The 5th APEC Oil & Gas Security Network Forum
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APERC Oil and Gas Security Exercise in Chile

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APERC
Asia Pacific Energy Research Centre

APEC
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Economy Background

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Economic overview

The Economy Profile	2018
Area (Km²)	**756 094**
Population (million)	**17.5**
GDP per Capita (PPP, Constant 2011 international dollars)	**12 071**
Energy Reserves:	
- Oil (million barrels)	**11.8**
- Gas (million cubic metres)	**8.1**
- Coal (million tonnes)	**171**

"Chile has been one of Latin America's fastest-growing economies in recent decades, enabling the economy to significantly reduce poverty. Between 2000 and 2015, the population living in poverty (on USD 4 per day) decreased from 26% to 7.9%."

Source: APEC Energy Overview (2017), APERC 7th Outlook (forthcoming May 2019) and World Bank 2018, http://www.worldbank.org/en/country/cihle/overview)

Oil market structure

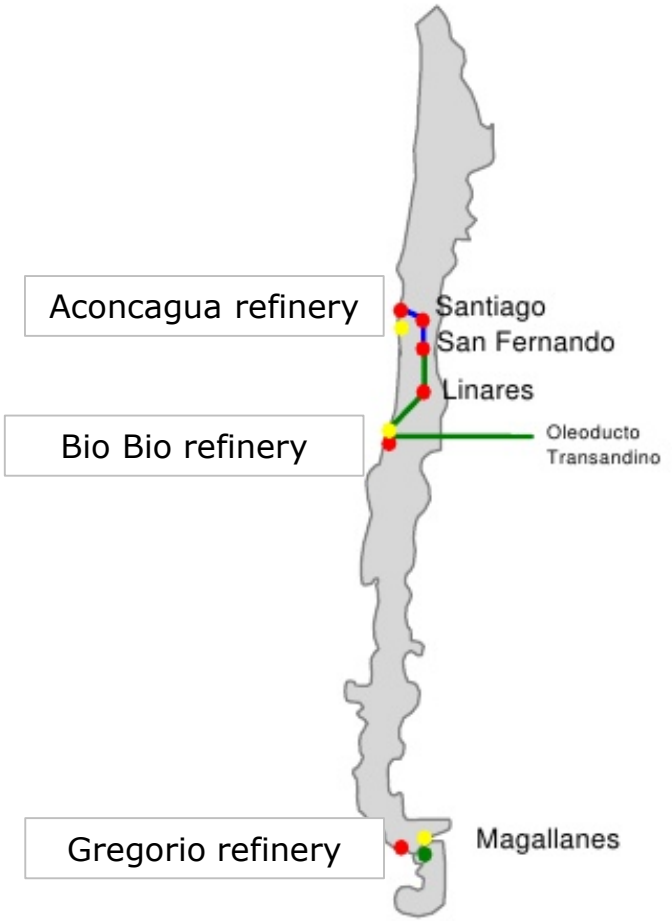
From a regulatory standpoint, Chile's **refining sector is open and competitive** as there are no legal impediment to private participation. However, in practice, ENAP* holds a monopoly in the sector, as it owns all three of the country's refineries and therefore 100% of refining capacity.

Chile has three refineries:

- Aconcagua: capacity of 104 thousand barrels per day (kb/d) or 16,500 cubic metres per day (m3/d);
- Bio bio: capacity of 116 kb/d or 18,500 m3/d;
- Gregorio: capacity of 18 kb/d or 2,800 m3/d (located in Magallanes in the southern tip of the country).

Aconcagua and Bio Bio **account for around 90% of Chile's total refining capacity** and serve the country's main consumption centres.

They produce primarily liquid fuels and liquefied gas for domestic consumption, along with some other industrial products.



*ENAP stands for Empresa Nacional de Petroleo (National Oil Company, in English)

Source: IEA, CNE and ENAP

Oil market structure

Chile's pipeline system is used to transport crude oil, liquid fuel and LPG between storage plants.

