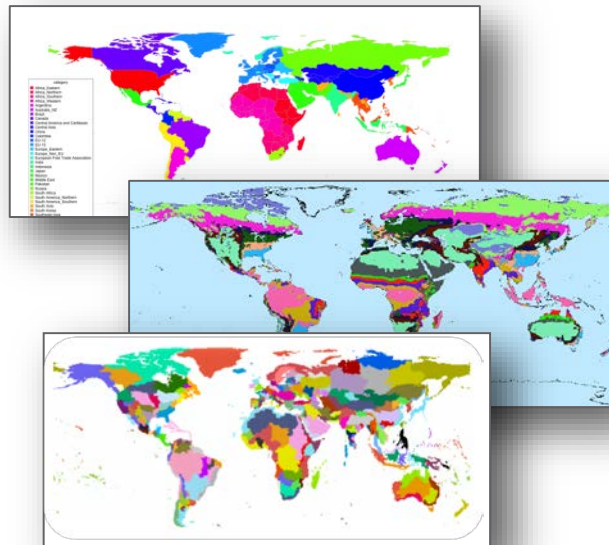


Sub-national Modeling and Scenario Development

Deep Regional Dives in GCAM

Global Modeling



Current examples include:

- GCAM-USA
- GCAM-China
- India Buildings
- U.S. Midwest agriculture

Regional Modeling in a Global Context

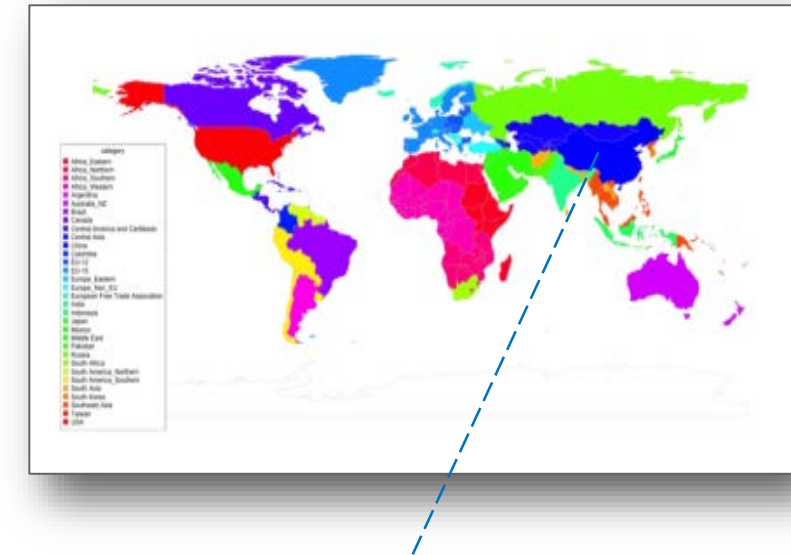
2005 Electricity Demand by Province (TWh)



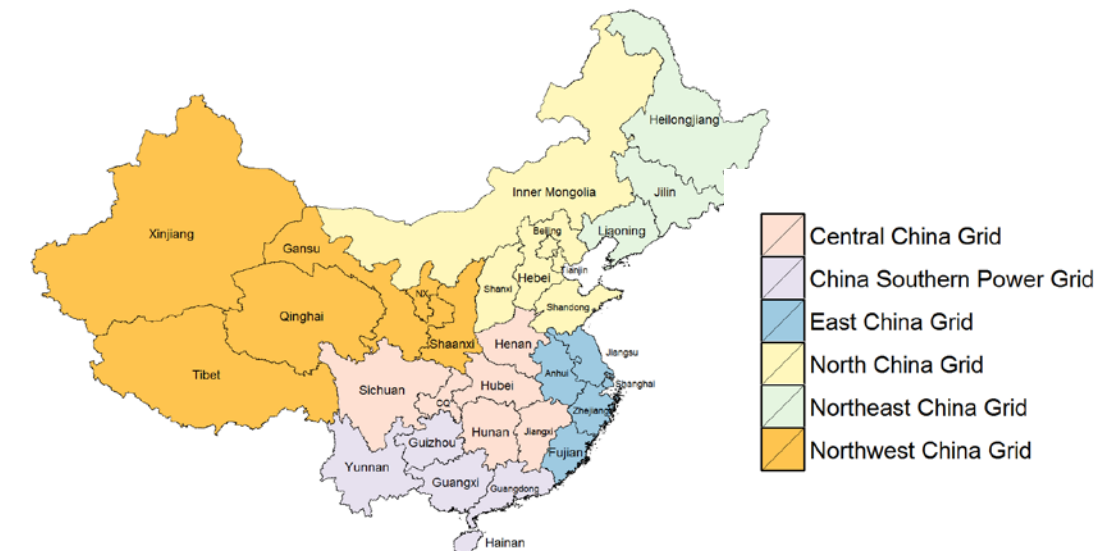
GCAM-China – Regional Modeling in a Global Context

