sector
- Large manufacturing capacity
- NOCs working with IOCs & international service cos
- US-China shale gas cooperation agreement
- Rapidly growing gas market
- Rising gas prices
- Subsidies (0.4 Yuan/m^3; US$ 1.8/mmBTU)
- 2 licensing rounds in 18 months

Constraints

- Higher well costs than USA:
  - depth, TOC, permeability
- Two separate legal regimes
  - Large NOCs sit on best acreage & pipelines
  - Many licensees from bid rounds have no E&P experience
  - Regulatory uncertainty
- Water shortages in N and W
- High population density in S; Topography
- Price risk; IPR risk
- Less competitive, innovative business environment
  - Equipment quality and skills

Outlook for China's shale gas ambitions

- Targets for 2015 and 2020 probably will not be met
- Key short-term issues for rapid production increase:
  - Flow rates, reserves and costs
  - Improved licensing process: credible operators
  - Regulatory clarity for foreign investors
  - Attractive deals for foreign service companies
  - Price credibility
- Longer term:
  - Pipeline third-party access
  - NOCs to relinquish acreage
  - Regulation of land, water and environment