



# The Stanford Natural Gas Initiative

Mark Zoback, Professor of Geophysics  
Director, NGI

Brad Ritts, NGI Managing Director

12 October 2016  
Affiliates Meeting



An aerial night view of a city skyline, likely Hong Kong, with numerous skyscrapers illuminated. In the foreground, an airport tarmac is visible with several aircraft parked. The text is overlaid on the image.

Why a Natural Gas Initiative at Stanford?

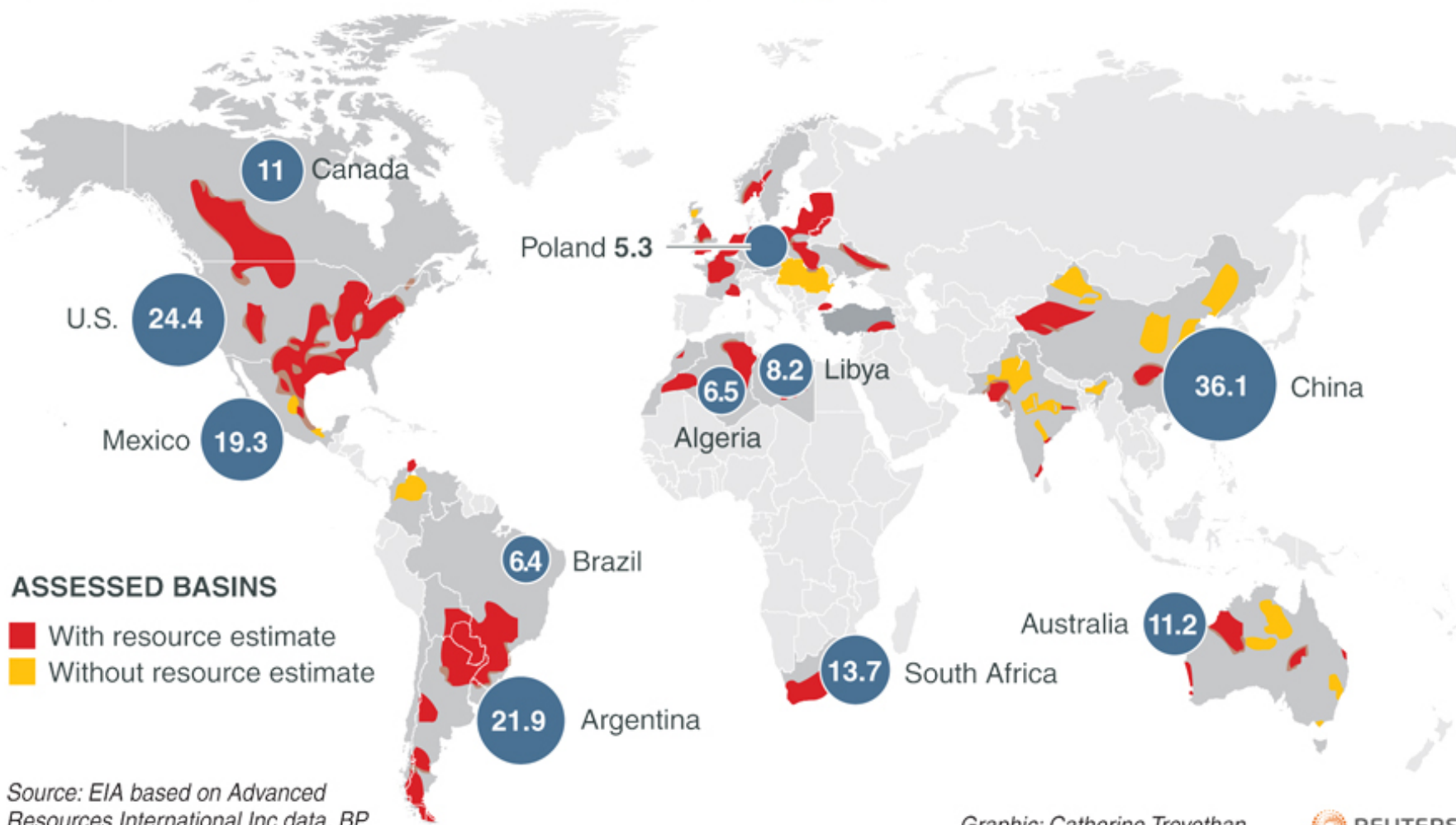
Natural Gas is Not Just About Keeping the Lights On

