



Generadoras de Chile



Climate change, energy and electricity

An electric and renewable future for a carbon neutral Chilean economy

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ChileMass Innovation Summit 2019

Boston, 9th April 2019



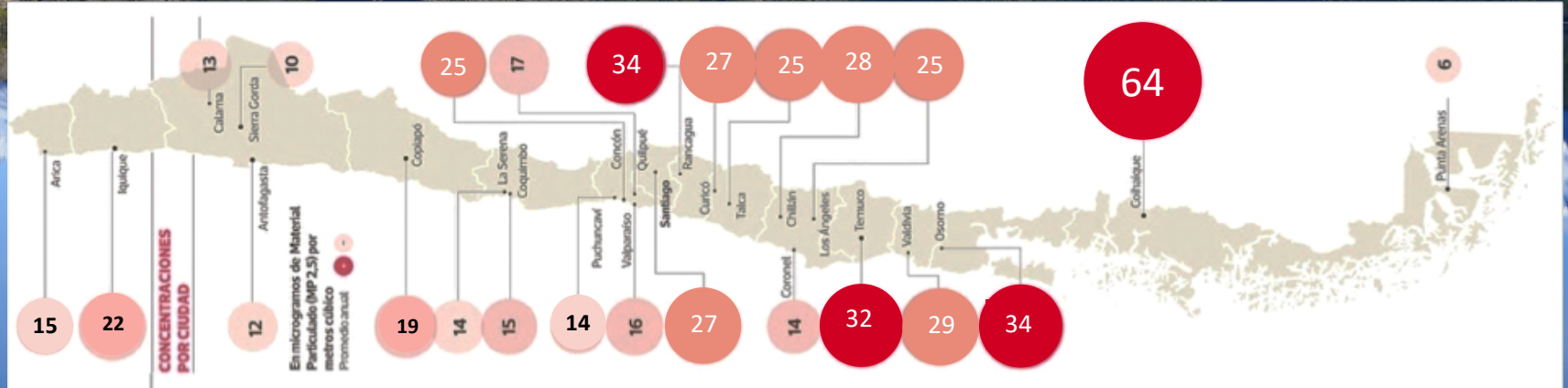
Air pollution is Chile's biggest environmental hazard



causing **+4.000** premature deaths per year

Coyhaique in pristine Patagonia has Chile's (and Latam's) worst air quality

Annual average concentration of fine particulate matter (MP 2.5) in micrograms per cubic meter




24% of primary energy in Chile is still wood / biomass

86% of fine particulate matter comes from the burning of wood



We still have a large gap in energy inequality

A photograph showing a large, black, rounded metal kettle with a curved handle and a spout, sitting on a metal grill. To its right is a smaller, more slender metal pitcher with a handle and a lid. The grill is positioned over a fire, with bright orange and yellow flames visible through the metal bars. The background is a blurred, rustic setting with wooden walls and some hanging items.

