ENERGY STUDIES INSTITUTE

The Future for Gas in China

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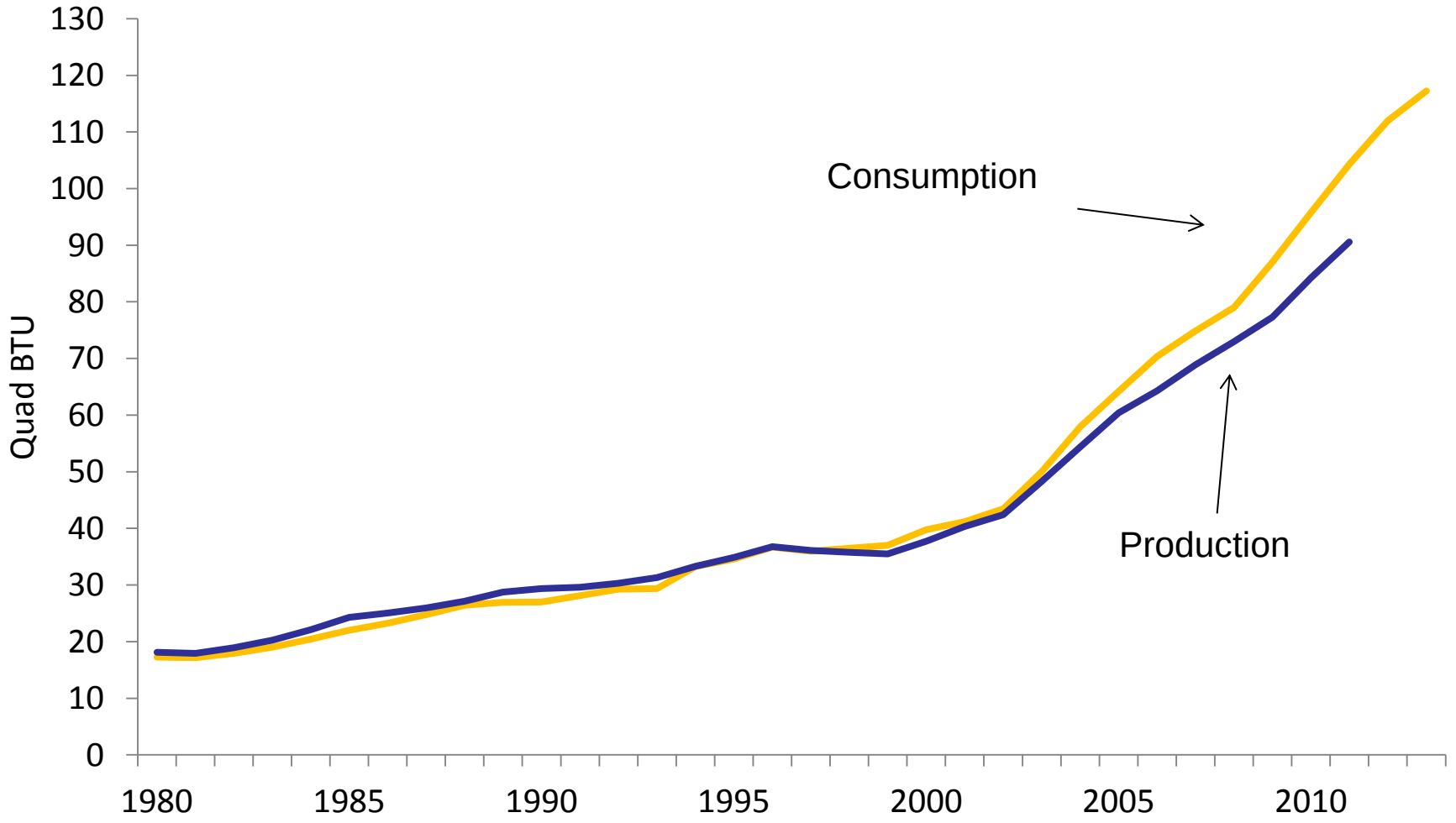
Outline

