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3-1. Pathways to shale gas development in APEC

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Outline

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II. Project overview

III. Policy framework for shale gas development

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V. Remarks

Rationale

- The need to reconcile growing energy demand with a lower carbon footprint from fossil fuels.
- The attractiveness of unconventional resources, particularly shale gas, to meet the rising energy demand.
- The strategic position of the APEC region to boost its natural gas supply through its shale gas resources.
- The number of economies aiming to follow suit on the United States shale gas-driven energy transformation.

APEC in the global gas market

By 2011, APEC:

- Represented nearly **60% of the primary demand.**
- Concentrated **70% of the LNG imports.**
- Accounted for nearly **60% of production.**
- Held **37% of proved reserves.**
- Was a **net gas exporter region.**

From 2000 to 2011, natural gas demand grew at an average rate of 2.6% per year.

Natural gas profile by economy

Net trade position	Domestic gas production	
	Present	Not present
No trade	New Zealand Papua New Guinea* The Philippines Viet Nam	
Importer	**Chile** **China** Chinese Taipei Japan Korea **Mexico** Thailand United States	Hong Kong, China Singapore
Exporter	**Australia** Brunei Darussalam **Canada** **Indonesia** Malaysia Peru Russia	

Classification based on 2011 values.
***As of 2014 is an LNG exporter**
Source: EDMC (2014); for Vietnam, IEA (2012).

The role of unconventional gas in APEC

- 2010 - APEC Energy Leaders instructed the elaboration of an Unconventional Gas Census.
- 2012 – APEC Energy Leaders agreed to **promote cleaner fossil fuels**, including the evaluation of the production, trade potential and environmental impact of diverse unconventional natural gas resources.
- 2013 - **APEC Unconventional Natural Gas Census** is released to provide information of potential unconventional resources.
- 2014 – APEC Energy Leaders encouraged **sharing best practices** on unconventional oil gas exploration and production.

A region with abundant shale gas resources

Economy/region	Natural gas production 2011	Natural gas proved reserves* 2011	Shale gas technically recoverable resources estimation	
			APEC Unconventional Natural Gas Census, 2013	EIA, 2013
	bcm			
Australia	49.7	789	11,300	12,374
Canada	147.1	1,727	2,550	16,226
Chile	1.4	98	-	1,359
China	106.2	3,030	25,100	31,573
Indonesia	91.1	3,994	-	1,303
Mexico	46.4	490	8,410	15,433
Peru	13.1	353	2,070	-
Russia	614.4	47,572	-	8,127
Thailand	34.5	300	-	142
United States	590.1	7,717	16,410	16,056
Total	**1,694**	**66,070**	**65,840**	**102,592**
World	**3,126**	**187,289**	**65,840**	**203,910**
APEC as % of world**	**54%**	**35%**	**-**	**50%**

At January 1 2012

****Refers to the 10 APEC economies shown in this Table. For EIA (2013),World total refers to 42 economies.**

Source: EDMC (2014); APEC Energy Working Group (2013), EIA (2013), IEA (2012) and Oil and Gas Journal (2012)