The Need To Optimize the Uses of Natural Gas  
Is More Important Than Ever

# Global Shale Gas ~ 200 Years of Supply

## GLOBAL SHALE GAS BASINS

● Top reserve holders 200 - In trillion cubic metres



# Goals of NGI

1. Complete original research to generate new knowledge about any aspect of natural gas
2. Increase opportunities for shared learning and collaboration in natural gas research and analysis
3. Ensure that new knowledge and unbiased facts are communicated to all stakeholders – seek to have NGI results used in science, technology, business, and policy

# Summary of Natural Gas Initiative at Stanford

- Fund new research into natural gas
  - ✓ Funded ~\$2MM in research to date
  - ✓ Started with seed grant program
  - ✓ High-impact research focus areas
- Convene meetings to allow dialog and cooperation on natural gas issues
  - ✓ Technical and policy workshops for SMEs
  - ✓ High profile symposia on topics of global significance
- Communicate research directions and new knowledge
  - ✓ Launch of “Natural Gas Brief” series
  - ✓ Workshop and symposium white papers
- Develop close cooperation and interaction with industry and other external stakeholders
  - ✓ Industrial affiliate program

# Stanford Natural Gas Initiative Leadership

- Director: Mark Zoback (Geophysics)
- Faculty Management Committee:
  - Adam Brandt (Energy Engineering)
  - Tom Jaramillo (Chemical Engineering)
  - Tony Kavscek (Petroleum Engineering)
  - Michael Wara (Law)
  - Frank Wolak (Economics)
- Managing Director: Brad Ritts
- Strategic Advisor: Tisha Schuller
- Focus Area Managers

# Natural Gas Briefs

Topical series published by NGI and intended for broad, general audience

## Upcoming briefs:

1. New opportunities in natural gas conversion (Jaramillo)
2. What do we know about natural gas leakage? (Brandt and Ravikumar)
3. Are methane hydrates a future natural gas resource? (Ritts)
4. De-escalating the fracking wars (Schuller)



## Natural Gas Brief

Stanford | Natural Gas Initiative  
School of Earth, Energy & Environmental Sciences  
and Precourt Institute for Energy

AUGUST 2016



### Why Isn't Natural Gas in India's Climate Plan?

Mark C. Thurber

India's energy-related emissions of greenhouse gases (GHGs) are predicted to grow far more than those of any other country between now and 2040.<sup>1</sup> This is a function both of India's low per capita energy consumption and GHG emissions today and its plan to continue to rely on carbon-intensive coal to supply the vast majority of its energy.<sup>2</sup> The climate policy commitment that India made in advance of the 2015 Paris Climate Conference—its Intended Nationally Determined Contribution (INDC)—aims to displace significant coal with an ambitious build-out of solar energy.<sup>3</sup> At the same time, India's policymakers still appear to view coal as the only energy source that can reliably support economic growth, and they target a doubling of domestic coal production by 2020.<sup>4</sup>

One energy source that does not appear anywhere in India's INDC is natural gas, despite the fact that gas-fired power plants emit roughly half the CO<sub>2</sub> per unit energy output of coal plants. Just as importantly for India, gas-fired plants are negligible emitters of local pollutants, in contrast with coal plants, whose emissions of sulfur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), and particulates are a major contributor to air pollution.