- Energy
- Natural gas
- Gas imports
- Shale gas

China's oil and gas basins

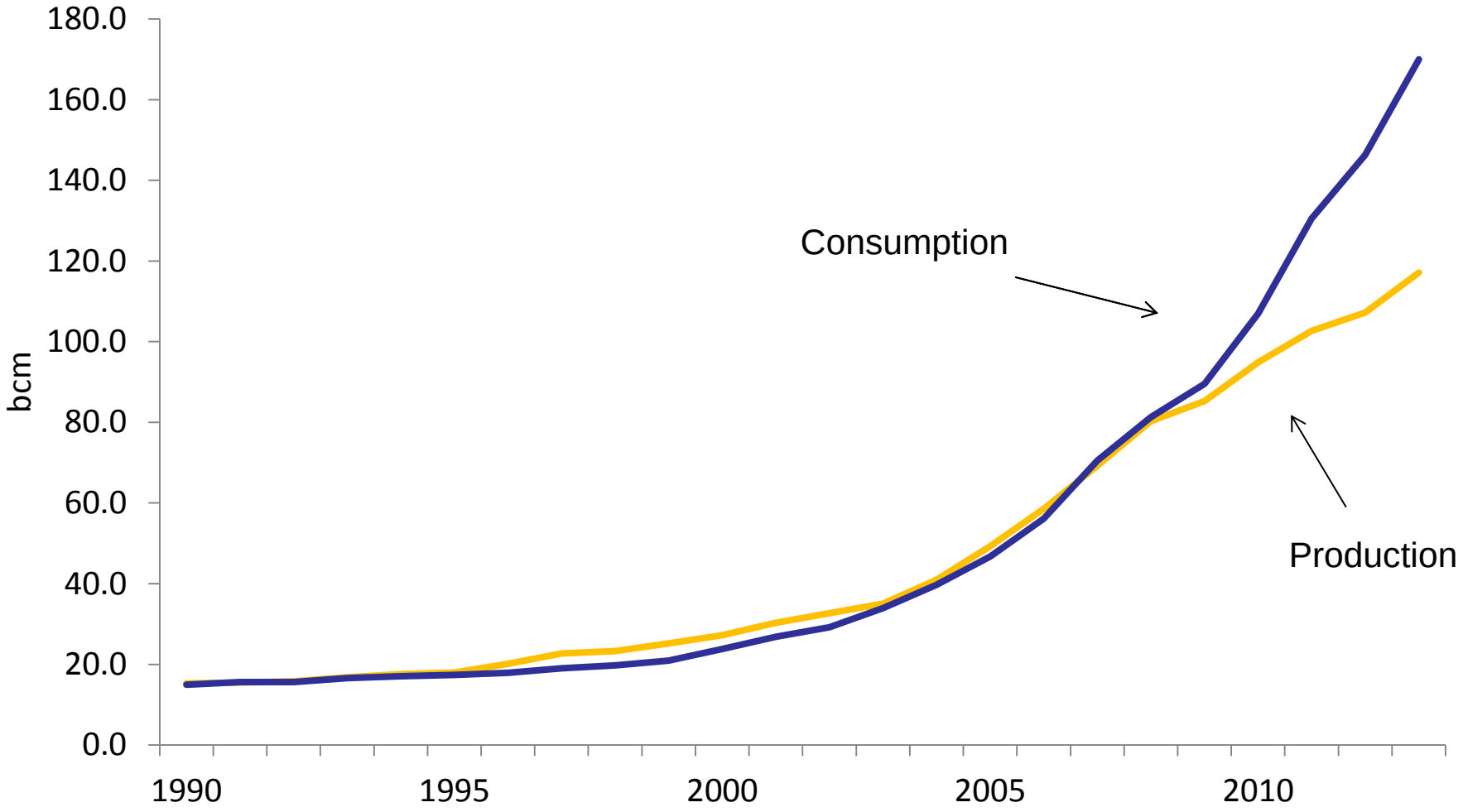
Primary energy production & consumption



Structure of primary energy consumption (%)