Project overview

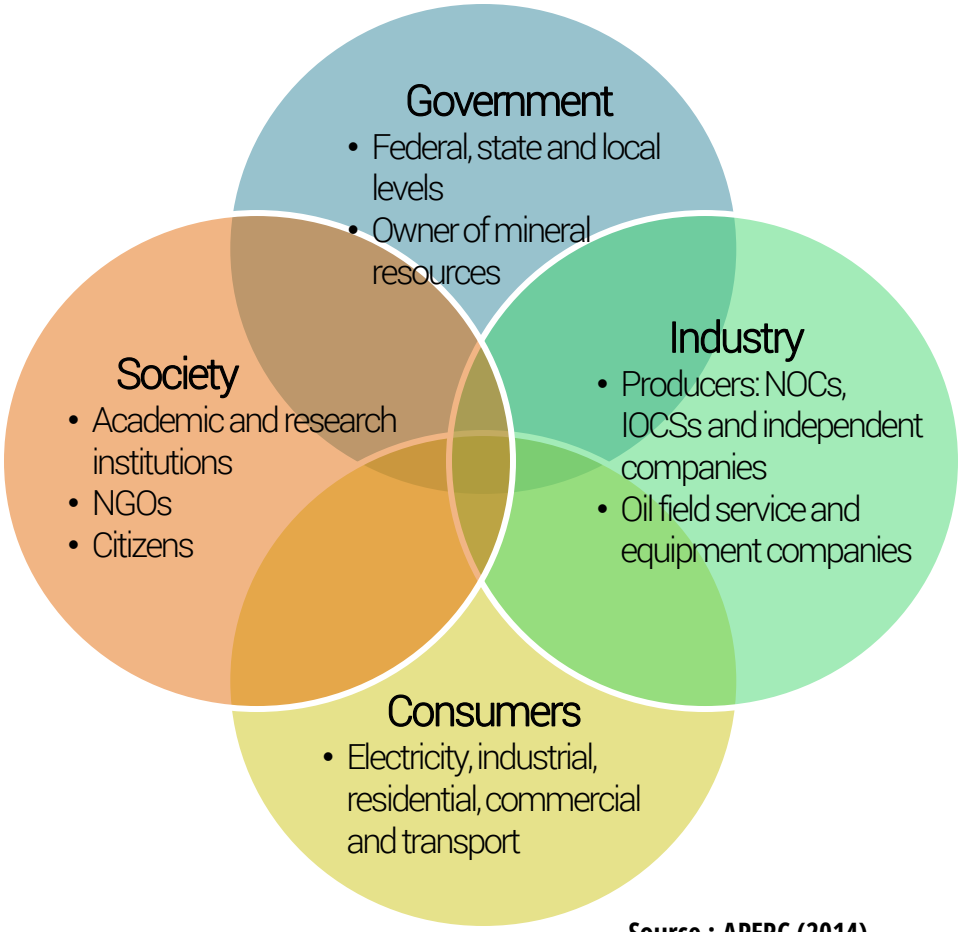
Aims

- To develop a general policy framework with a number of key success factors to the commercial development of shale gas.
- To outline a set of policy recommendations in a number of APEC economies.
- To facilitate the exchange of economy experiences and enhance the knowledge on shale gas development across APEC.
- To become a stepping stone for the establishment of cooperative mechanisms on shale development that combine APEC's strengths and APERC's expertise.

Scope

- Focuses on **six** economies:
  - Australia, Canada, Chile, China, Indonesia and Mexico
- Entirely focused on shale gas.
- Not technical but policy-oriented.
- Employs primary and secondary information sources.
  - Literature review
  - Economy visits
  - Expert insights (interviews to key stakeholders, workshops, academic and industry events)

Addressing the complexity of shale gas development



Source : APERC (2014)