Poor people spend
of their income for heating and cooking **2,5x**

We still have a large gap in energy inequality



In winter
poor people live **-4.5°C** (-8°F) below the
comfort temperature

The Economist

OCTOBER 28th-31st 2003 www.economist.com

Don't blame China
PAGE 65

The Democrats' economic ideas
PAGE 25

Iran's last chance
PAGE 37

A SURVEY OF CORPORATE LEADERSHIP
A138 PAGE 50

The end of the Oil Age

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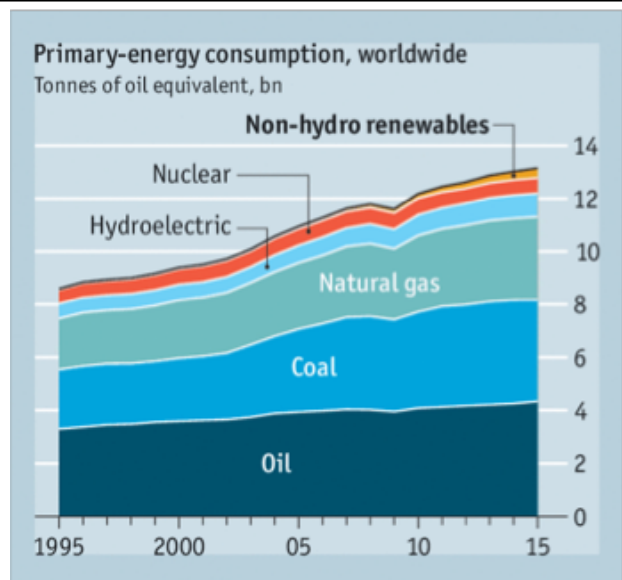
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The image shows the front cover of The Economist magazine. At the top, a red banner contains the magazine's title, 'The Economist', in white serif font. To the right of the banner, a list of featured articles is presented in a clean, sans-serif font, separated by horizontal lines. The main headline, 'Crude awakening', is prominently displayed in a large, bold, black sans-serif font. Below it, the subtitle 'The truth about Big Oil and climate change' is written in a smaller, red sans-serif font. The central visual element is a high-contrast photograph of a blue hand splashing upwards from a dark, reflective surface, set against a light, hazy background. The overall design is minimalist and professional, typical of the publication's branding.

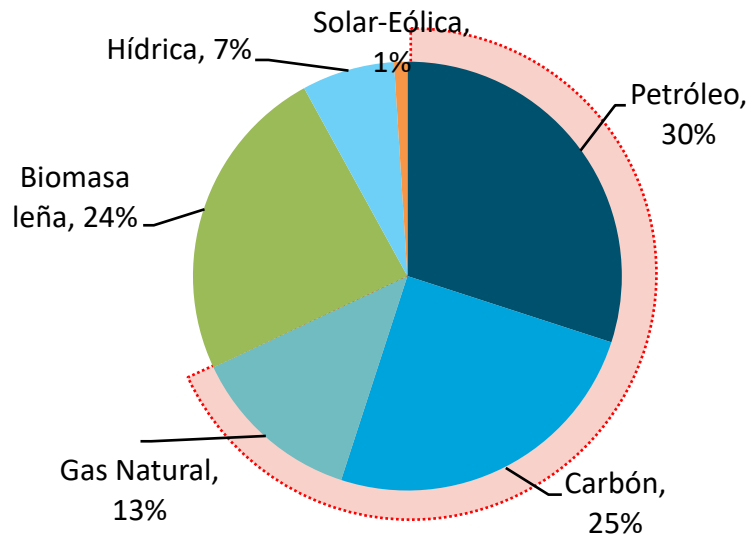
Oil, coal and natural gas are still the dominant energy sources

