Finding Solutions to Make District Energy a Reality in Chile

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CONTENIDO

- The Issues
- Rapid Assessment Results for Temuco & Renca
- Observations from the Rapid Assessments
- Suggestions and Recommendations

EL EQUIPO EXTRAORDINARIO

UN Environment

- Lily Riahi
- Celia Martinez
- Ben Hickman

Sustainability Solutions Group

- Yuill Herbert
- Mel de Jager
- Julia Meyer-MacLeod

Reviewers

Ministry of Environment, Ministry of Energy, UN Environment, Danfoss, City of Vancouver, International Energy Agency

LOS CHILENOS EXTRAORDINARIOS

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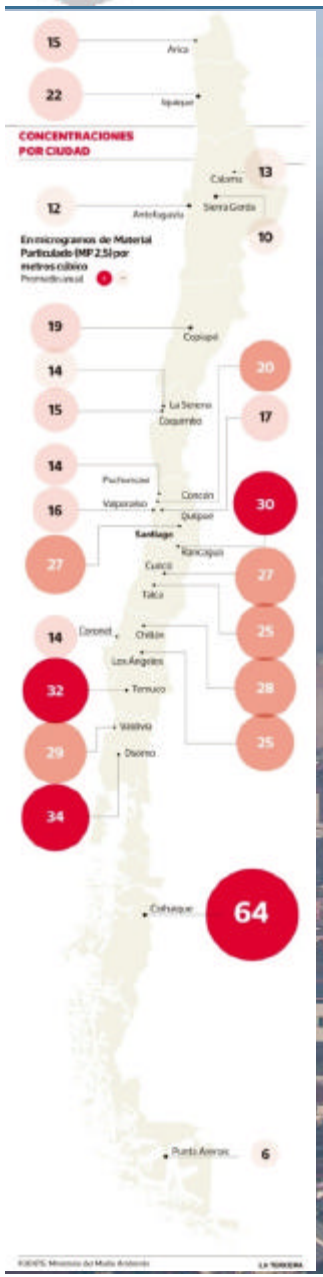
EL DESAFIO QUE COMPARTIMOS



OBJETIVOS, CALEFACCIÓN SOSTENIBLE

- Reduce air pollution
- Reduce greenhouse gas emissions
- Improve the affordability of energy
- Provide opportunities for economic development
- Improve national energy independence

ÉXITOS HASTA AHORA

- Woodstove change-out program
- Woodstove & pellet stove certification
- Energy efficiency retrofits for homes
- Initiatives to dry firewood
- Wood burning is curtailed when necessary
- Measurement of sources and levels of air pollution
- Smaller district energy clusters have been built
- Investigations of ways to accelerate district energy
- Engagement with the District Energy in Cities Initiative

¡DÍA DE JUBILACIÓN!

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LA PRÓXIMA GENERACIÓN

OBJETIVOS, EVALUACIONES RÁPIDAS

What is the potential of district energy in each city:

- Reduce air pollution and greenhouse gas emissions
- Cost savings for citizens
- Local economic development

What renewable sources (e.g. waste heat) are available?

What business models could be used?

What barriers exist, and how can they be overcome?

What concrete steps can be taken now?