	1980	1990	1995	1999	2000	2005	2011	2012	2013
Coal	***72.2***	***76.2***	***74.6***	***66.1***	***61.4***	***69.5***	***70.5***	***70.0***	***67.5***
Oil	20.7	16.6	17.5	23.2	28.6	21.0	17.5	17.9	17.8
Natural gas	**3.1**	**2.1**	**1.8**	**2.2**	**2.7**	**2.7**	**4.5**	**4.8**	**5.1**
Hydro	4.0	5.1	6.1	6.6	6.8	5.8	6.0	7.2	7.2
Nuclear & renew.							1.5	2.0	2.4

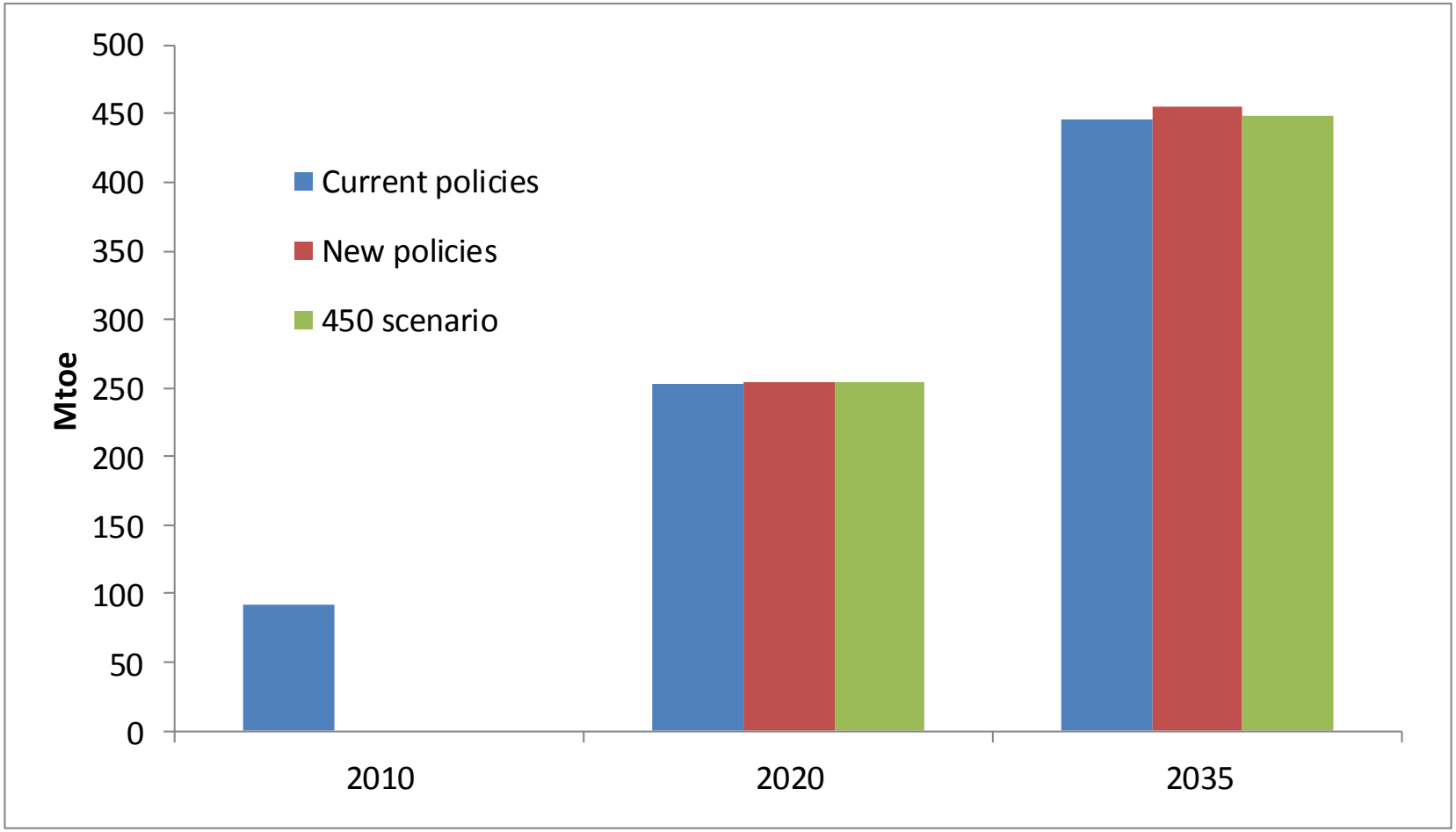
China's gas supply and demand



China's gas policy

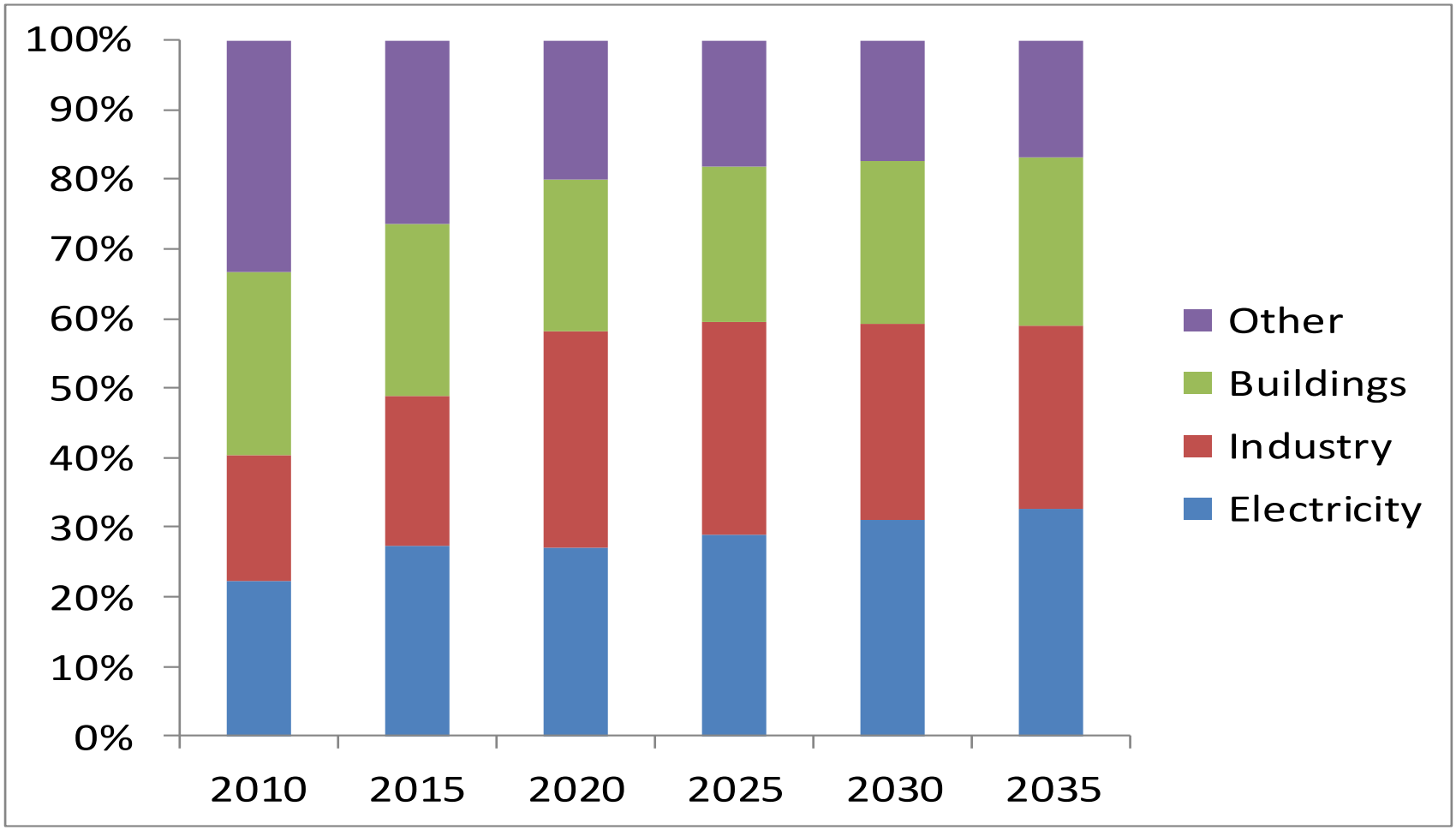
- Before mid-1990s:
  - Gas priced very low, for fertilizer
  - Local gas use for energy in Sichuan and NE China
- Mid 1990s to 2010:
  - Support for domestic gas production
  - Fluctuating support for gas imports
- 2010 onwards:
  - Rising gas imports
  - Surge of interest in shale gas
- End user priorities:
  1. City gas, CHP, vehicles
  2. Peak load power generation ,industrial and some chemicals
- China has little low cost gas (2-3 time coal price/m BTU)
  - Gas prices controlled along supply chain; but rising