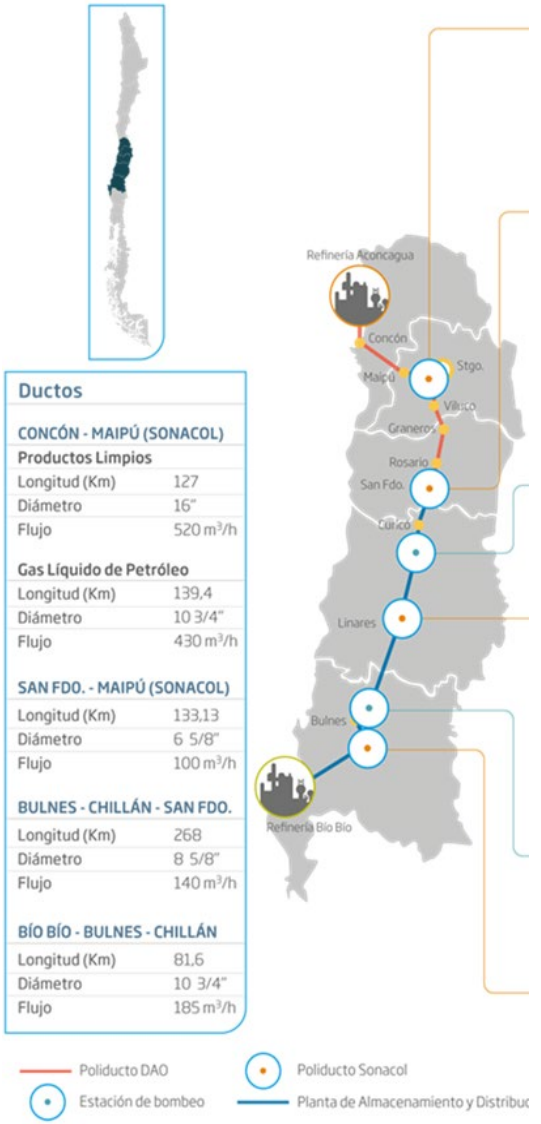
Two companies dominate Chile's pipeline logistics:

- Sonacol: operates a 465 km product pipeline network, primarily serving the central regions.
- ENAP: operates a pipeline network in the central and southern regions, and it is also the network's sole user.

Storage

Chile holds around 3.3 mcm (20.8 mb) of storage capacity for total crude oil and oil products. Crude-oil storage, which accounts for around 35% of total storage, is concentrated around ENAP's refineries.

Oil-importing companies have a stockholding obligation equivalent to 25 days of their domestic average sales in the previous six months.



Source: IEA, CNE and ENAP

Gas market structure

Upstream

According to the Constitution, hydrocarbons belong to the Chilean state. By law, gas exploration and extraction can only be carried out by ENAP or by the private sector through prior administrative concessions.

ENAP is the main stakeholder of the upstream industry in Chile, and is responsible for the exploration and exploitation of hydrocarbons.

Mid- and downstream

ENAP and private companies may import, store, transport, distribute and market gas. These activities are subject to specific technical standards on safety and quality.

Downstream natural gas companies can sell natural gas to large customers without a distribution concession and, as there is no wholesale market for natural gas in Chile that offers a benchmark, prices are agreed to bilaterally. Three companies sell natural gas directly to large customers without a distribution concession.

At the retail level, the transmission and distribution of natural gas in the economy requires a concession, and transmission networks must be operated under an open-access principle. In Chile, six companies provide the natural gas distribution in different geographic areas.

Source: IEA, CNE and ENAP

Gas market structure

Pipelines

Chile's gas system is regionally disconnected. The central and northern regions are supplied through Liquefied Natural Gas (LNG) imports via two LNG terminals. The southern region (Magallanes) relies on local production.

Gas transportation networks are owned by several entities, such as transportation companies, natural gas producers and/or distributors.