- To explore regional activities in China, we have added subnational detail to GCAM (version name: GCAM-China):
 - 31-province energy and economic system
 - Agriculture and land use by agro-ecological zones
 - Water supply and demand at major watershed scale
- The regional detail is imbedded in the broader GCAM model, thus providing global constraints and context.

Standard GCAM: 32 geopolitical regions

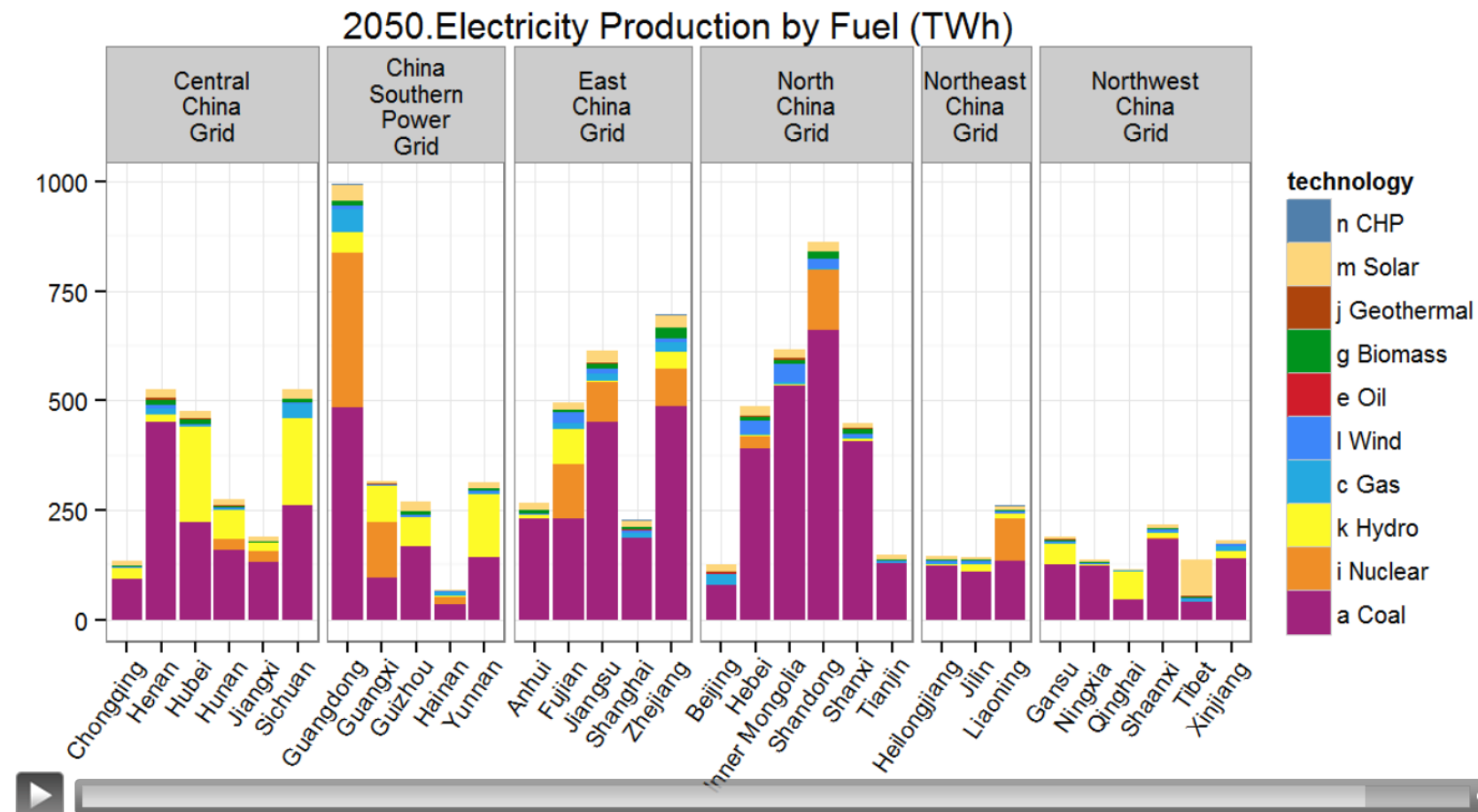


GCAM-China: Modeled Provinces



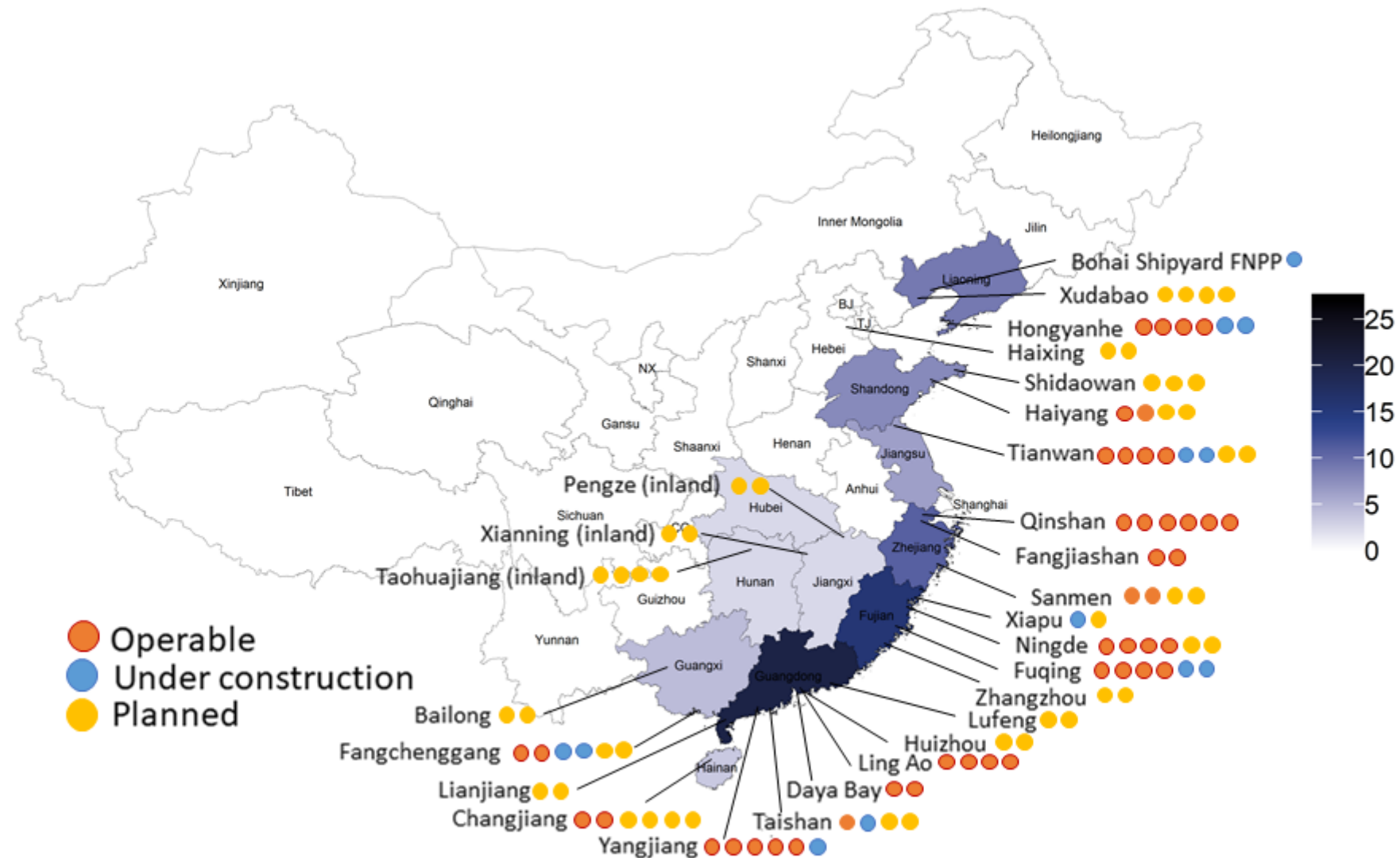
Current GCAM-China Detail

- Socioeconomics at the provincial level
 - Population
 - GDP
- Energy transformation at the provincial level
 - Electricity generation and refining by province
 - Electricity trade within 6 grid regions
- Renewable and carbon storage resources at the provincial level
 - Wind and solar
 - Carbon storage
- Coal and nuclear power generation at the plant level
- Final energy demand at the provincial level
 - Buildings: commercial, urban residential, and rural residential
 - Transportation: passenger & freight with detailed technologies
 - Industry: 10 subsectors