China's future gas demand



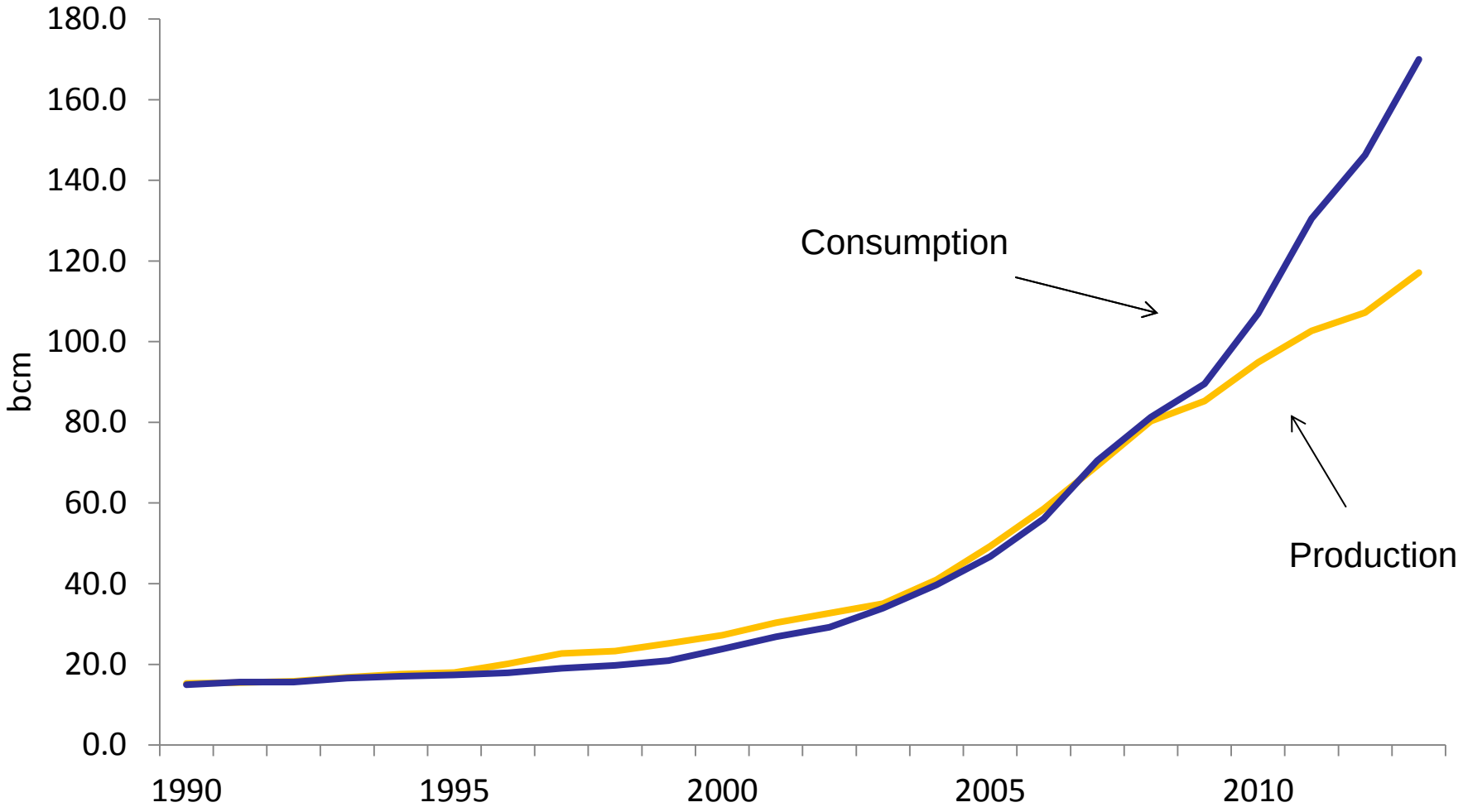
Source: IEA, World Energy Outlook, 2012

Projected end-use for gas (new policies)



