Financial Investment in Natural Gas Infrastructure, Natural Gas Regulation and Competition: The Australian Experience in International Perspective ©

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Contents

Abstract..................................................................................................................................................v

Acknowledgements..............................................................................................................................vi

Certificate of Authorship of Thesis ......................................................................................................ix

List of Figures........................................................................................................................................x

Glossary..................................................................................................................................................xi

Introduction, Research Question and Choice of Methodology............................................................1

Part One
Input Markets and Industry Conditions, Literature Review and Regulatory Governance

Input Markets and Industry Conditions

1. From Early China to a World Market. Geopolitics of Natural Gas.................................................7
2. Natural Gas Supply and Demand. Liquefied Natural Gas, Coal Seam Gas and Natural Gas..........................................................11
3. Natural Gas and Other Energy Sources.........................................................................................16
4. World and Regional Investment in Natural Gas Infrastructure. Impact of Natural Gas Infrastructure on Development.................................................................21

Literature Review

5. Institutions and Infrastructure Investment.....................................................................................25
6. Utilities Regulation..........................................................................................................................30
7. Regulating Natural Gas as a Natural Monopoly...........................................................................36
Regulatory Governance

8. Regulatory Independence and Capture Theory ..............................................41
9. International Entities for Natural Gas Dispute Resolution ...............................46
10. Liberalisation and Competition in the Natural Gas Sector ............................50
11. Financial and State Ownership in Natural Gas Infrastructure ..........................58

Part Two
Construction and Application of a Model to Study Financial Investment in Natural Gas Infrastructure

12. Analytical Framework .................................................................................62
13. Model ...........................................................................................................65
14. Hypothesis ....................................................................................................67
15. Acting Mechanisms and Direction ...............................................................68
16. Application of the Model .............................................................................69

Part Three
The Australian Case: Financial Investment in Natural Gas Infrastructure, Ownership and Regulation

17. Natural Gas History and Reserves. The Relationship Between Coal Seam Gas and LNG .................................................................70
19. General Economic Conditions ....................................................................94
22. Regulatory Governance. Agency Independence and Main Actors in the Regulatory Process in the State and Federal Level .................102
24. Factors Driving Investment in Natural Gas Infrastructure ............................115
25. Financial Investment in Natural Gas Infrastructure ........................................121
Part Four
Analysis

26. Reflections on the Model in Light of the Australian Experience .......................... 126

Final Word .................................................................................................................. 138

References .............................................................................................................. 140

Appendix I: List of Interviews .................................................................................. 172
Abstract

This is a study about financial investment in natural gas infrastructure in relation to other factors, such as regulatory independence, competition, clearly defined political constraints, stable energy and regulatory policies and availability of energy resources. This doctoral thesis develops a model to analyse the impact of the interaction of each of these factors on financial investment in natural gas infrastructure. The main objectives are: 1) To develop a model to study financial investment in natural gas infrastructure that could be used in other case studies; 2) To contribute in these areas on a theoretical level; 3) To present a thorough case study following this model focused on financial investment in natural gas infrastructure, natural gas competition and regulation. The thesis will answer the following research question: under what conditions has the interaction of the general economic conditions, input markets, national and international experience, institutional conditions, regulatory governance, industry conditions and regulatory and energy policies attracted financial investment in natural gas infrastructure in Australia during the 2001-2011 period?
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The day before I started this doctoral programme I met my wife and today that I submit my thesis she is here with me. Her love and support have made me a better person and her willing and force to overcome difficulties inspire me every day. For all her help, for all her love and for all the moments together that makes life be worth I thank her.

My parents have supported me and loved me since day 1. They have encouraged me to be a better person, a better son, a better brother, a better husband and a better student and now researcher throughout my life. My parent’s support has made it possible for me to study overseas during the last 10 years. Their example and love fulfil my life, they are the best people I know and I would like to dedicate this thesis to them, to my brother and to my wife.

I love my brother and he loves me, and his great suggestions inspired me to finish this thesis on time. My brother has overcome each obstacle in life with style which is an inspiration for my everyday life. I could not be prouder of him and his achievements, and more grateful towards his love.