World



Source: Renewable energy: A world turned upside down, The Economist, 25.2.2017

Chile



68% of energy are fossil fuels

Source: Balance Nacional de Energía, 2015

Oil products have still the largest share of final energy consumed in Chile

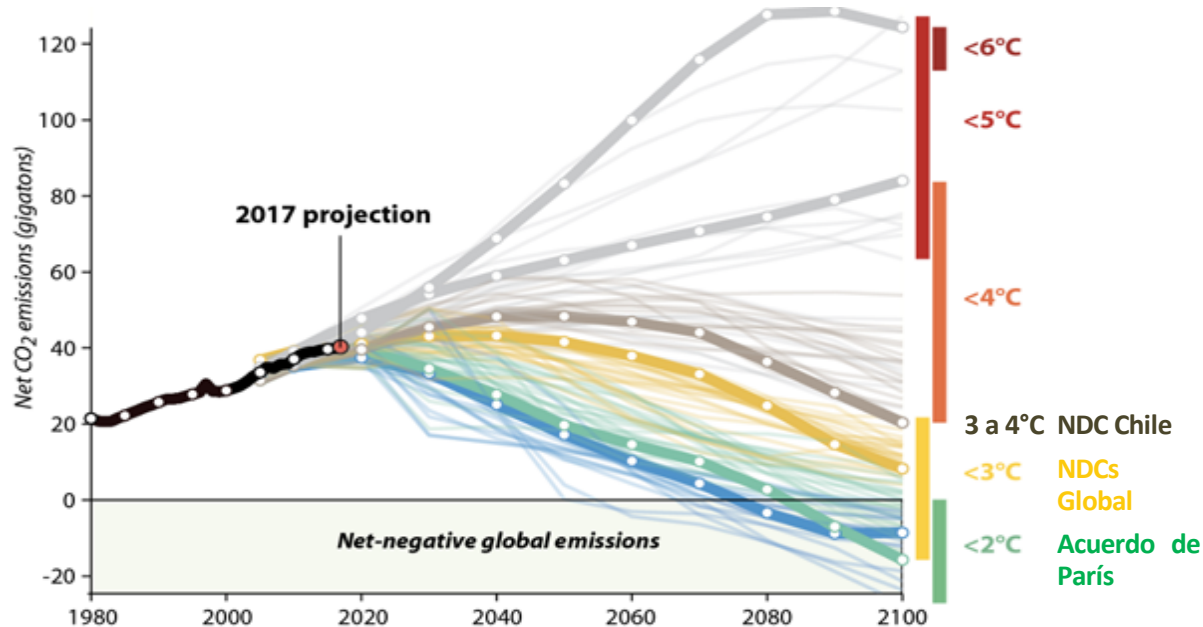
57%

of final energy consumed are oil products like diesel, gasoline and kerosene

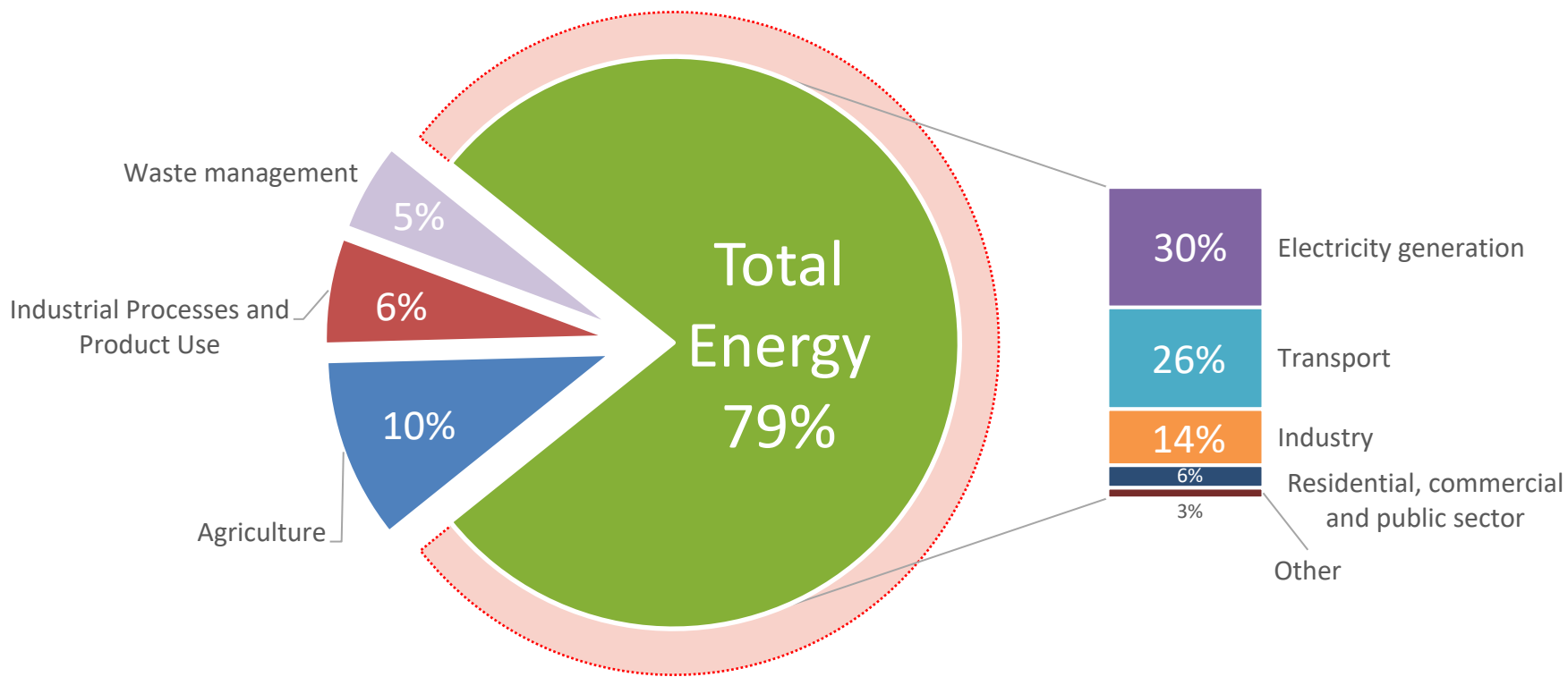


At the current rate of emissions the average temperature of the planet will have increased by more than 4° C by 2100