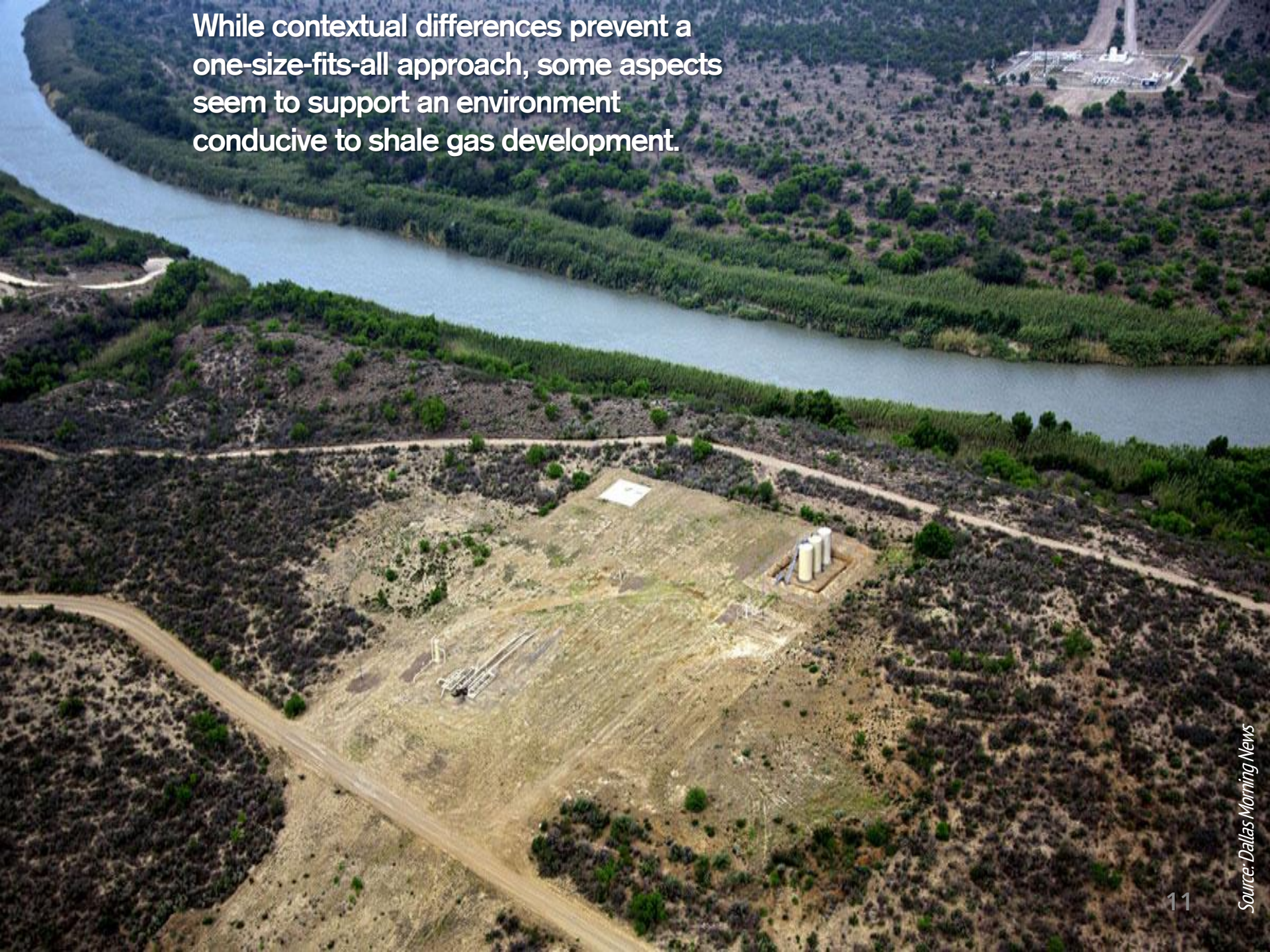
In comparison to conventional gas, in shale gas:

- Reservoir productivity is highly heterogeneous
- More specialized data technology and data are needed
- Wells typically decline faster, hence more intensive drilling and larger acreage are required
- Exceeds demands for water, materials, equipment and workforce
- Requires repeatable and modular operations
- Has a more noticeable land and water footprint
- Usually incurs in higher costs
- Stirs more social impacts

Preliminary insights

- **Shale development takes time, infrastructure and** typically, **more resources** than conventional oil and gas projects.
- Projects depend on **economics and are carried out by companies**.
- **Private mineral rights (as in the U.S.) are not strictly necessary** to shale gas development.
- **Social license** is decisive to the pace of development.
- There are different patterns of development across economies.