The reasons for the non-inclusion of gas in India's INDC appear obvious at first. India does not have nearly as much gas as it does coal, and gas is more expensive than coal. Relying too heavily on gas would therefore appear to put India's energy

security and economic development prospects at risk. And indeed, past experience seems to show the danger of a gas strategy. India's development of the Hazira-Vijaipur-Jagdishpur (HVJ) pipeline from the western gas fields resulted in the siting of fertilizer plants, power plants, and other gas-consuming industries along the pipeline route, but shortfalls in actual gas deliveries have been a persistent problem, in some cases forcing these facilities to convert to dual fueling. Also, in a 2006 report, the Planning Commission of India expressed skepticism based on their modeling that gas could be cost-competitive with coal for power generation.

I will argue that India should not be so quick to dismiss gas as an important part of

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its strategy for climate change mitigation (and local air quality improvement). Gas imports have the potential to be comparatively inexpensive for a long time due to the expansion of gas supply around the world (especially in the United States and Australia). Imported coal does not always come cheap, and coal use imposes many negative externalities on India that are not being accounted for in models of energy costs. That said, there are very real institutional obstacles to large-scale substitution of gas for coal. Gas pricing and regulatory

# Current Research Portfolio

- Current Focus Areas
  - Methane Conversion (Jaramillo, Cargnello, Zheng, Norskov)
  - Methane Leakage (Brandt, Jackson, Wara)
    - MEMS and Laser gas sensors
- Developing Focus Areas
  - Improving Production from Unconventional Gas Reservoirs (Kovscek, Zoback)
  - Global Natural Gas Markets (Wolak, Thurber)
    - ❖ Energy Poverty
    - ❖ Global Coal to Gas Fuel Switching
    - ❖ Integration with Renewables
    - ❖ LNG and Global Markets
- Seed Grant (Pre-Focus Area)
  - Gas separation and membrane technology (H<sub>2</sub>S and CO<sub>2</sub>)



# NGI Workshops and Symposia

NGI-SUNCAT Workshop: **From methane to liquid fuels and beyond: opportunities and challenges for a natural gas-powered future**

14 September 2016

NGI Affiliates Meeting: **Insights from industry on issues and research opportunities facing natural gas industries**

12 October 2016

NGI Workshop: **State of the science of natural gas leakage: remaining gaps and questions**

9-10 November 2016

NGI-GDP Symposium: **New business models and technologies to reduce energy poverty with natural gas**

