

Unconventional Gas Development Mitigating Environmental Risk



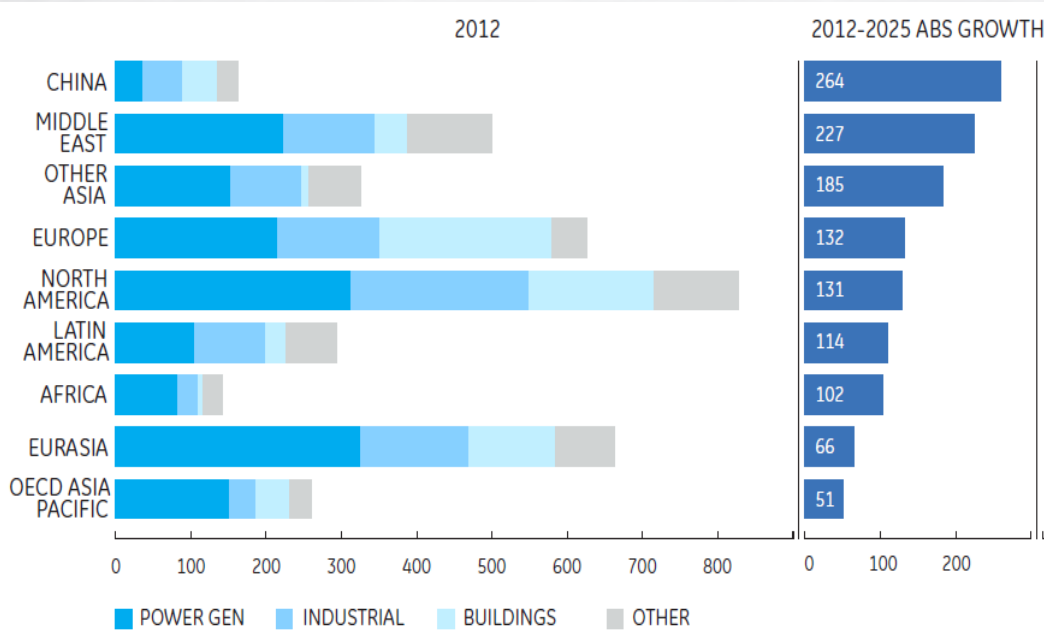
The “Age of Gas”

Natural gas is taking a larger role in global energy mix

Percent of Primary Global Energy Production



“Age of Gas” Outlook ‘12 –’25 (Bcm per year)



Global growth 36% ‘12 to ‘25

Key drivers

- Unlocking new gas supply sources
- Need for environmental mitigation
- Price competitiveness ... Asia & EU
- Gas network growth

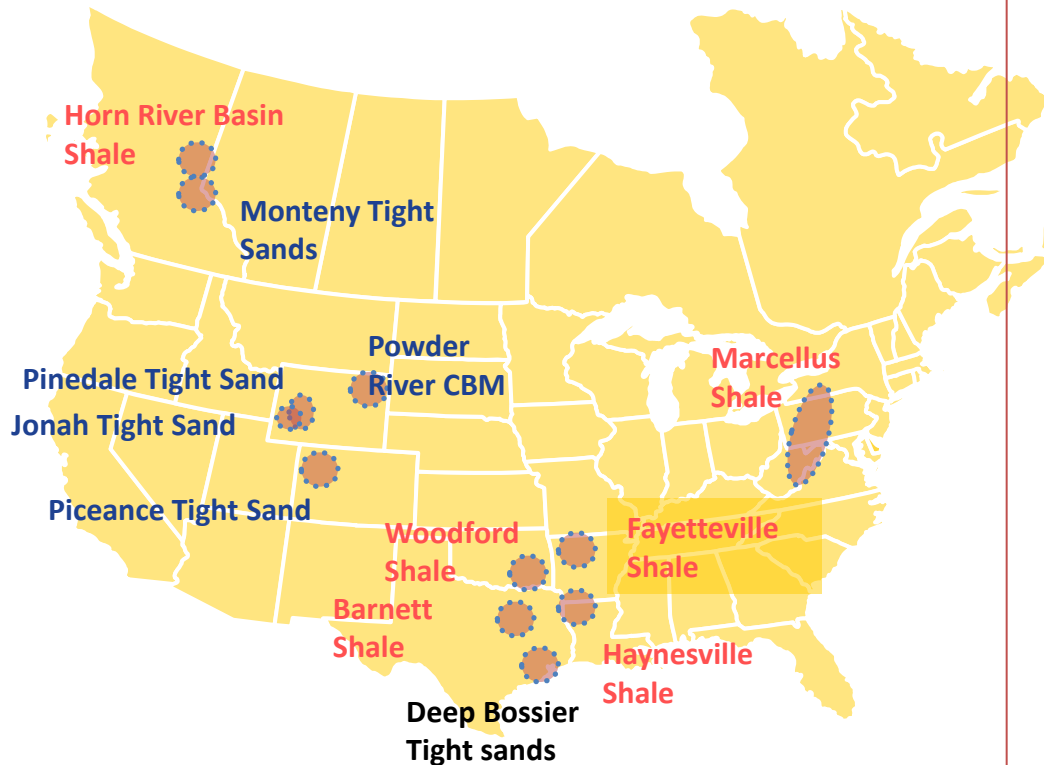


GE imagination at work

Sources: History -BP Stat report, EIA, IEA. Outlook-GE Fuel COE Jul '13
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Growing shale gas supply in the US