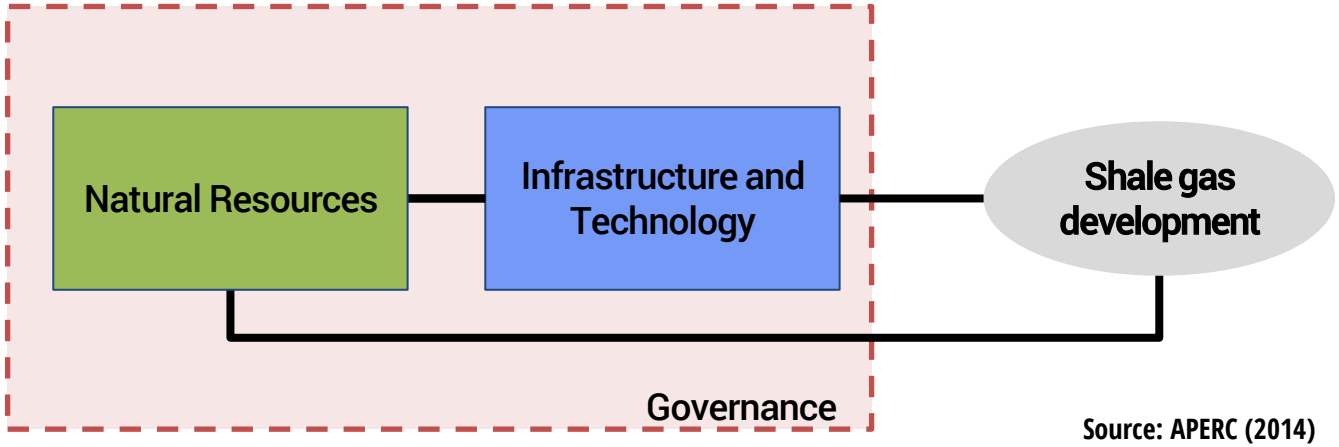
Exploration	Development	Commercial production
		Australia
	Indonesia	Canada
Chile	Mexico	China



While contextual differences prevent a one-size-fits-all approach, some aspects seem to support an environment conducive to shale gas development.

Source: Dallas Morning News

APERC's message: What should be the policy focus?



Source: APERC (2014)

- These categories suggest the type of inputs and timeframes involved in the development of shale gas.
- Natural resources cannot be readily changed; infrastructure and technology can be built-up in reasonable middle to long term time horizons.
- It is governance though, what brings about a more favorable context for changes to occur.

Key factors to shale gas development (RIG)

Category	Label	Policy implication
Access to natural Resources	N1	Access to and quality of shale resources
	N2	Access to water
Infrastructure and technology	I1	Public access to geological information
	I2	Industry expertise adaptable to shale gas development
	I3	Developed markets and gas-to-market infrastructure
	I4	Oil and gas field services and auxiliary infrastructure
Governance	G1	Political support to shale gas development
	G2	Competitive market structure with access to capital markets
	G3	Unregulated natural gas prices
	G4	Open access to gas transmission infrastructure
	G5	Regulatory capacity, transparency and adaptability
	G6	Social license