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List of Figures

Figure 1: Long Term Crude and Gas Prices…………………………………………………15

Figure 2: 1973 and 2010 Fuel Shares of Total Primary Energy Supply (TPES)…………….18

Figure 3: U.S. Average Natural Gas Prices: 1990-2005…………………………………..…52

Figure 4: The Effect of Institutions on Public Policy and Sector Performance……………….66

Figure 5: The Effect of General Economic Conditions, Input Markets, Industry Conditions, National and International Experience, Institutional Conditions, Regulatory Governance and Regulatory and Energy Policies on Financial Investment in Natural Gas Infrastructure I……………………………………………………………………………………………….67

Figure 6: Australia’s Oil and Gas Basins and Gas Pipeline Networks…………………………….74

Figure 7: Queensland Coal Seam Gas: Production Period 1997–2010………………………78

Figure 8: Major Gas Transmission Pipelines…………………………………………………85

Figure 9: Forecast Sources of Eastern Australia’s Natural Gas Production…………………116

Figure 10: Well-to-Burner Greenhouse-Gas Emissions of Natural Gas…………………....117

Figure 11: Central Processing Facility and Onshore Facilities Plan: Ichthys Project……...124

Figure 12: The Effect of General Economic Conditions, Input Markets, Industry Conditions, National and International Experience, Institutional Conditions, Regulatory Governance and Regulatory and Energy Policies on Financial Investment in Natural Gas Infrastructure II…………………………………………………………………………………………….128
Glossary

**ANZ Infrastructure Services**
An investment manager and adviser across infrastructure, utilities and various sectors of energy. ANZ Infrastructure Services has two specialised trusts for managing investments in infrastructure: the Energy Infrastructure Trust and the Diversified Infrastructure Trust.

**APA Group**
The largest natural gas infrastructure business in Australia with operations and ownership of gas transmission and distribution assets worth more than $8 billion. APA Group’s pipelines deliver more than half of the country’s natural gas usage.

**Apache Energy Ltd**
An Australian-based subsidiary of Apache, an independent U.S. company first founded in 1954. Apache Energy Ltd is a major investor in onshore and offshore infrastructure in Australia.

**Arbitration Institute of the Stockholm Chamber of Commerce (SCC Institute)**
The SCC Institute is an independent part of the Stockholm Chamber of Commerce (SCC). Mediation rules, arbitration rules, rules for expedited arbitrations and services under the UNCITRAL Arbitration Rules and SCC procedures and services comprise the rules adopted by the SCC Institute.

**Australia Pacific LNG Project (APLNG)**
A joint venture of ConocoPhillips, Origin Energy Australia (Origin) and China Petrochemical Corporation (Sinopec Group) to construct a four-train LNG plant on Curtis Island and to construct a 520 km transmission pipeline from Curtis Island that is expected to produce 9 million tonnes per annum of LNG.

**Australian Energy Market Commission (AEMC)**
An independent commission that amends and makes the rules for elements of natural gas markets and for the National Electricity Market. The AEMC is the developer and rule-maker for Australia’s energy markets and an adviser to the Ministerial Council on Energy.
**Australian Energy Regulator (AER)**
Is responsible for the economic regulation of the distribution and transmission networks in the national electricity market and for the regulation of the wholesale electricity market. The AER is also responsible for implementing National Gas Rules and National Gas Law in all jurisdictions except Western Australia (WA) and for the economic regulation of distribution and transmission pipelines.

**Australian Gas and Light Company (AGL)**
The largest electricity and natural gas retailer and the biggest private operator and owner of renewable generation assets in Australia. AGL was founded in 1837 and in 1841 supplied gas in Sydney for the first public lighting of a street lamp.

**Australian Petroleum Production and Exploration Association (APPEA)**
An association that represents more than 80 companies that account for 98% of Australia’s petroleum production. APPEA is the main national body representing the country’s gas production and exploration and upstream oil industry.

**Australian Pipeline Industry Association (APIA)**
The main national body representing Australia’s transmission pipeline sector. The majority of APIA’s membership is composed of high-pressure transmission of oil and gas industry representatives.