Terminals

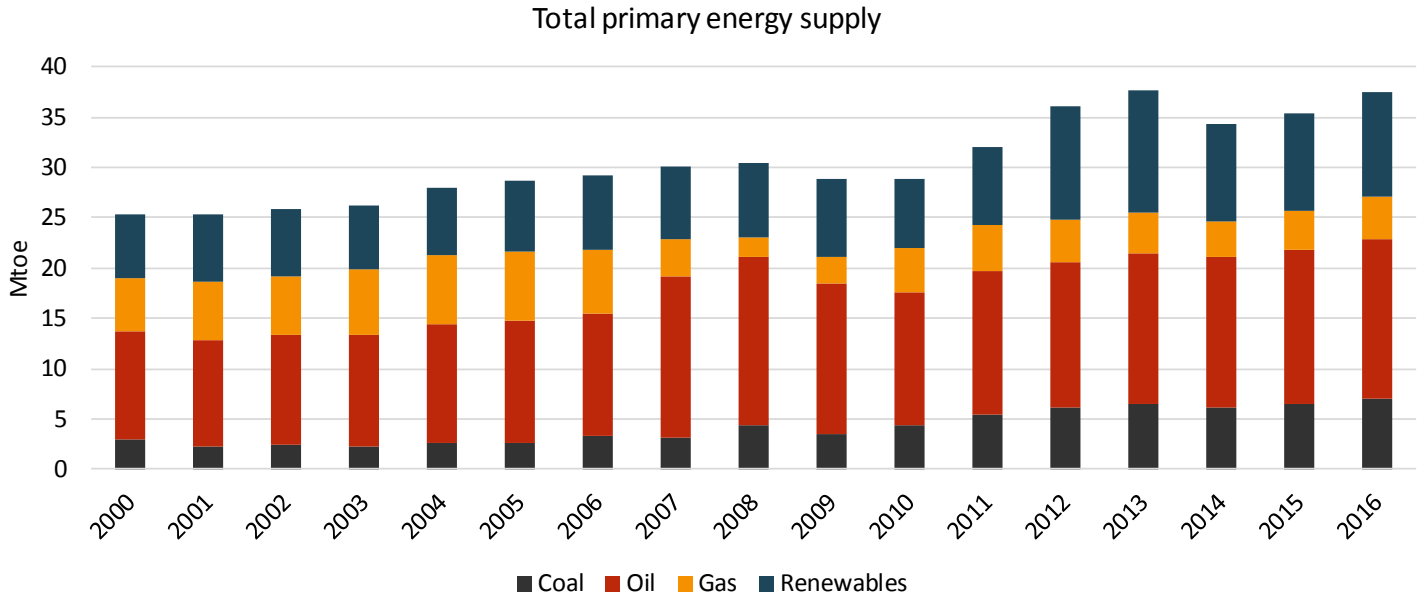
A group of public and private Chilean companies worked together to build two LNG terminals. LNG Quintero was built in the Valparaiso Region and LNG Mejillones in the Antofagasta Region.