Global net CO₂ emissions and expected temperature increase



Electricity generation produces ~30% of Chile's greenhouse gas emissions



We are fully dependant on electricity

But only **22%** of energy we actually consume is electricity



We are a country rich in renewable resources



In 2018, 45% of electricity produced was renewable

Chile ranked #1 as the most attractive country to invest in renewables

CLIMATESCOPE 2018

by BloombergNEF

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CHILE ⚡ ON-GRID

01 / 2.63

GLOBAL RANK / SCORE

3.32

FUNDAMENTALS SCORE

1.68

OPPORTUNITIES SCORE

2.22


EXPERIENCE SCORE

276.99 \$bn

GDP

18.38 Million

POPULATION

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Santiago

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100% of new power plants under construction recently were renewable

Without any subsidies, except Chile's endowment of massive sunshine, wind and water

B 8

ECONOMÍA Y NEGOCIOS

EL MERCURIO
MARTES 22 DE MAYO DE 2018

A la fecha, hay 33 plantas de generación que se están edificando y que producirán 1.839 megawatts

Histórico: 100% de las centrales eléctricas en construcción en Chile son renovables y suman inversiones por US\$ 6.978 millones

VALERIA IBARRA

Uno de cada cuatro dólares que se invierten en Chile se destina al sector eléctrico. Y por primera vez en la historia del país, el 100% de las centrales generadoras en construcción, 33 en total, son renovables. Estas instalaciones producirán 1.839 megawatts (MW) de energía cuando estén en marcha y suponen una inversión de US\$ 6.978 millones.

"Estamos viviendo una transición energética única como país y quizás una de las más potentes en el mundo", explica Claudio Seebach, presidente de Generadoras de Chile. "Es una buena noticia para el país, en la medida que implica hacer más sustentable nuestro parque generador, reduciendo emisiones y, sobre todo, bajando en forma importante los costos de generación, en que esa expansión será fundamentalmente con energía solar fotovoltaica y eólica", señala a su turno Hugh Rudnick, socio de Systeep y académico de la UC.

El Gobierno creó un grupo de trabajo para establecer un cronograma y las condiciones para el cese programado y gradual de plantas carboneras, explica la ministra de Energía, Susana Jiménez.