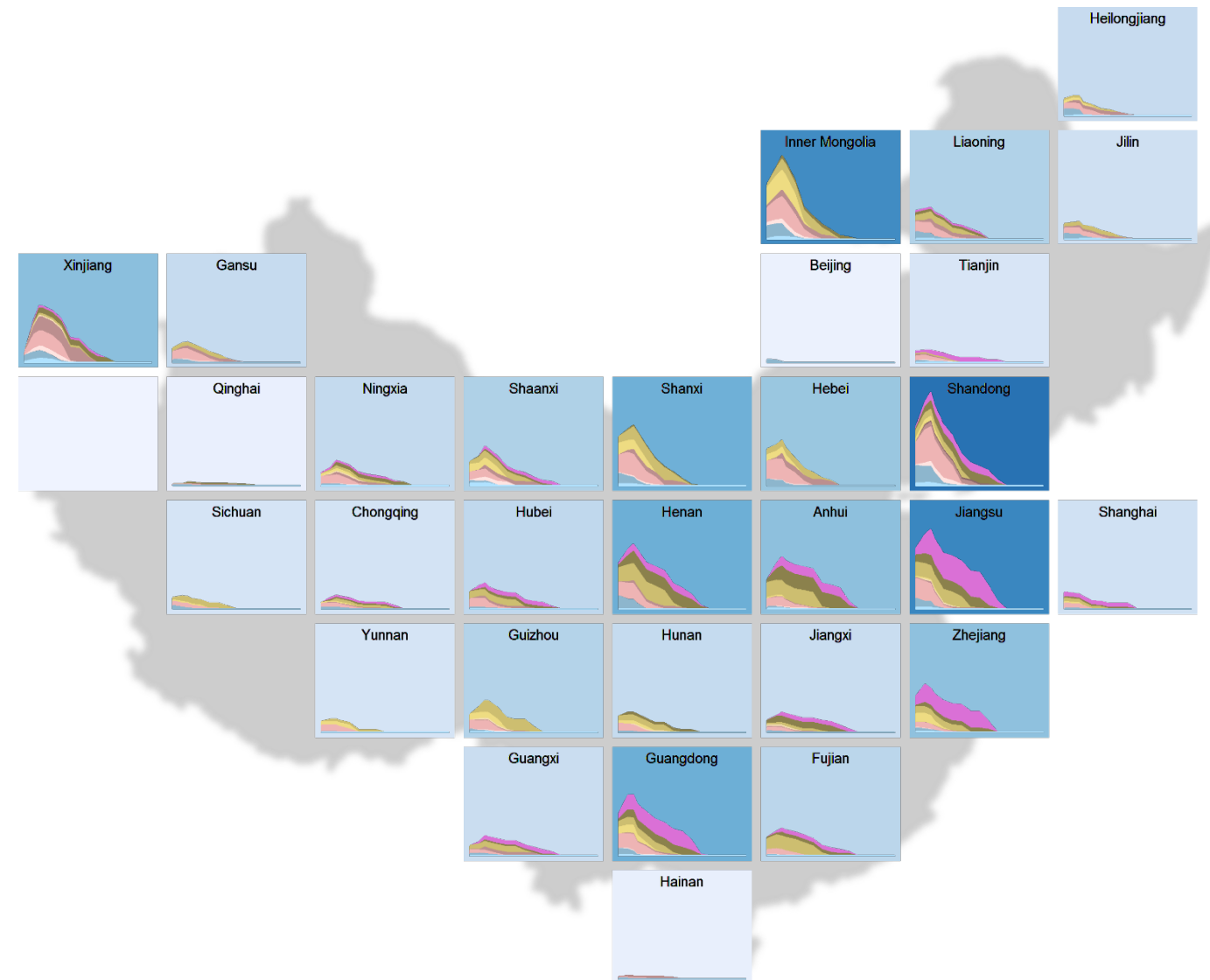