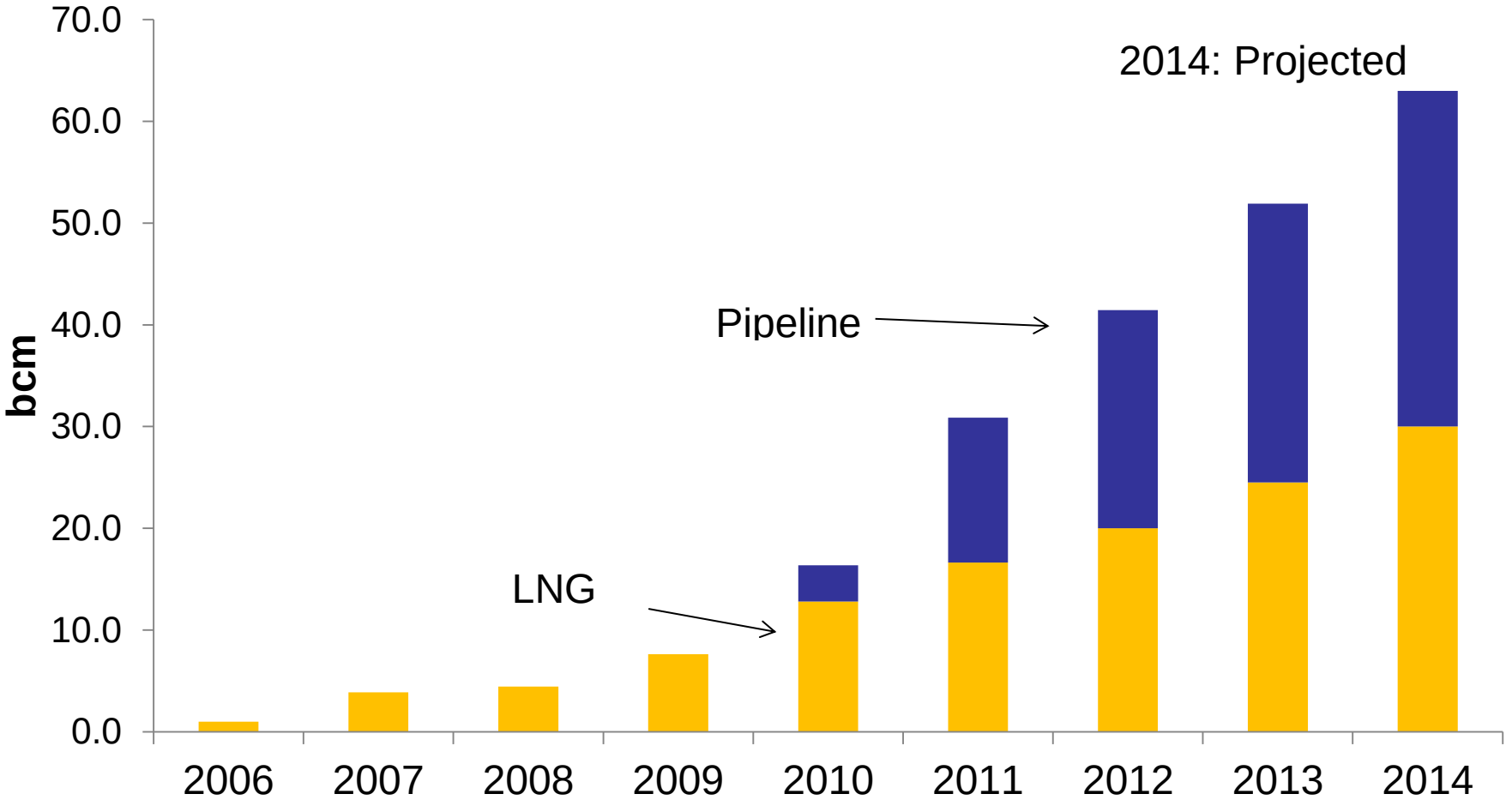
Source: IEA, World Energy Outlook, 2012

China's gas supply and demand

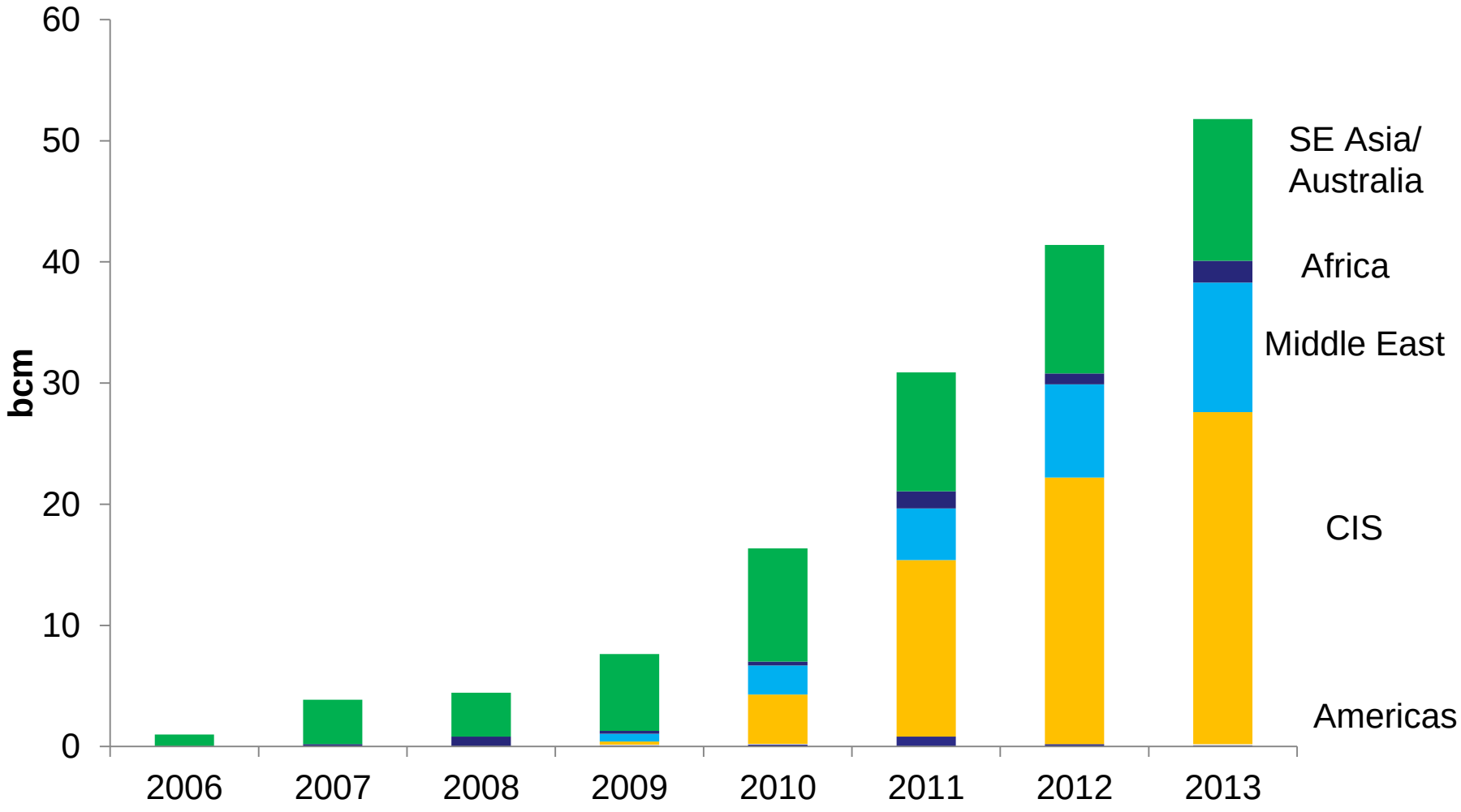


China pipelines & LNG plants

China gas imports



Sources of China's gas imports



Outlook: LNG terminals and pipelines

	2013	2015/16	2020
LNG capacity (bcm)			
- Capacity	40	60	?? 100
Pipeline capacity (bcm)			
-Central Asia	30	40+	65+
-Myanmar	12	12	12
- Russia	0	0	30
Total import capacity (bcm)	**82**	**112+**	**200+/-**

Supply & demand projections

bcm/yr	*2013*	2020	2030	2040
Demand	*170*	<400	500+	500++
Total gas production	*117*	220	300+/-	?
Net import requirement	*53*	200 +/-	200-300	?

cf Japan's LNG imports for 2013: 120 bcm
World total LNG trade for 2013: 325 bcm
World total gas trade for 2013: 1,035 bcm

Key uncertainties for LNG

- How fast will gas consumption grow:
  - Economic growth and energy intensity