9-10 May 2017

NGI Workshop: **Improving recovery from shale gas reservoirs**

October 2017

NGI Affiliates Meeting: **Stanford research review**

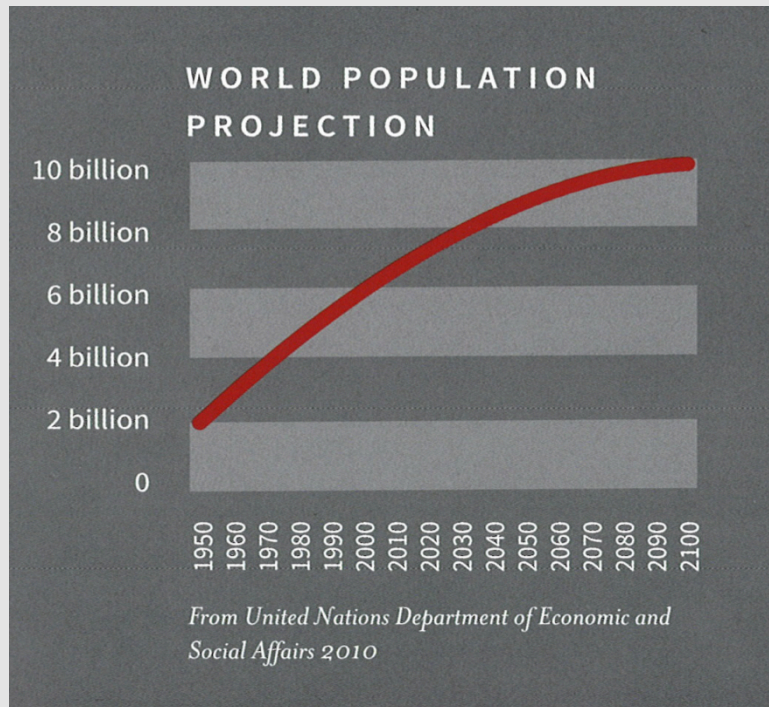
October 2017

NGI Workshop: **Integration of natural gas and renewables**

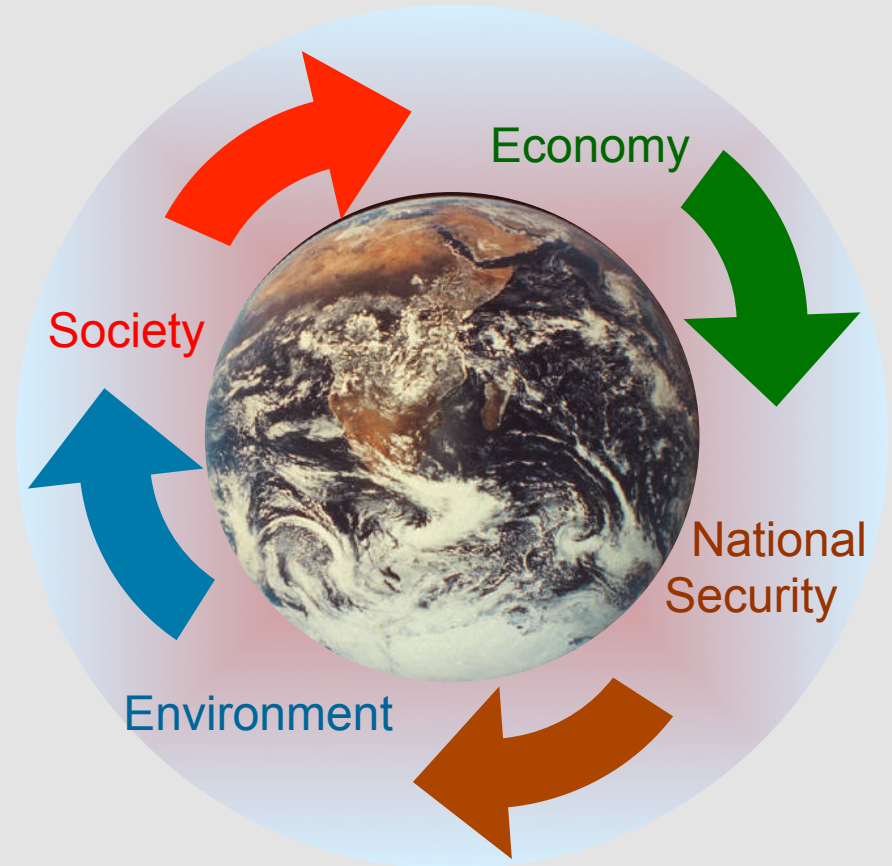
January 2018

# Global Energy and Environment Challenge

## The World in 2050



~ 9 Billion People



How Will We Provide Twice As Much Accessible, Affordable, and Secure Energy While Protecting the Planet?

# AGENDA – October 12<sup>th</sup>

8:45-10:30 Natural Gas, Renewables, and Sustainable Development

8:45 Keynote: “Pathways to the Future for Natural Gas in a Carbon Constrained Environment” – George Minter, Southern California Gas

9:30 “Integration of Gas and Renewables” – Wolfgang Moehler, IHS

9:45 Panel Discussion

Bill Brown, NetPower and 8Rivers Capital

George Minter, SoCalGas

Wolfgang Moehler, IHS

Vikram Singh, TIAA

Sabrina Watkins, ConocoPhillips

Moderator: Mark Thurber, Stanford

10:30 Break

10:45-12:00 Natural Gas and Transportation

10:45 “Natural Gas in Transportation” – Tiffany Groode, HIS

11:05 “Cutting Edge Technologies in Clean Transportation” – Cherif Youssef, So Cal Gas