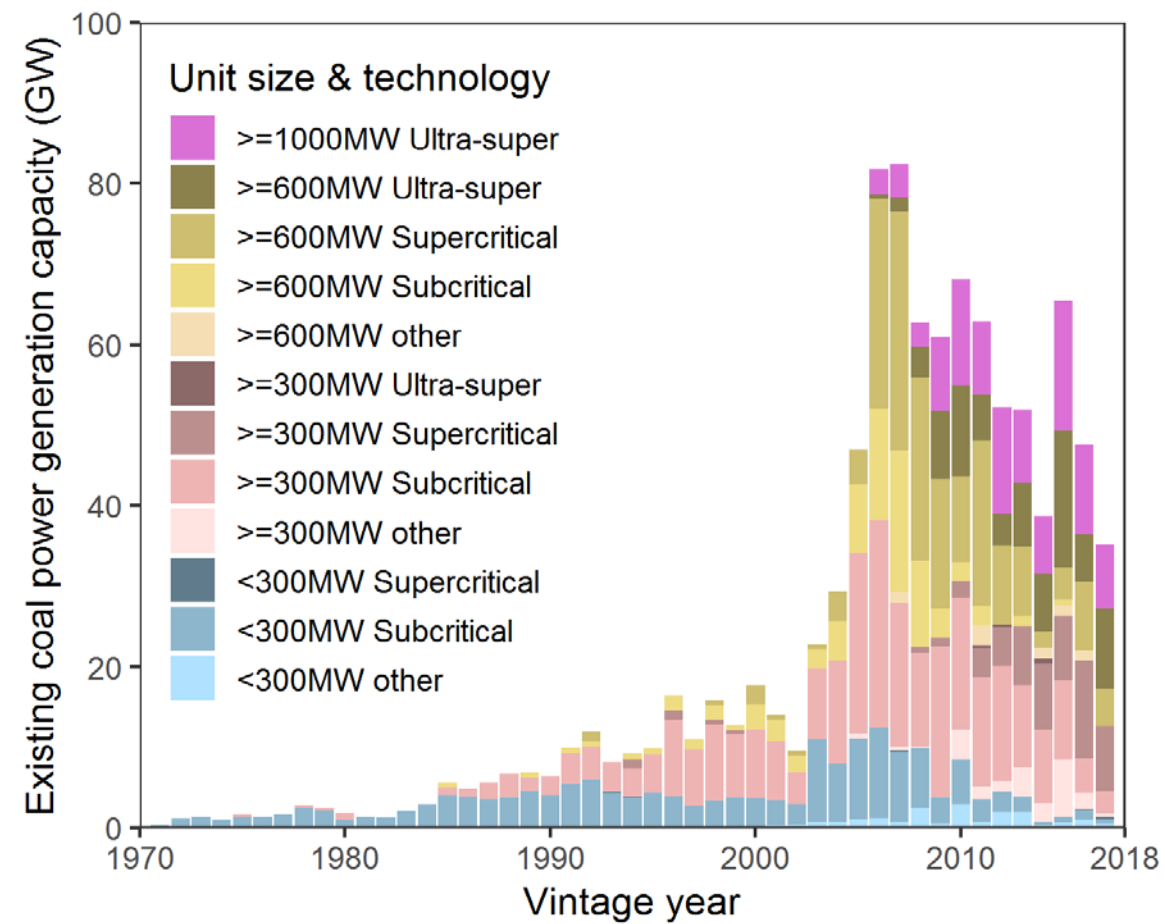