LNG Mejillones

LNG Quintero

Source: IEA, CNE and ENAP

Energy trends

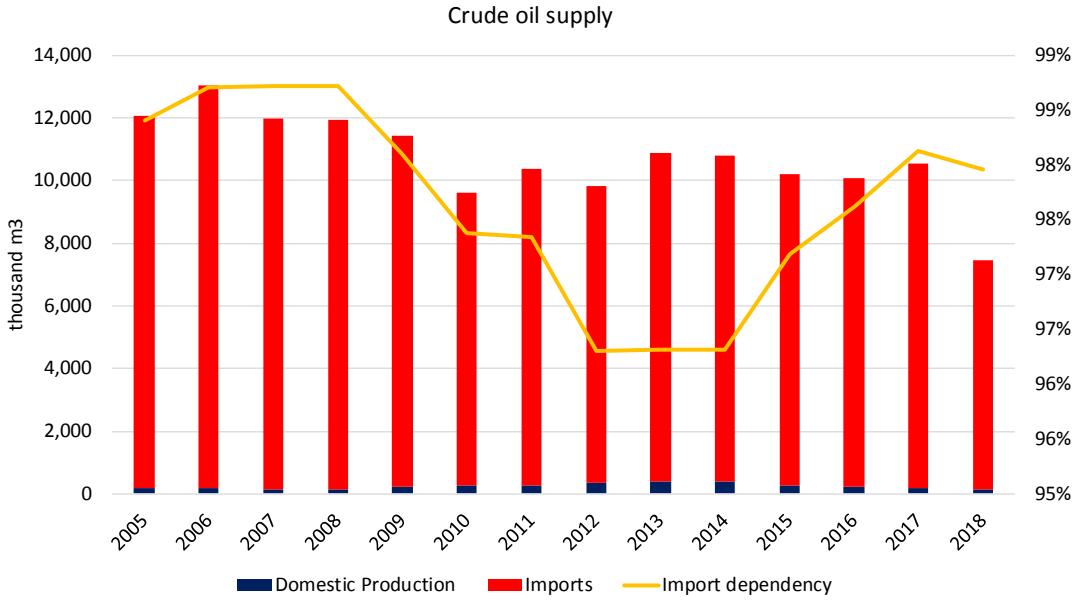


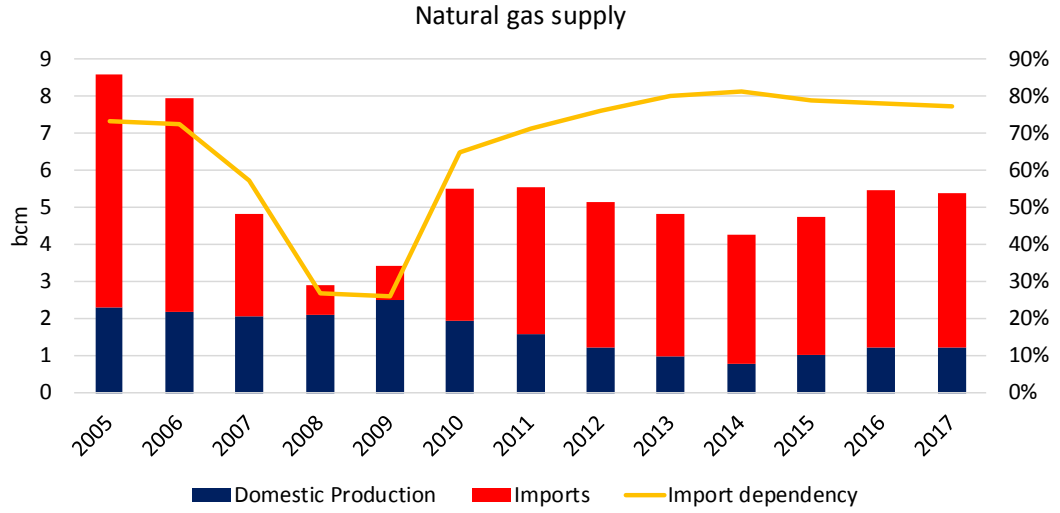
Total primary energy supply (**TPES**) **increased 32%** from 2000 to 2016. Oil has traditionally been the major energy source in Chile's energy sector (42% share). The share of gas in TPES decreased from 21% in 2000 to 12% in 2016.

In 2008, Argentina stopped its piped gas exports to Chile, decreasing its share of Chile's energy mix. Overall oil demand rose in 2007-08 in response to an abrupt decrease in natural gas piped imports from Argentina, which eventually ceased.

Increased demand for fuel oil and diesel came as a result of power generators and industrial users switching away from natural gas (-21% from 2000-16).

Crude oil and natural gas supply in Chile





Although the share of imported oil in total oil supply has remained at a similar level over the past decades, natural gas has experienced large fluctuations.

Between 2006 and 2008, gas imports fell by 86% as a result of a curtailment of gas supply from Argentina.

Moreover, natural gas production has been insufficient, therefore Chile started to diversify its imports.

Chile is a net crude oil importer, with a dependency on imports more than 95% over the past 10 years.

Domestic crude oil production is able to meet roughly 5% of local refinery intake.

Terminals and delivery of natural gas from each system

Two onshore LNG regasification terminals were developed in a public–private partnership and since 2010 Chile has been a net importer of LNG for its gas supply.

Terminal	Regasification Capacity [mcm/d]	Elevation [m.s.n.m]	Date of Operation
Mejillones LNG	5.5	45	July 2009
Quintero LNG	15	50	June 2010

LNG Mejillones - Pipeline Norandino, GasAtacama and Taltal

Year	Res - Com	Industrial	Power
2016	0%	17%	83%
2017	0%	15%	85%
2018	0%	12%	87%

LNG Mejillones

Supplies the north of Chile. The power sector is the leading sector in using natural gas from LNG Mejillones.

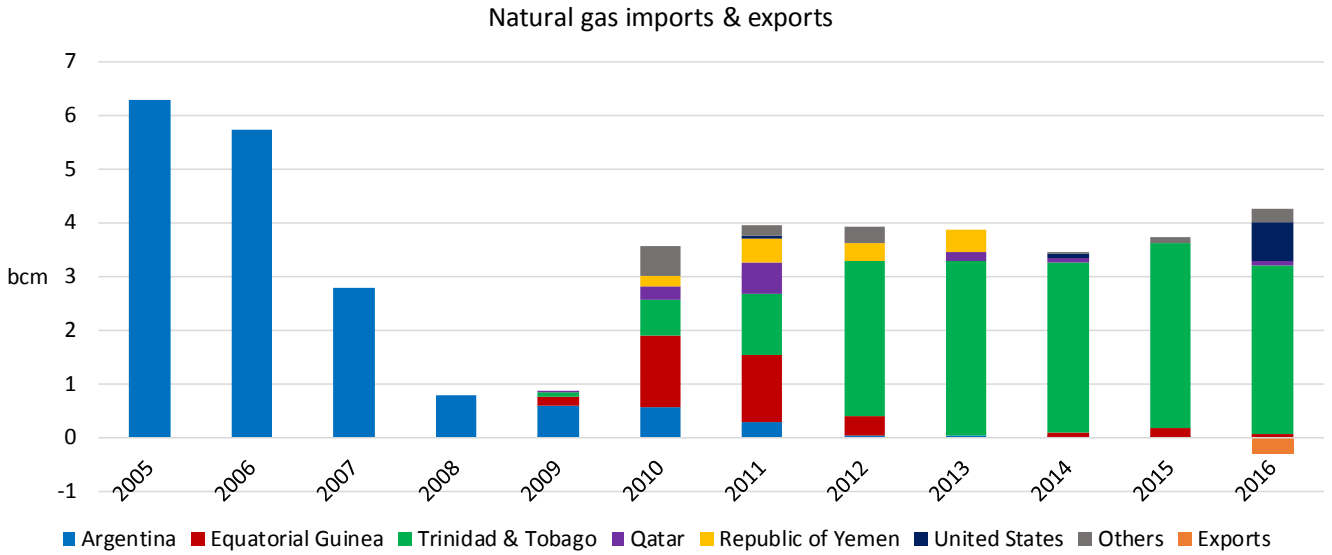
LNG Quintero - Pipeline Electrogas and GasAndes