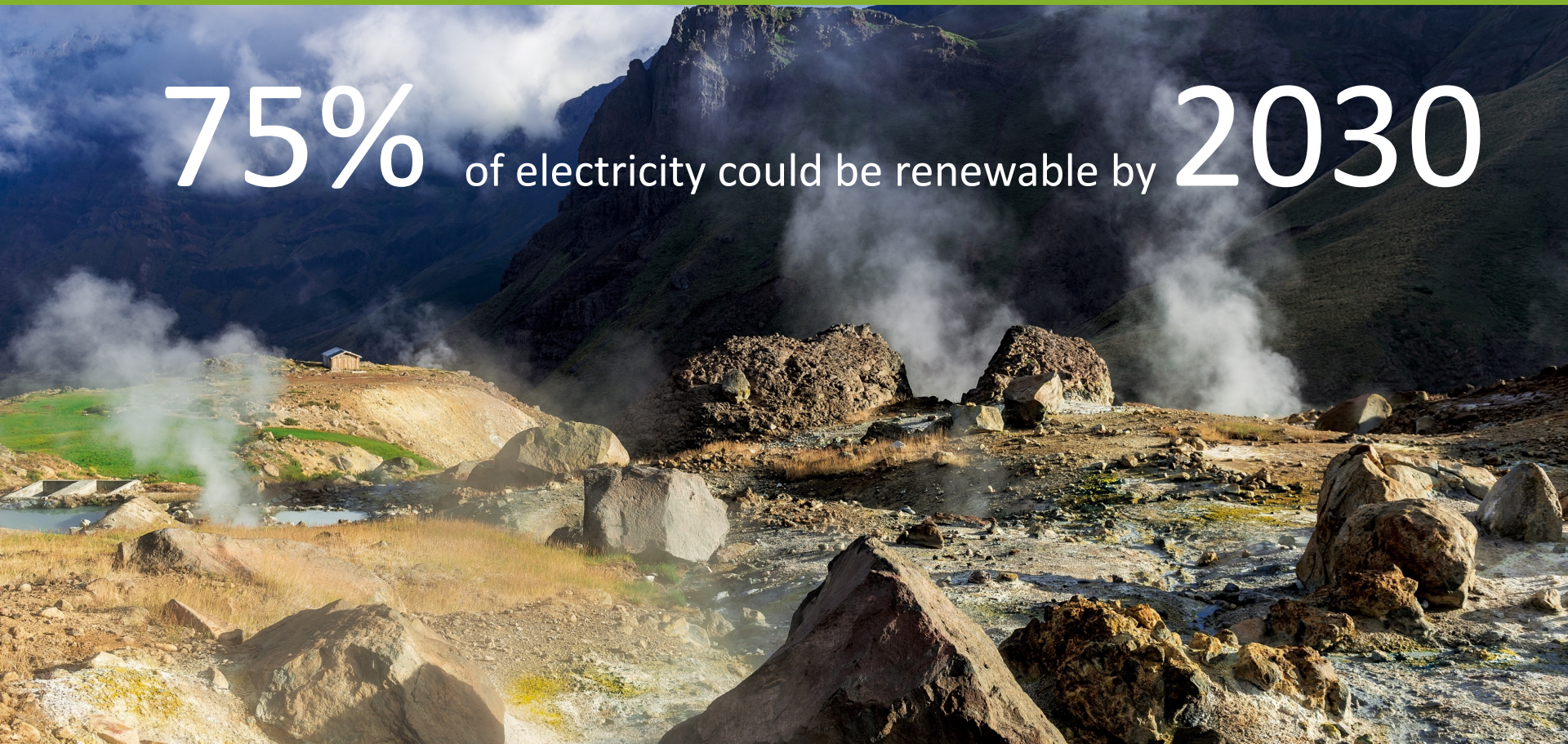


Se estima que, para 2030, la energía solar aportaría el 30% de la producción de energía eléctrica.