Example: energy transitions and the role of nuclear

2030 Nuclear capacity by province (GWe)

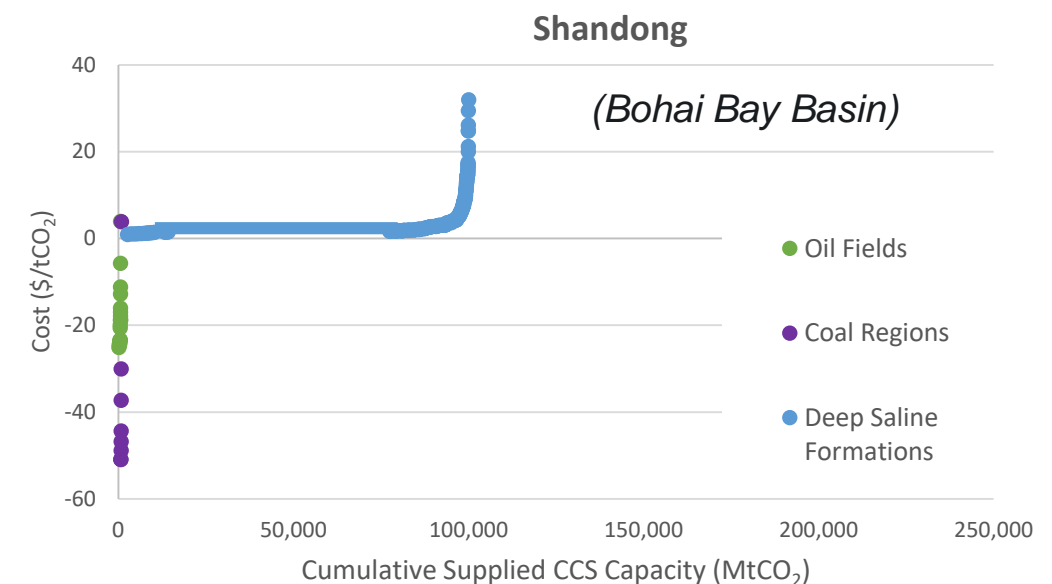
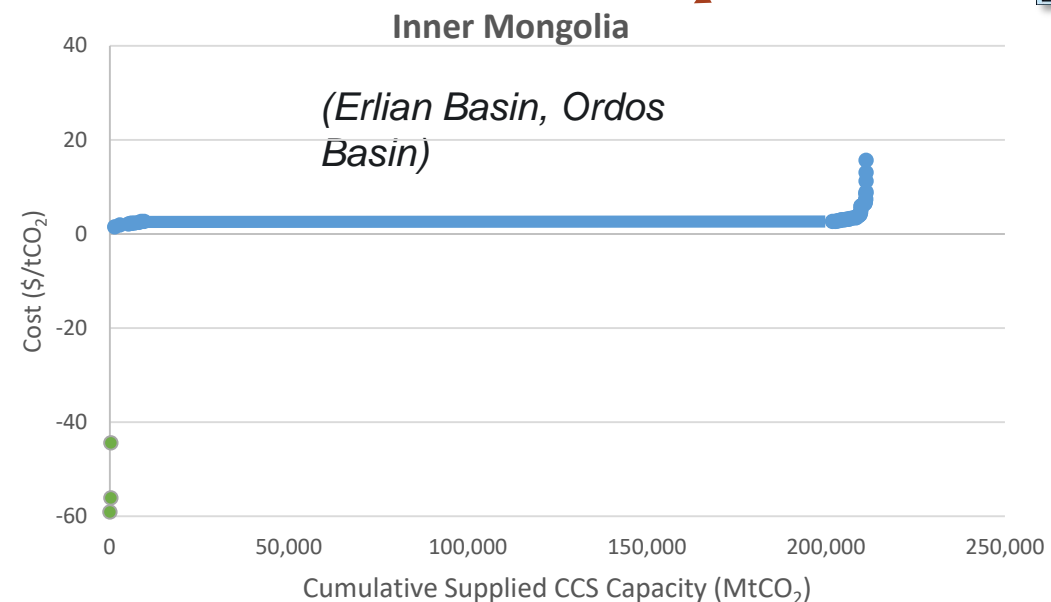
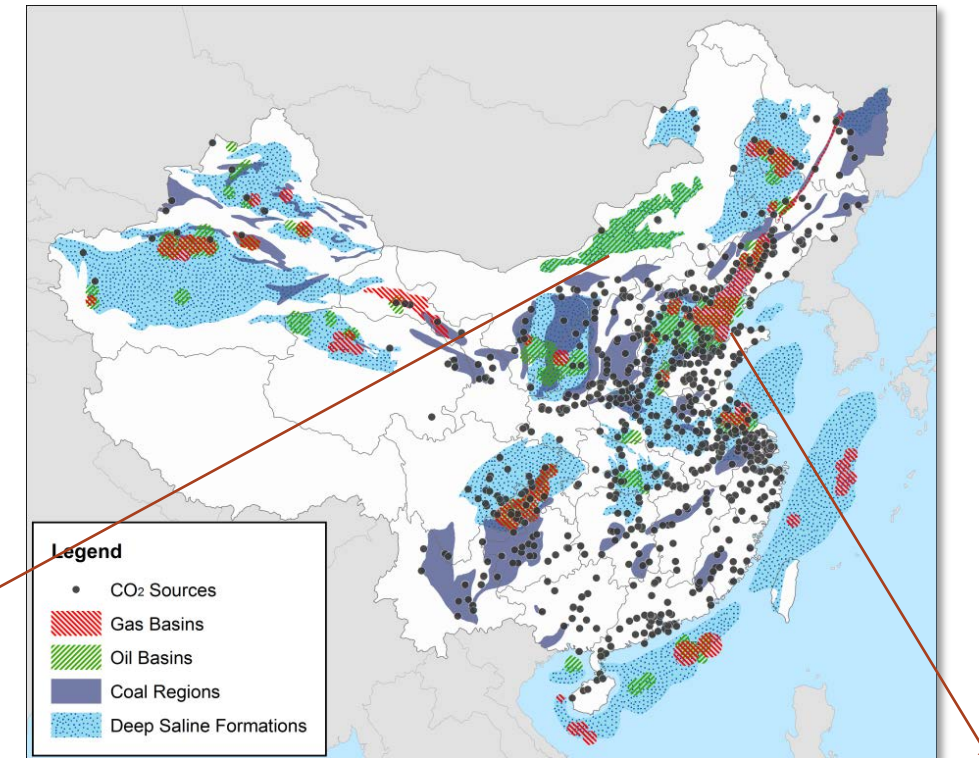