Year	Res - Com	Industrial	ENAP	Power
2016	12%	21%	8%	59%
2017	13%	21%	8%	58%
2018	14%	24%	10%	52%

LNG Quintero

Is the main terminal for the central part of Chile. The power sector, is the leading sector using natural gas, followed by industrial.

Natural gas imports and exports in Chile



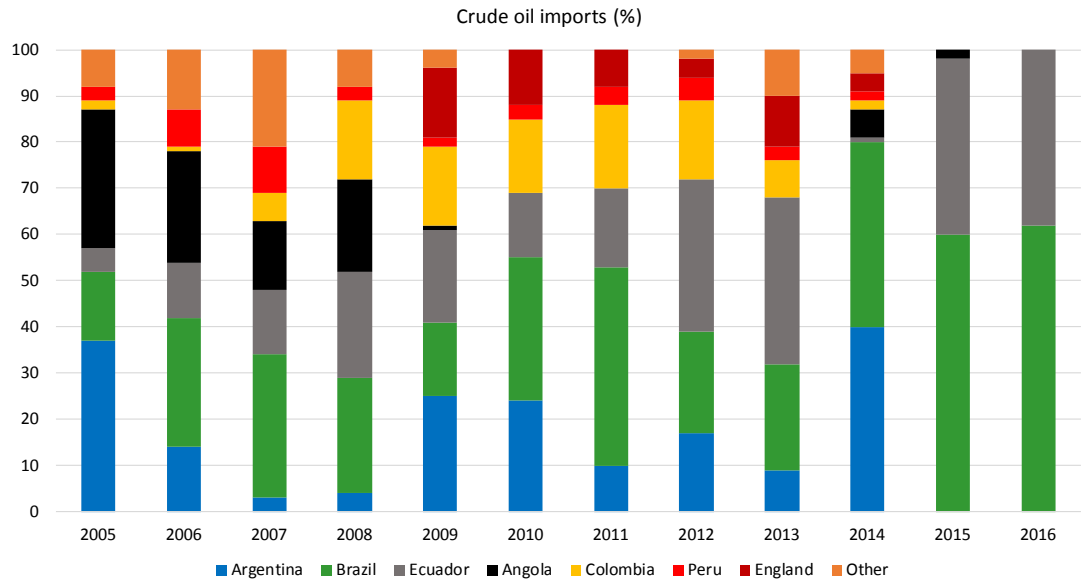
Beginning in 1997 Chile imported its natural gas exclusively from Argentina. In 2005, Chile imported almost 15% of Argentina's natural gas production.

From 2005 through 2008 imports decreased 88%. However, imports increased 447% from 2008 to 2016.

Expansion of the Panama Canal reduced the transit time from the Atlantic Ocean and import sources have subsequently become more diversified. In 2016, Chile imported LNG from Trinidad and Tobago (73%), the United States (17%), Qatar (2%) and Equatorial Guinea (2%).

During 2016, Chile re-exported natural gas to Argentina, totalling 0.28 bcm. This exportation was accomplished by re-directing the Norandino and GasAndes pipelines.