**Chevron**
A major global American energy company with special interest in Australia, where it participates in the Gorgon Project, the North West Shelf Venture, the Browse LNG Development and the Wheatstone Project.

**China Petrochemical Corporation (Sinopec Group)**
A very large petrochemical and petroleum enterprise group that is state-owned and whose sole investor is the state. Sinopec Group is headquartered in Beijing and ranks as the second biggest oil firm in the world by refining capacity and second by service stations. China Petrochemical Corporation is one of the APLNG Project partners.
Coal Seam Gas (CSG)
The naturally occurring gas trapped in underground coal seams by water and ground pressure. Methane constitutes the most common gas found in coal seams which is the reason why Coal Bed Methane (CBM) is used interchangeably with CSG.

Concessions
A private entity takes over the management of a state-owned enterprise for a given period throughout which it also assumes substantial investment risk.

Cubic Foot
A non-metric unit of volume, defined as the volume of a cube with sides of one foot (30.48 cm) in length. MCF (or mcf) is used for 1,000 cubic feet, BCF (or Bcf) is used for a billion cubic feet and TCF (or Tcf) is used for a trillion cubic feet.

Dry Natural Gas
Natural gas is considered “dry” when no other hydrocarbons are present and is almost pure methane.

E.ON AG
A German-based group manager that coordinates the operations of five global units and twelve units in Europe. E.ON AG is a minority shareholder in the Nord Stream pipeline with a special focus on Russia.

GLNG Project
A major ongoing gas project in Queensland in the conversion of CSG to LNG. The partners of GLNG are Santos, Kogas, Petronas and Total. GLNG represents an investment of $16 billion to develop a LNG plant on Hamilton Island. GLNG Project includes the construction of a 450 km long gas pipeline and plans to have the first cargo for 2014.
**Gorgon Project**
A joint venture of the Australian subsidiaries of Chevron (operator), Shell, ExxonMobil, Osaka Gas, Tokyo Gas and Chubu Electric Power. The Gorgon Project is the biggest single resource gas project in the history of Australia and will comprise of the construction of a LNG plant in Barrow Island with the capacity to provide 15 million tonnes per annum of LNG and a domestic gas plant. Gorgon LNG will be supplied to the international markets and domestic gas will be supplied inland by pipelines.

**Greenfield Projects**
A private entity or a public-private joint venture that builds and operates a new facility for the time specified in the project contract. The facility may return to the public sector at the end of the contract.

**Hydraulic Fracturing (Fracking)**
A technology involved in CSG production used worldwide in the gas and oil industry for over 70 years that consists of pumping large volumes of water (usually 98-99.5%) mixed with chemicals and sand (or similar products).

**Ichthys Project**
A joint venture by INPEX (operator) and Total to produce gas from the Ichthys Field. Gas coming from the Browse Basin will first go into an offshore facility plant, from which it will be transported from an 855 km long gas pipeline to a LNG processing facility (to be built) in Darwin. Initially, the Ichthys Project will have a capacity to produce 1.6 million tonnes per annum of liquefied petroleum gas (LPG) and 8.4 million tonnes per annum of LNG.

**INPEX Corporation**
A corporation headquartered in Tokyo that has over 70 projects in 26 countries whose main business is research, exploration, development, production and sales of gas, mineral resources and oil and other related lending to the ventures involved in these activities.
International Centre for the Settlement of Investment Disputes (ICSID)
An independent institution established under the Convention on the Settlement of Investment Disputes between States and Nationals of Other States with over 140 member states that provides facilities for settlement of disputes between foreign investors and host countries.

International Energy Agency (IEA)
An independent organisation focused on the analysis, research and statistics of areas such as energy security, environmental awareness, economic development and engagement worldwide. IEA is headquartered in Paris and was founded in response to the 1973-1974 oil crisis.

Kogas
The world’s largest LNG importer and Korea’s sole LNG supplier. Kogas was incorporated by the Korean government in 1983 and is a partner of GLNG Project.