Example: coal power generation under RCP 2.6

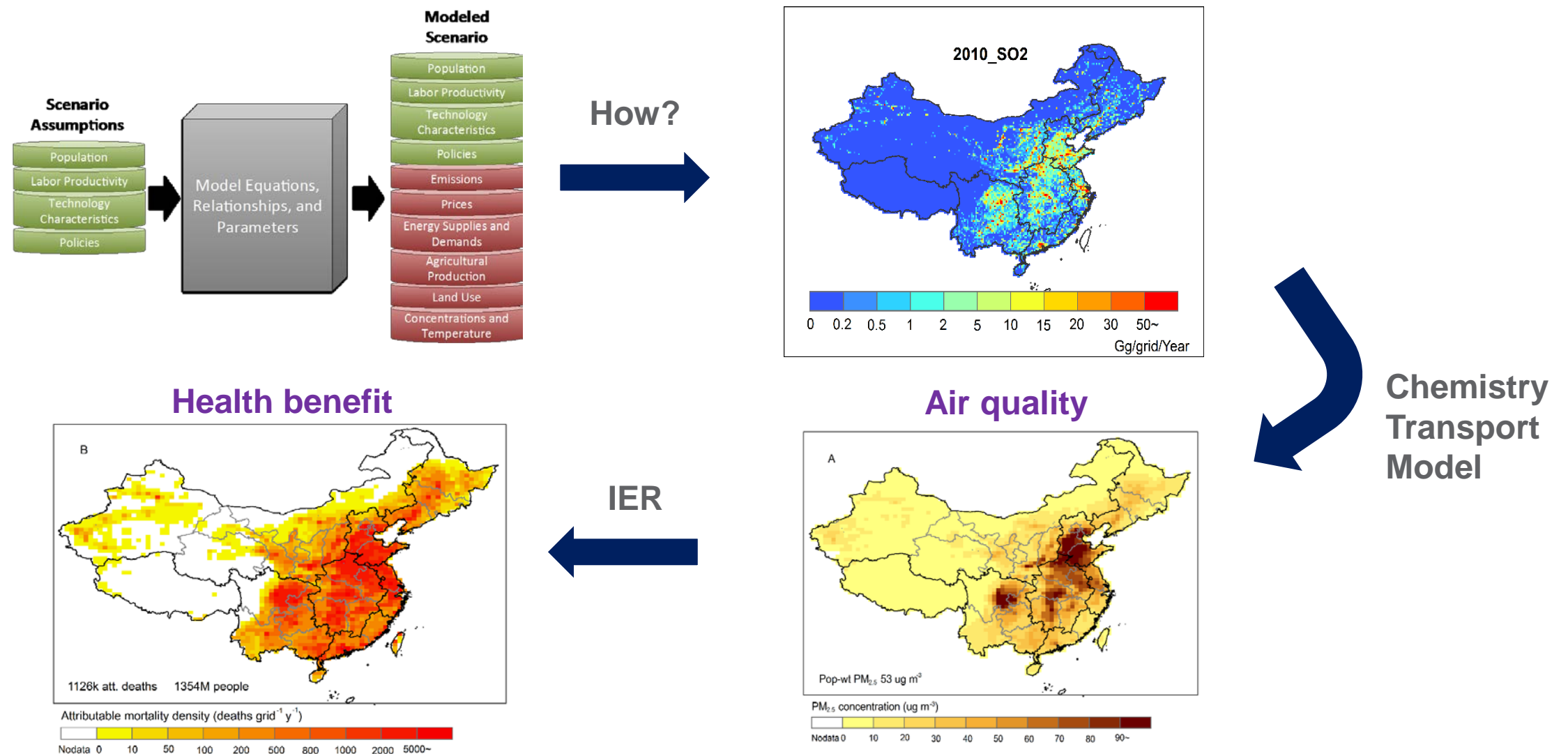


Example: provincial CCS cost curves

- 1,600 large CO₂ point sources (power plants and industrial sources)
- 2,300,000 MtCO₂ storage capacity
 - EOR, coal basins, deep saline formations
- Significant opportunity for both low-cost and moderately priced storage