Major unconventional gas sources



Red: shale gas
Blue: other unconventional gas

Large potential

Current Production in 2008: 9.9 Bcfd

14% of N. American Production

+ Additional between 2008 and 2010: 5 Bcfd

+ Additional between 2010 and 2015: 8.4 Bcfd
potential to be 25% of N. American production by 2015

Source: GE Energy outlook 2009

Public Concerns Intersect with Industry Operations

Water Impacts

- Industry uses a lot
- Industry doesn't recycle enough
- Injection wells are bad

Air Impacts

- Methane leaks
- General GHG issues
- Flaring

Community Impacts

- Noise
- Dust
- Traffic

The social license to operate is the critical element

Three approaches to balancing energy imperatives with environmental concerns

Good business practices

Advanced Technology

Smart regulations

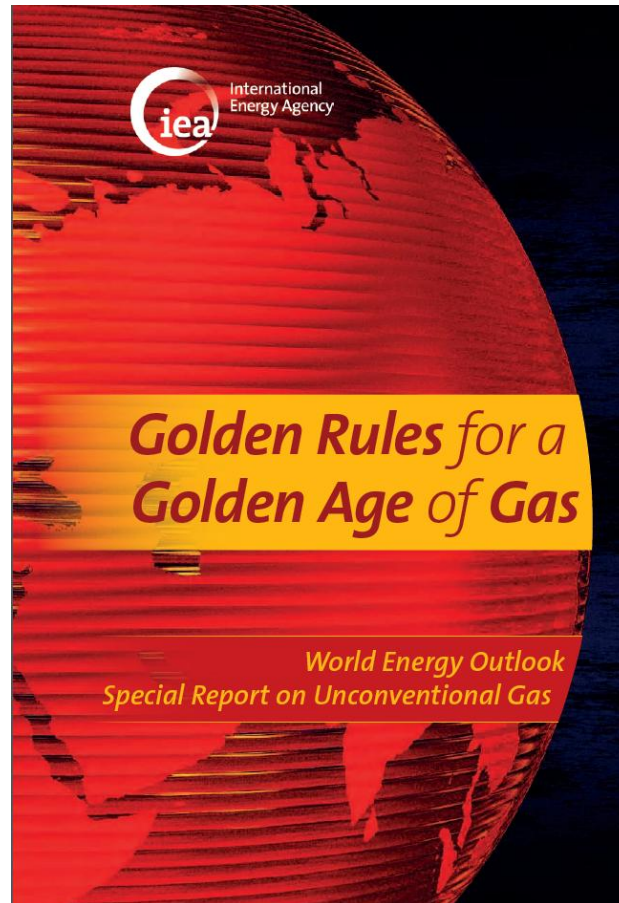
Unconventional is safe today, but can be better tomorrow!

Good business and operational practices

Leasing

Contracts

Set backs



Water treatment

Well integrity

Operational
timing

Technology Solutions

Water

- Less, not fresh or an alternative
- Recycle more
- Less injection

Air

- Maintenance
- Use new technology
- Monetize the gas

Community

- Power to Lift

R&D to find substitutes to fresh water is needed!

Solutions for unconventional O&G

Coal Seam Gas



Recovery & Brine

- Environmental discharge
- Evaporation pond availability
- Brine volumes & disposal

Current Status

- 150MLD installed
- Mobile systems for gas wells
- Piloting beneficial brine soln's

Shale Gas Produced Water



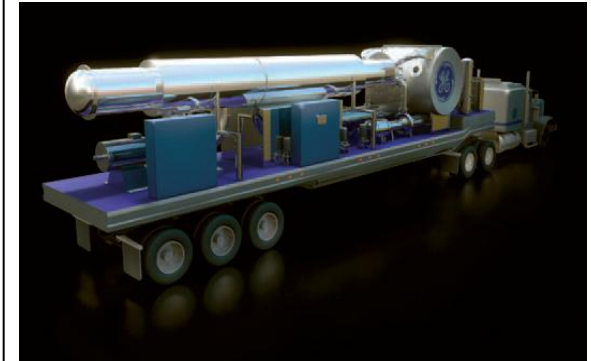
Water Disposal

- OnePass filtration
- Biocide alternative
- Tank cleaning, pump changes

Current Status

- Piloted successfully
- Validated cost \$0.07/bbl
- More effective control

Shale Gas Produced Water & Flow Back



Water Disposal/Supply

- Thermal ZLD (mobile/central)
- Brine disposal & transport
- Source water – mobile UF

Current Status

- Mobile evaporators operating
- Source Water UF piloted
- UF cost 10% ↓ vs. biocide

Water

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How much methane leakage is too much?