Crude oil and oil products imports in Chile

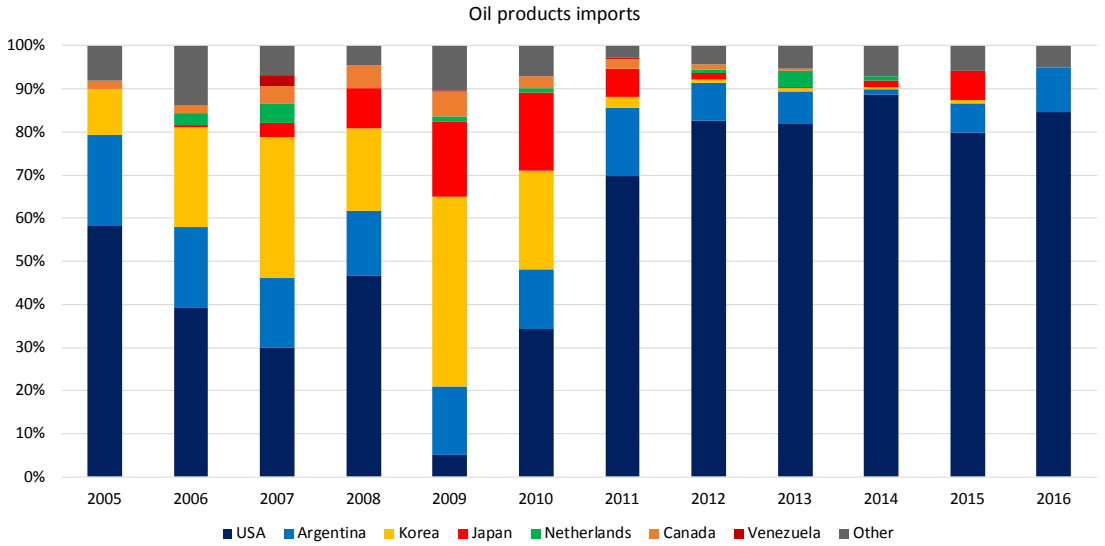


Chile's crude oil imports used to be heavily dominated by Argentina; now, by Brazil and Ecuador.

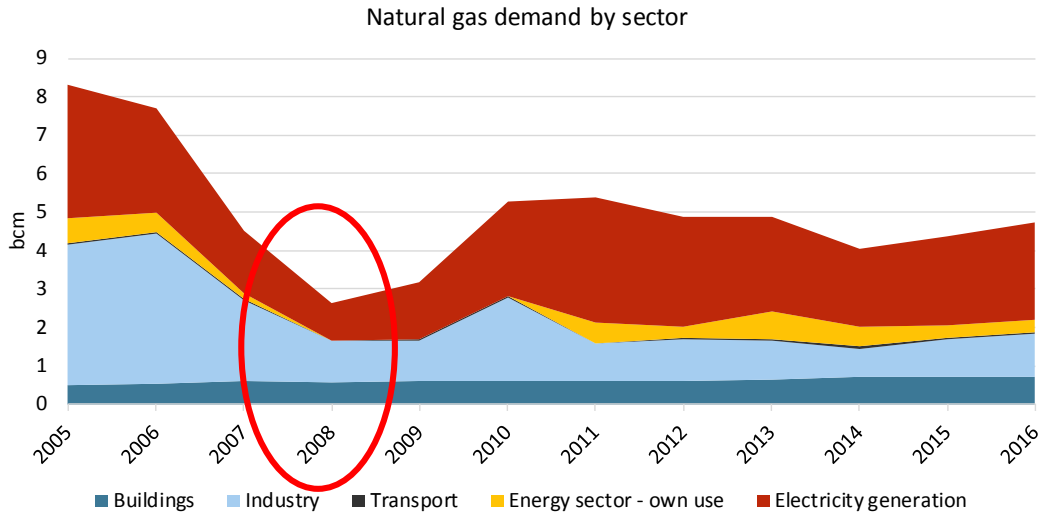
This is seemingly driven by lower transportation costs and tariff agreements.

All oil products imports to Chile are received in marine terminals along the coast, as there is no oil products pipeline interconnection with neighbouring economies.

The US is, by far, the main source of oil product imports for Chile, particularly for diesel, with over 95% of imports in the past five years.



Natural gas and oil products demand by sector in Chile



During 2006-2008 Chile experienced an extreme drought, and almost a complete interruption of natural gas supply from Argentina (imports continued for the residential and commercial sectors).

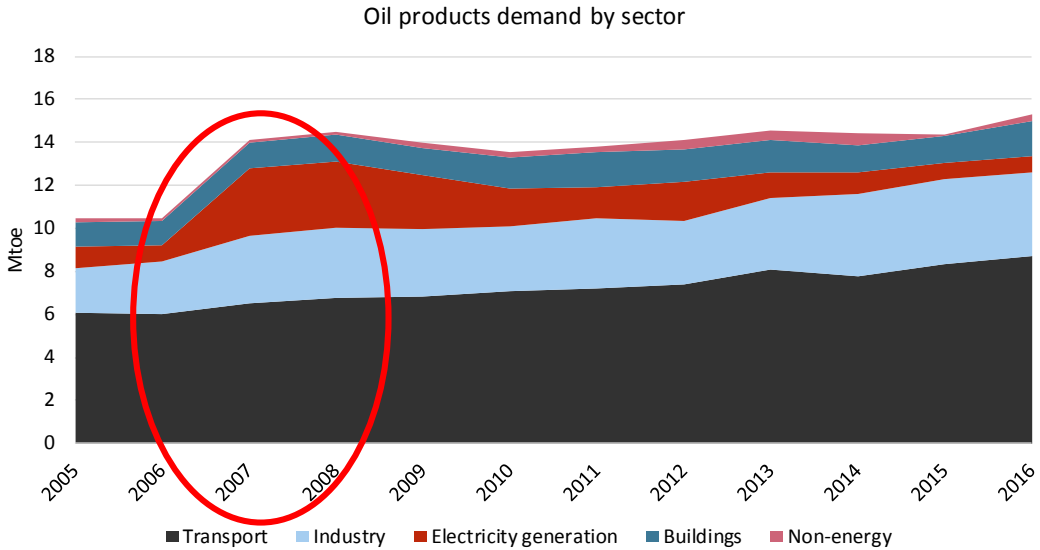
The electric system switched to coal from hydro and natural gas.