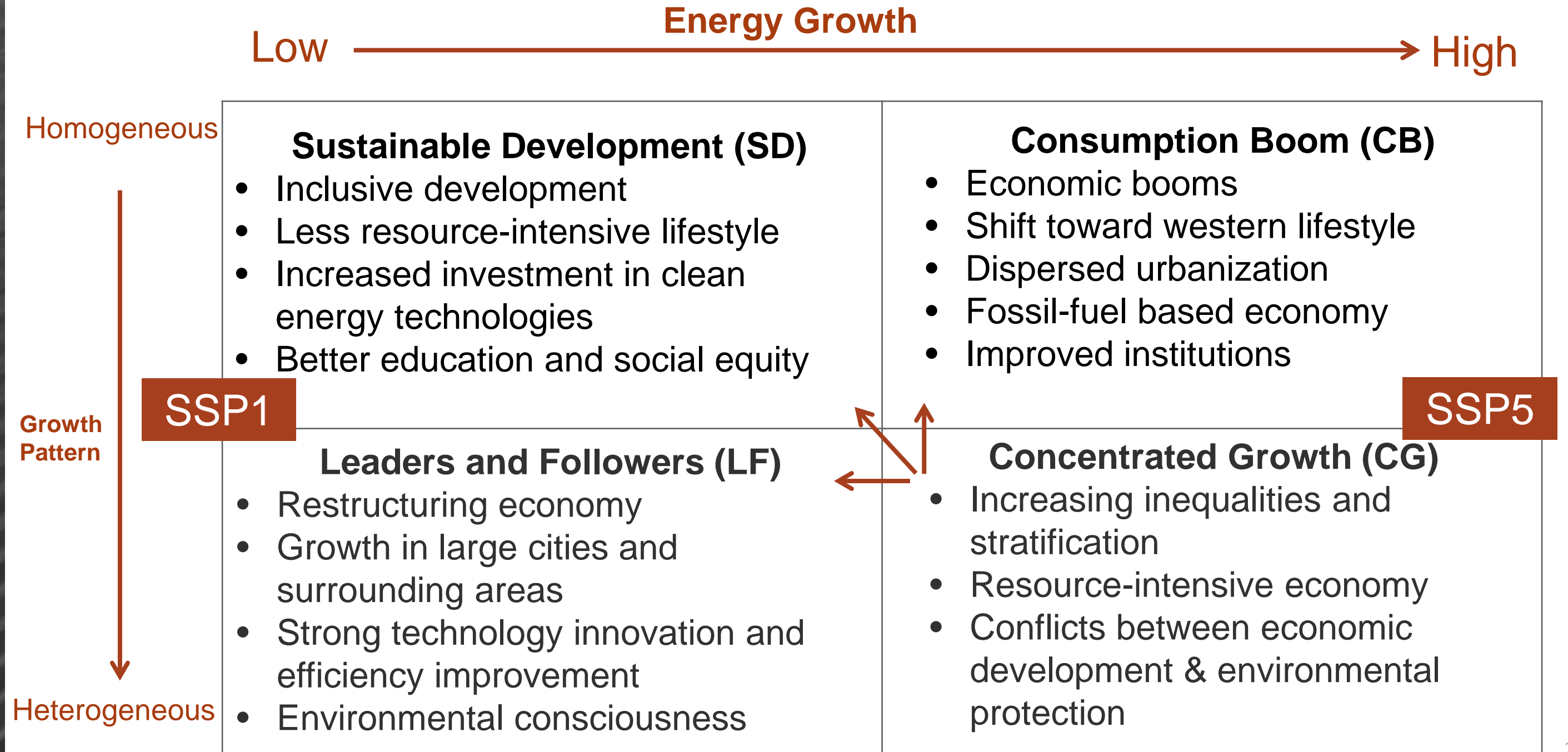
Example: air pollutant emissions and health benefits



How do we develop scenarios to address issues at finer scales?

- Representing the geographic and societal heterogeneity
- Capturing societal change and governance
- Working with models of different spatial and temporal scales
- Contextualizing scenarios
 - Lifestyle and behavior change
 - Economic transition and changing growth patterns
 - Distributional effect
 - Co-benefits/SDGs
 - National, provincial, and local policies

Developing alternate scenarios



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