energéticos transnacionales (in-

The future of electricity generation is renewable

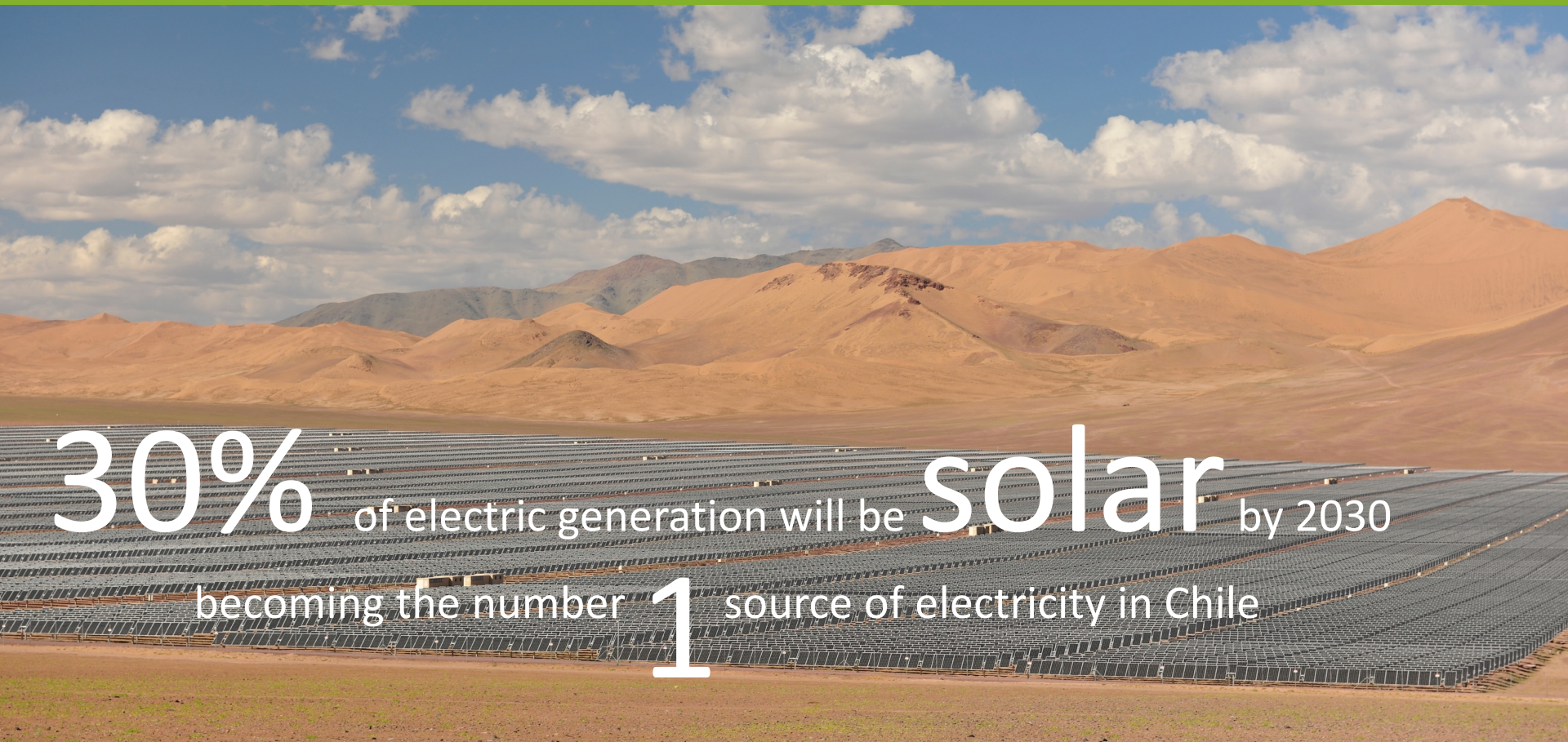
75% of electricity could be renewable by 2030



The future of electricity generation is renewable

By 2030 capacity solar PV and wind capacity will grow between 30% (+8.8 GW) and 65% (+16 GW)

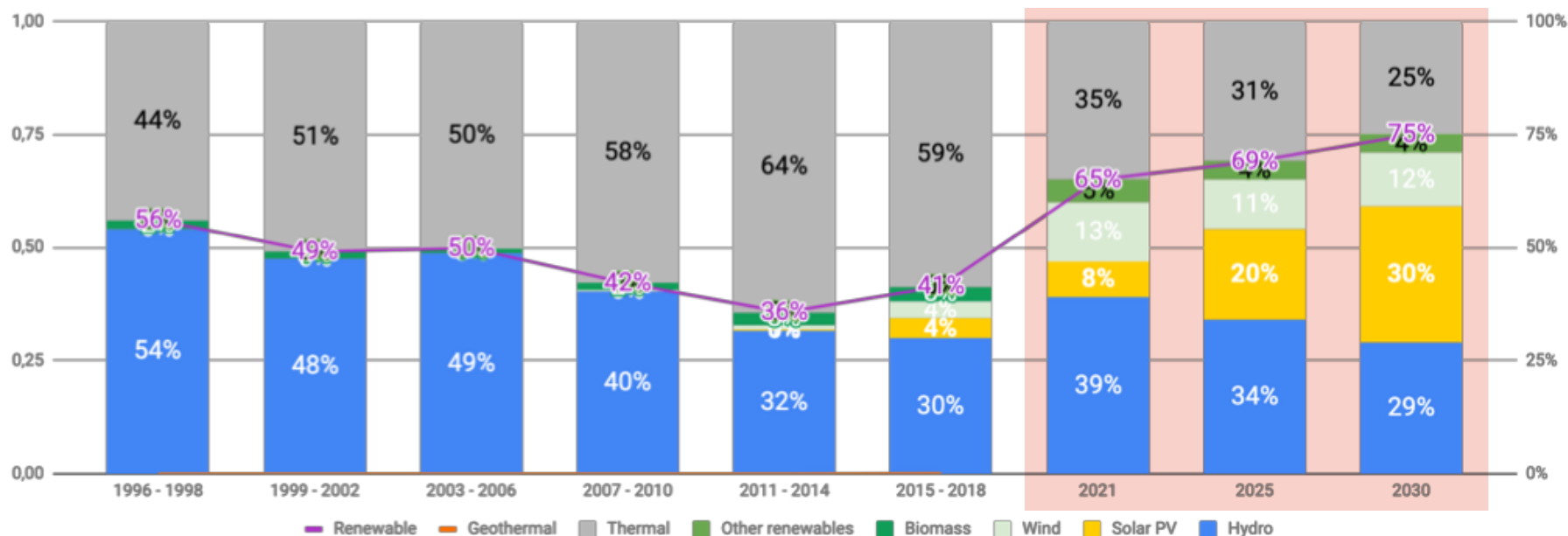
Investment potential of 8 to 18 billion dollars