Oilfield Power Generation & Electrification

Power solutions need to be **Flexible, Scalable, Economic, & Reliable**

- Mobile / temporary power generation from 1 MW to +20MW
- Utilization of field gas as primary fuel improves economics & environment
- Modularized purpose built power management reduces grid degradation
- OPEX side procurement models free up CAPEX for value add investment
- Microgrid systems that provide complete power control/ assurance
- RM&D optimizes response to ever evolving power conditions across assets



GE Power & Water



GE Energy Management



GE Oil & Gas

GE allows operators more control & flexibility in their power/ production choices

Oil field diesel-to-gas drill rig power

GE's gas engines solutions are creating value today...



Jenbacher J320

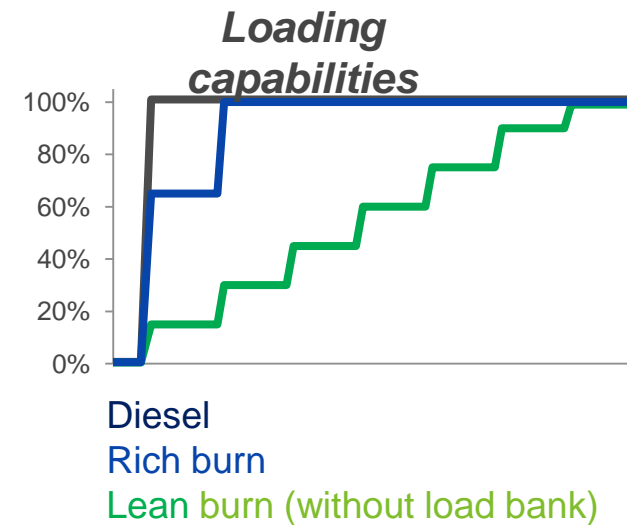
- ✓ Rated output: 1007 kW
- ✓ Lean burn
- ✓ Installations on both field gas & LNG
- ✓ 1st U.S. EPA certified for mobile & stationary
- ✓ Up to 37.2% electrical efficiency
- ✓ Up to 25% reduced emissions
- ✓ Over 20 installed in N. America as of 2012



Waukesha VHP 7044

- ✓ Rated output: 1200 kW
- ✓ Rich burn
- ✓ Fuel flexible for variable gases
- ✓ Up to 31.2% electrical efficiency
- ✓ Up to 25% reduced emissions
- ✓ First units shipped for 1Q 2013

- Up to 60% lower operating costs
- Up to 25% lower NOX/CO emissions



**Marcellus shale,
Pennsylvania, USA**

- 6 x J320 engines
- 1st U.S. EPA certified technology for mobile and stationary drilling
- Operating on LNG
- Up to **60%** lower fuel costs compared to diesel
- Emissions reduction up to up to **25%**

Technology Solutions

Water

- Less, not fresh or an alternative
- Recycle more
- Less injection

Air

- Maintenance
- Use new technology
- Monetize the gas

Community

- Power to Lift

Industry operations in communities cause conflict

Trucks for Fuel ... Trucks for Water



Smart Regulations

A GE White Paper

Goals

- Support the development of natural gas resources
- Promote adoption of GE technologies

Natural Gas: State Policy Best Practices

Stage 1: Site selection / preparation

DRAFT

Issue	GE position	States with BPs
Land rights	<ul style="list-style-type: none"> • Issues concern royalties and other contract issues between landowner and developer. GE has no interest or position. 	
Setbacks and Prohibitions	<ul style="list-style-type: none"> • Setbacks and prohibitions are means of protecting well and surface waters and addressing noise, dust, and safety issues of concern to nearby residents. While these issues are legitimate, advocates seek to impose unreasonable requirements to limit or prevent development. • While GE has no specific interest, GE supports "reasonable" site-based setback requirements necessary to allow development with public support and acceptance. • Safety issues, such as high H2S content, could create a market for O&G measurement technology and GE supports appropriate safety requirements. 	<ul style="list-style-type: none"> • Colorado O&G Conservation Commission, Public Water System Protection (Rule 317B). Three zones with stricter requirements the closer operations are to classified waters (0-300'; 301-500'; 501-2,640') • Illinois SB 1715: requires 300'+ setbacks re: waters, public structures, schools, etc. as per table.
Permit Requirements	<ul style="list-style-type: none"> • Permit conditions impose specific requirements to implement and make enforceable regulatory requirements. • While most requirements are not relevant to GE interests, GE favors requirements that are clear, consistent, enforceable and strike a balance between industry and public interests that allow responsible development. • GE supports creative incentive structures to encourage treatment and reuse of flow-back and produced water. 	<ul style="list-style-type: none"> • Texas Railroad Commission voluntary water recycling rules: eliminate need for agency permit if recycled "fluids" remain in O&G operations.

(continued next page)



PRIVILEGED & CONFIDENTIAL/ATTORNEY-CLIENT COMMUNICATION

In the US, community engagement is essential

Three approaches to balancing energy imperatives with environmental concerns

Good business practices

Advanced Technology

Smart regulations

A balanced approach will maintain the social license



Thank You



For More Information Contact
Paul Doucette, Operating Agent – paul.doucette@ge.com