Liquefied Natural Gas (LNG)
Natural gas (mostly methane) that has been transformed to liquid form after been cooled. The volume of the gas is reduced more than 601 times when liquefied. Some of the LNG properties are: non-toxic, non-corrosive, odourless and colourless.

Liquefied Petroleum Gas (LPG or LP Gas)
A mixture of hydrocarbons that is synthesised by refining “wet” natural gas or petroleum that is used as fuel in vehicles and heating appliances. Varieties of LP Gas include mixes that are primarily butane, primarily propane and mixes including the former and the latter.

Organisation for Economic Cooperation and Development (OECD)
An international organisation focused on promoting policies that will improve worldwide social and economic welfare. OECD provides governments a forum to measure productivity, compare data and set international standards, amongst others, on a wide range of issues.
Origin Energy Australia (Origin)
An Australian company headquartered in Sydney responsible for the production of 13.5% of the country’s electricity. Origin has operations in Australia and New Zealand (NZ) in business areas such as natural gas and oil exploration and production, electricity generation, Contact Energy (NZ), renewable energy and energy retailing.

Petronas
The second world liquefied natural gas (LNG) producer and Malaysia’s national gas company. Petronas controls and owns all the oil and gas resources in Malaysia and is a partner of GLNG Project.

Pluto LNG Project
A joint venture of Woodside (operator), Tokyo Gas and Kansai Electric. The Pluto LNG Project has a capacity of 4.3 million tonnes per annum of LNG and will process gas from fields situated in the Carnarvon basin. The first LNG cargo from Pluto LNG Project is expected for March 2012.

Queensland Curtis LNG Project (QCLNG)
A project fully owned by Queensland Gas Company Pty Ltd (QGC) that will develop a LNG plant on Curtis Island and will construct a 540 km long gas pipeline. The final investment decision from QCLNG accounts for over $14 billion.

Santos
The largest domestic gas producer and a major Australian gas and oil producer and explorer with interests in Australia and worldwide. Santos is a partner in the GLNG Project, the PNG LNG project, the Bonaparte LNG and Darwin LNG, amongst others.

Sovereign Wealth Fund (SWF)
A state-owned entity most usually structured as a fund, pool or corporation. A SWF is mainly composed of financial assets, i.e. bonds, instruments and stocks.
Stockholm Chamber of Commerce (SCC)
A privately-owned business organisation based on voluntary membership that is independent from the Swedish government. The SCC provides trusted third party services for companies when entering into business agreements.

The Political Constraint Index Dataset (POLCON)
A dataset produced by Witold J. Henisz that measures political constraint in 226 countries in the timespan 1800-2007. POLCON measures the ability to provide credible policy commitments and is updated periodically.

The World Bank Group
A group composed of five agencies: The International Bank for Reconstruction and Development (IBRD), International Development Association (IDA), International Finance Corporation (IFC), Multilateral Investment Guarantee Agency (MIGA) and the International Centre for the Settlement of Investment Disputes (ICSID).

Tokyo Gas
The largest natural gas utility operator in Japan, established in 1885. Tokyo Gas owns 58,574 km of pipelines and is a partner in the Pluto LNG Project.

Total
A French company that is a major international player in the oil and gas industry in which the government still holds some minority actions. Total is a partner in the Ichthys and GLNG projects.

United Nations Commission in International Trade Law (UNCITRAL)
The core legal body within the United Nations System which aims to provide harmonised rules on commercial transactions through seminars, technical assistance in law reform projects, legislative and legal guidelines and conventions, rules and models. It was established by the General Assembly in 1966 and is composed of sixty members that meet annually at the Vienna International Centre or at the UN Headquarters in New York.
U.S. Energy Information Agency (EIA)
The analytical and statistical agency within the U.S. Department of Energy responsible for analysing, spreading and collecting energy information. EIA receives funding from Congress and its analyses, forecasts and data are independent from the U.S. government.

Wet Natural Gas
Natural gas is considered “wet” when other hydrocarbons are present and is not almost pure methane.

Woodside
A major global LNG producer and operator of the Pluto, North West Shelf and Sunrise projects. Woodside is also the operator and major equity holder of the Browse LNG development.