30% of electric generation will be solar by 2030
becoming the number 1 source of electricity in Chile

Chile is recovering its renewable tradition

Evolution and projection of power generation mix in Chile [% of energy produced]



Source: Data 1996 – 2017: Triannual average based on Energía Abierta, CNE

Projection 2021 - 2030: Results for scenario DMCM: mid demand growth, mid costs. Long term analysis of SEN with ERV, PSR Moray, 2018

We have a voluntary agreement on the future of coal



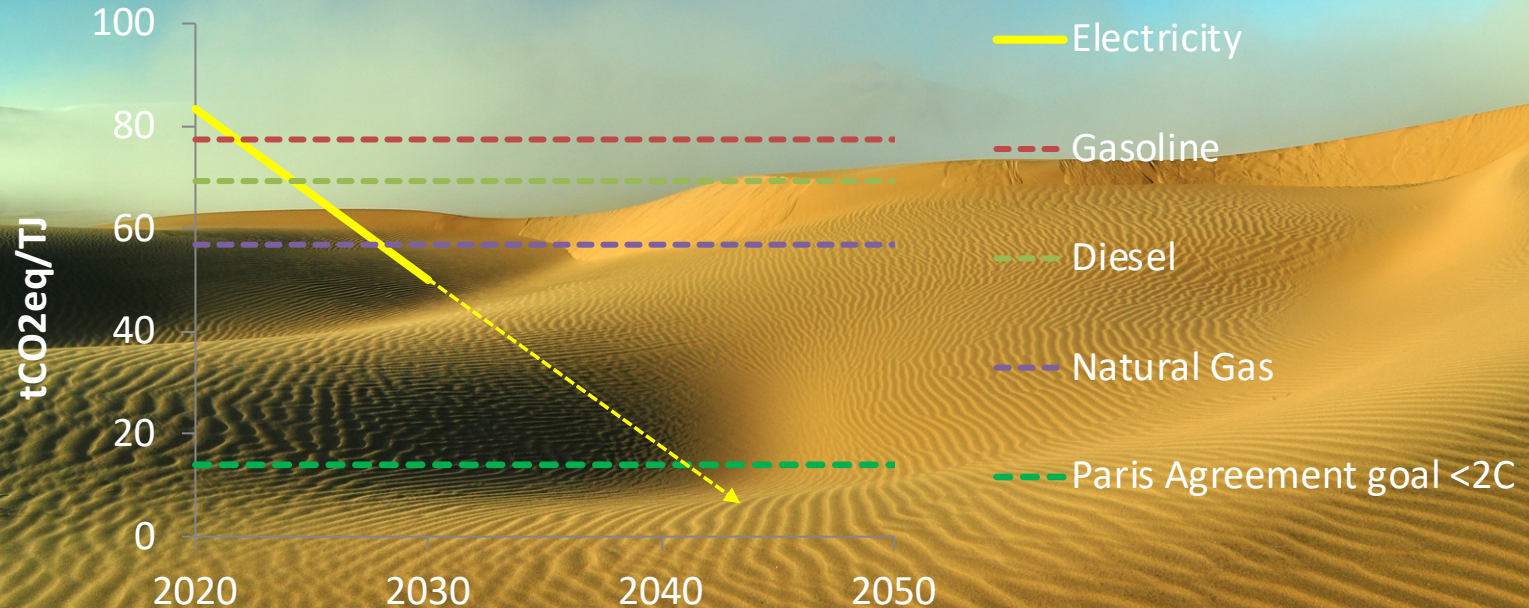
Generadoras de Chile

GOBIERNO Y GENERADORAS ANUNCIAN FIN DE NUEVOS DESARROLLOS DE PLANTAS A CARBÓN

Se constituye además un grupo de trabajo para analizar y definir condiciones y un cronograma para el cese programado y gradual de generación eléctrica a carbón en el marco de la Política Energética 2050.

Electricity is the only source of energy that is dramatically decarbonizing

CO₂ emission intensity of electricity vs fossil fuels



The future will be electric

Priority of electrification should be public transport, taxis, logistics and heat for industry and homes

Public transport



Taxis



Logistics



Heat pumps



Santiago has the largest fleet of electric buses in public transport outside China

Currently only 2% of transport is electric in Chile

12 PRODUCCIÓN
Y CONSUMO
RESPONSABLES



Energy efficiency