Natural gas consumption by all sectors decreased 43% from 2005 to 2017. Industry demand decreased 69% from 2005-16.

Transport is the largest oil product consuming sector in Chile, with 54% of the total in 2016, followed by industry sector (25%).

The electricity generation sector increased the use of oil products by 308% from 2006 to 2007.

Oil product use in the electricity generation sector started decreasing after 2008. Oil consumption decreased 76% from 2008-16.



6th OGSE in Chile

APEC Oil and Gas Security Exercise (OGSE)

Main objectives of "the APEC Oil and Gas Security Exercises":

- To investigate the domestic systems for the emergency preparedness in each APEC economy.
- To develop possible scenarios of an oil and gas emergency situation.
- To accumulate the necessary information and analysis by mobilising capable experts in the APEC region.

Purpose of the Exercise

To conduct the OGSE activity and present oil and gas supply emergency scenarios developed by APERC to the economy participants.

To review responses from economy participants and get feedback and recommendations from invited experts to the exercise.

6th OGSE in Santiago, Chile

- March 13-15, 2019 in Santiago, Chile.
- The OGSE in Chile was a 'blind' type exercise.
- Participants were briefed about hypothetical supply disruptions without prior notice.
- The goal was to simulate a possible emergency response with limited time and information.

	Venue	Main theme
Tuesday 13 March	ICON Hotel	• Welcomes remarks • Oil and gas security in Chile by the Ministry of Energy • Oil supply emergency scenario
Wednesday 14 March	ICON Hotel	• Gas supply emergency scenario • Experts' comments and suggestions
Friday 15 March	LNG Quintero Regasification Terminal	• Briefing on LNG Quintero terminal • Site visit

Expert team

1. ***Mr. Gabriel Bauza***
   Managing Partner, Gas Energy Latin America

2. ***Mr. Carlos Sucre***
   Consultant, Extractive Sector Initiative, Inter-American Development Bank (IADB)

3. ***Dr. Phoumin Han***
   Energy Economist, Economic Research Institute for ASEAN and East Asia (ERIA)

4. ***Mr. Patrick Willging***
   Logistics Management Specialist, United States Department of Energy (DOE)

5. ***Mrs. Sylvia Marcela Reinoso***
   Capacity Building Specialist, Latin American Energy Organization (OLADE)

6. ***Mr. Hiroaki Maruyama***
   Project Director, Japan Oil, Gas and Metals National Corporation (JOGMEC)

7. ***Mr. Jason Elliot***
   Senior Energy Analyst at the Energy Policy and Security Division, International Energy Agency (IEA)

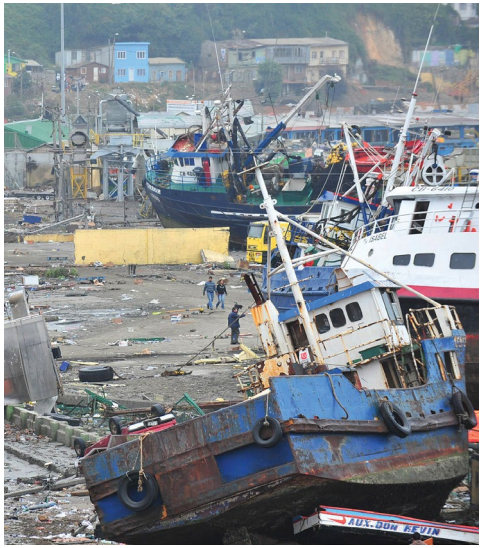
6th OGSE in Santiago, Chile

Emergency Scenarios

The APEC region, vulnerable to natural disasters

More than half of APEC members, are located in the Pacific Ring of Fire – a string of volcanoes and sites of seismic activity (earthquakes) around the edges of the Pacific Ocean.

Roughly 90% of all earthquakes occur along the Ring of Fire, and the ring is dotted with 75% of all active volcanoes on Earth.