Determines the potential for shale gas development

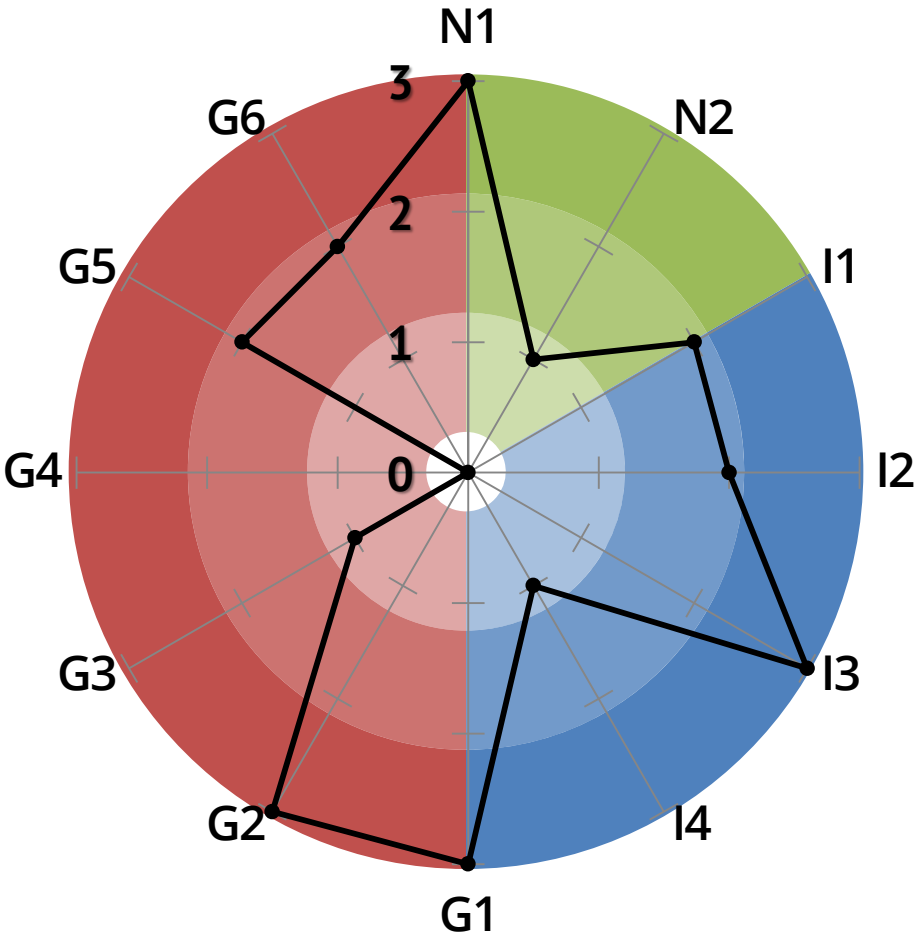
Drives the economic productivity of shale gas resources

Achieves low and predictable transaction costs to align the interests of the different stakeholders involved

Source : APERC (2014)

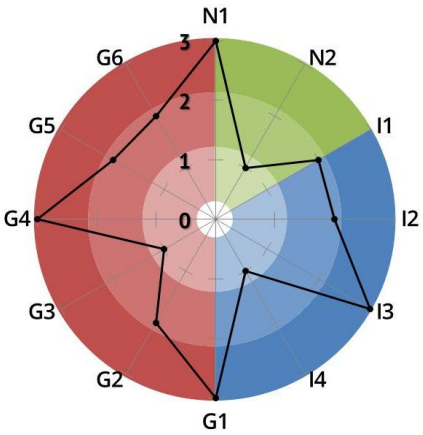
Putting up these concepts in a general framework applicable to each economy

- The suggested scale is as follows:
  - 0 – Absent
  - 1 – Partially in place
  - 2 – Partially in place and in process of design/development
  - 3 – In place

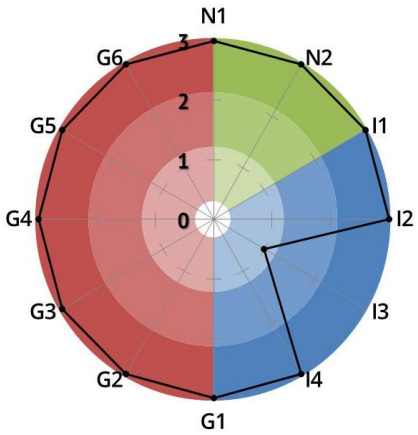


Example only. Not related to any particular economy.
Source: APERC (2014)