  - Share of gas in fuel mix:
    - vs coal in power generation & heating; vs oil in transport
  - This will depend on either:
    - Price and policy support for gas
    - Penalties for coal (administrative/tax/trading)
- How much will gas production grow:
  - Conventional gas + Tight gas, shale gas, CBM & SNG
- LNG price vs pipeline

Flexibility is key

China's shale gas basins

Source: ARI, 2013.

Key observations: China shale gas

Geology/ information	Geological data not easily available. Geology not as favourable>> higher costs
Access to Land/ Resource	State owns resource rights. Central government issues licences. PetroChina & Sinopec hold best acreage
Rapid drilling	Low-moderate availability of: technology, skills, capital, supply chains, FDI. Dominant companies (NOCs): hold best land, but lack urgency (this is changing)
Economic incentives	Rising gas prices (+ subsidies for shale) Immature gas market, Pipelines insufficient Tax incentives. Petrochemical industry for NGLs

Key observations: China shale gas Regulation

- NOC areas: Tight licensing regime (PSC)
  - Work programmes, procurement regulations
- Different licensing system outside NOC areas:
  - bidding rounds, Chinese companies only
  - Framework for foreign involvement is not clear
- No obligatory third-party pipeline access
  - New rule
- No environmental regulations for fracking
- Lack of understanding of unconventional gas
- High transaction costs/unpredictability

Implications for shale gas in China

- Foreign companies:
  - Opportunities for service providers
  - Less attractive for E&P companies (today)
- Do not expect to replicate US experience
  - 6.5 bcm/yr by 2015 is likely
  - 60-110 bcm/yr by 2020 is probably unrealistic