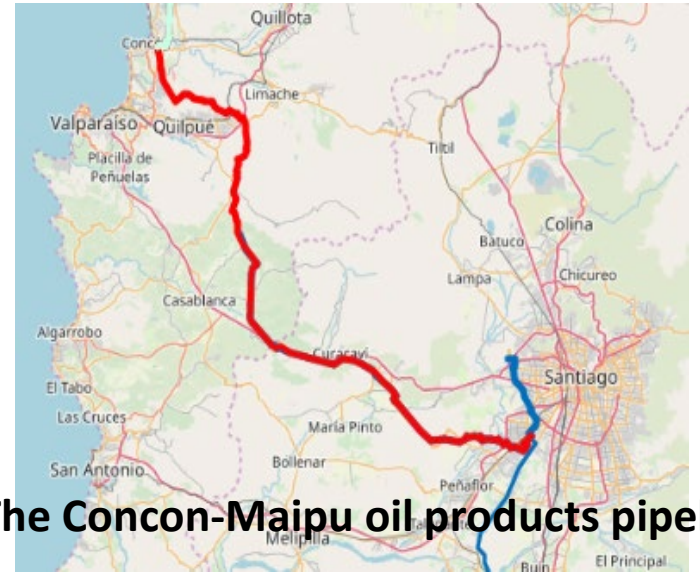
Oil supply emergency scenario

An explosion at one of Sonacol's oil product pipelines in the Valparaiso region created a fireball of flame and damaged homes, prompting the evacuation of nearby residents.

The explosion occurred on the Concon – Maipu liquid products pipeline. The Concon-Maipu liquid products pipeline **transports 99% of liquid fuels consumed in Santiago Metropolitan region**.

With a total and abrupt shutdown of the the Concon-Maipu pipeline system, the vast majority of gasoline, diesel, jet fuel and LPG supply to Santiago is interrupted.

Repairing of the pipeline and the normalisation of the flows will take an unknown period of time.



The Concon-Maipu oil products pipeline

They were informed later that the pipeline damages would be repaired in two weeks.

Oil emergency responses from Chile

Oil Companies doesn't have the resources to address these types of events. They asked the government priorities and considered the security of the gas/fuels stations.

The operational committee established priorities considering the following:

- Supply (strategic and critical areas)
  - Firefighters, health, and police;
  - Activate international cooperation (neighbouring countries).

- Demand
  - Given that Chile does not have enough reserves, the government found that there is a structural problem it needs to solve.
  - Nowadays companies only have commercial reserves not emergency reserves.

Gas supply emergency scenario

The coast of Valparaiso Region has been hit by an earthquake of **8.1 magnitude**, causing severe losses and damage. A possible tsunami alert is issued.

Communication systems start to fail, only text messages, radios and satellite phones work.

It is confirmed that the earthquake knocks out LNG Quintero, leaving the terminal completely out of operation. Pipeline damage is unknown.

LNG Quintero supplied 68% of total natural gas regasified volumes in Chile.

Unfortunately, five robotic arms used to unload the LNG suffered severe damage and could take up to two months to repair.

They were informed later that underground pipelines have not suffered any damage, and can continue operations and the tsunami alert is cancelled.

Gas emergency responses from Chile

The impact on Chile was very severe, because:

a. The magnitude of the earthquake;
b. The damage to LNG Quintero Terminal and
c. The failure of communications.

In general, the arrangements by the government were the coordination with other sectors and stakeholders, centralising information, and making arrangements with Argentina to import gas.

The government didn't see any policy barrier to address the emergency situation. They proposed:

- A demand restraint plan will be made to prioritise the residential sector.
- The propane/air plant will operate to compensate for the decline in gas supply.
- A possible solution discussed was to bring LNG from LNG Mejillones Terminal.
- Switching to substitute oils will be made for electric generation.

Expert review team preliminary findings

- Was impressive how the team came up with solutions in such a short time.

- Will be very important to present the experience and protocols in the region or abroad, because not all the economies in the region have the knowledge and experience that Chile has.

- It is important to have an obligation for stockpiles.

- Utilities should be aware of demand management policies.

- Priority users and priority suppliers should be determine in advance and it is a priority to know the location of each of them.

- Communication and avoiding panic will be important in this type of situation. For example, you could have a maximum purchase amount at fuel stations. To communicate this, it will be very important to have good communication channels.

- The emergency relationship with neighbouring economies should be specified in prior agreements. Communications are fundamental among parties and internationally.

Photos

Photos

Natural gas at -165 Celsius.

Thank you for your kind attention!

https://aperc.ieej.or.jp/

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