3 SALUD
Y BIENESTAR



Health and air pollution

13 ACCIÓN
POR EL CLIMA



Greenhouse emissions

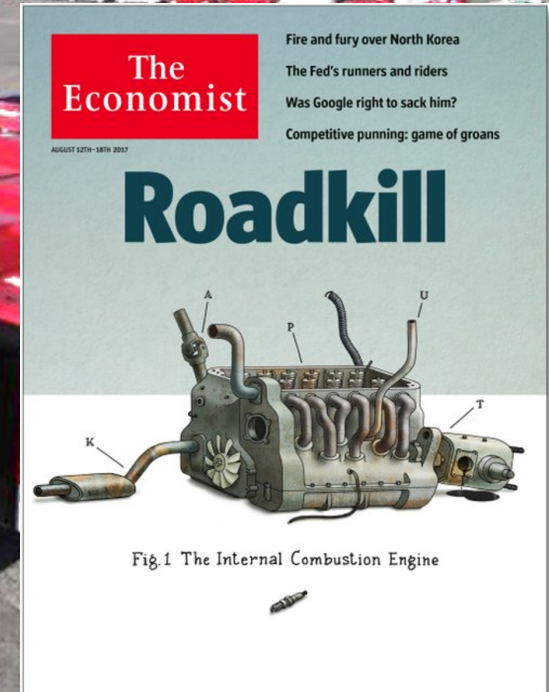








Fig.1 The Internal Combustion Engine

Heat pumps are the cheapest, most efficient and cleanest source of heat

Electric consumption of 10 kWh of electricity produces 30 to 40 kWh of heat

		Efficiency (%)	MP2.5 (kg/month)	Monthly cost (USD)	Investment (USD)
	Wood stove	20 – 60 %	3 - 12	55	250 - 600
	LPG	95 %		102	90 - 160
	Natural Gas	95 %		83	200 - 500
	Kerosene	95 %	0.03	72	75 - 700
	Electric heat pump	300 – 400 %		50	300 - 1500
	Electric resistance	100 %		180	15 - 300

Electrification will be key to reduce CO2 emissions and local pollution



Chile can inspire the world by leading a path to become carbon neutral by 2050

Sections ≡

The Washington Post

A wide-angle photograph of a desert landscape at dusk or dawn. In the center, a tall, narrow, dark-colored solar tower stands prominently. The tower has a vertical slit and is surrounded by a low wall. The ground is dry and brown, with some sparse vegetation. In the background, there are rolling hills and mountains under a sky with soft, wispy clouds. The lighting is warm, suggesting the low sun.

‘A SOLAR SAUDI ARABIA’

While Trump promotes coal, Chile and others are turning to cheap sun power



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