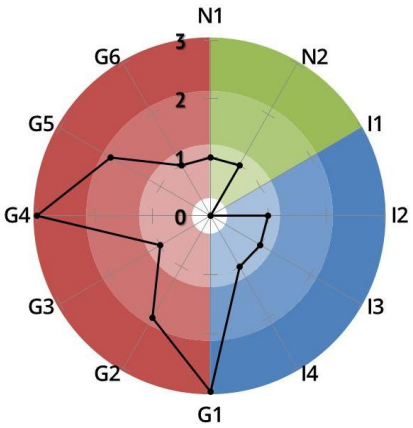
Findings by economy



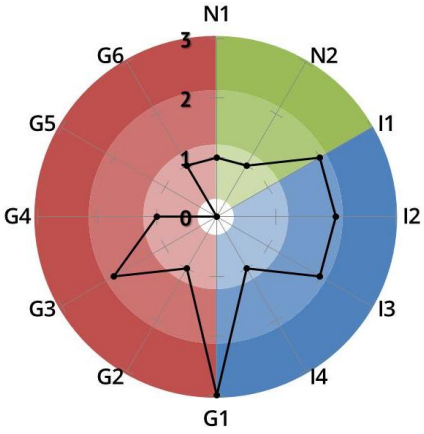
Australia



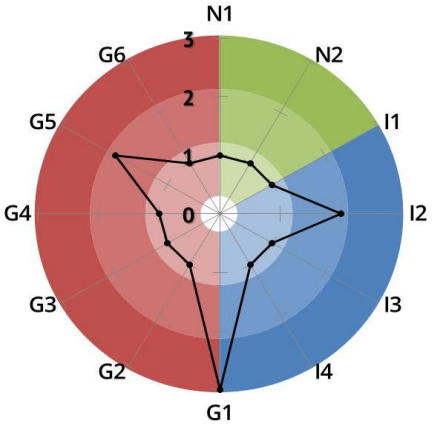
Canada



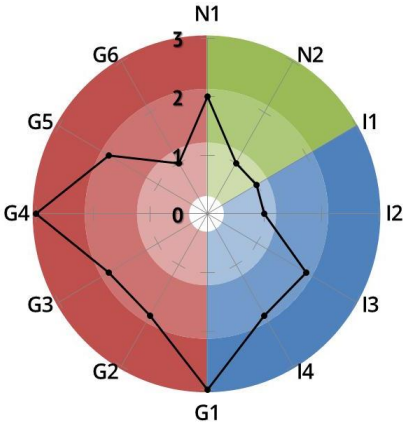
Chile



China



Indonesia



Mexico

Findings by economy

Criteria	Australia	Canada	Chile	China	Indonesia	Mexico
R	• Lack of water in prospective plays		• Technical difficulties in access to resources	• Less favorable geology than in the United States	• Size of resource base still undetermined	• Lack of water in prospective plays
I	• Geological information is still scarce	• Gas-to-market infrastructure might be limited in some plays	• Pipeline infrastructure is very difficult to develop • Industry is small	• Pipeline infrastructure, industry expertise and oilfield services are limited	• Public access to geological information is still a challenge • Gas-to-market infrastructure is limited	• Public access to geological information is still incomplete • Pipeline infrastructure is still limited
G	• Prices not fully deregulated in some states and sectors • Social license may be a challenge		• Prices not deregulated in the prospective shale play (Magallanes) • Regulatory capacity not yet developed and social challenges	• Lack of a competitive industry • Challenges to open access • Insufficient regulatory capacity • Social issues	• Dominant NOC • Challenges to open access	• Remains to be seen if Mexico will live up to the expectations of its energy reform • Social license could become a problem

Closing remarks

- Provision of incentives help support the commerciality of shale gas and competitiveness against conventional sources.
- Institutional capacity is strategic to develop win-win situations that align the interest of the different stakeholders involved and increase the economic efficiency in the development of shale gas resources.
- Regulation must be predictable. It must evolve in step with the market, for which mutual collaboration between government and industry is essential.
- Transparency and public information are fundamental to avoid corruption.
- International cooperation helps disseminate knowledge and best practices that enhance context-specific solutions.
- Stakeholder engagement throughout the value chain improves the legitimacy of projects and aligns different stakeholders towards a social license.

Thank you !

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