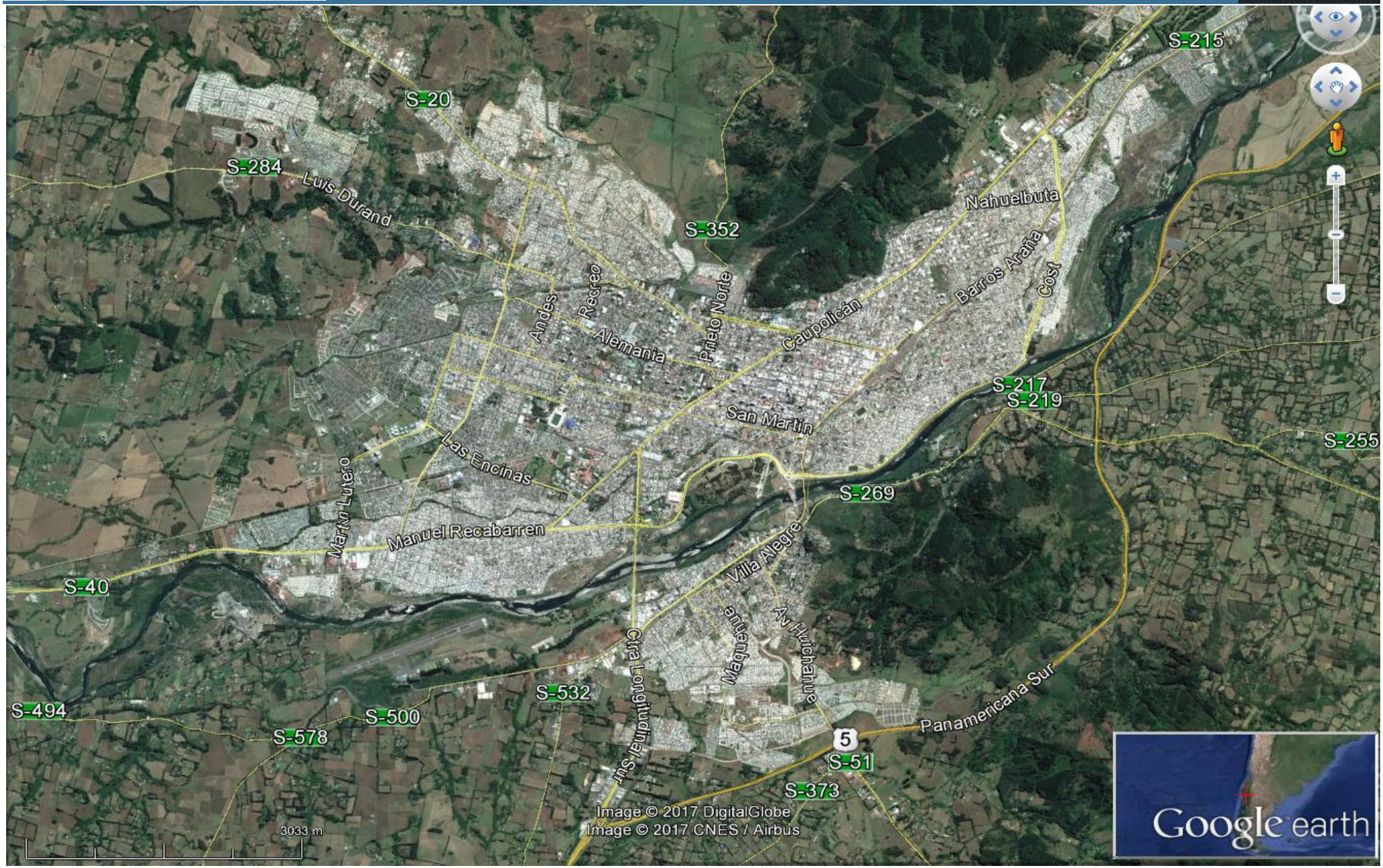
EL MÉTODO, EN BREVE

A. What do we have?

B. What do we need?

C. What technology, businesses can convert A to B?

CONTEXTO DE TEMUCO



CONTEXTO DE TEMUCO

- Population ~260,000
- Very strong interest in improving air quality
- The price and cost of all energy types is high
- Areas of high density exist (~150 larger buildings)
- 93% of air pollution is from woodstoves in houses
- Single family houses cover ~97% of Temuco

CALDERA DE BIOMASA VIEJA

PROGRESO EN TEMUCO

Escuela de Música Armando Duffey (and theater) heated by pellet boilers

Pellet boilers in Liceo Pablo Neruda

CONDOMINIO FRANKFURT, TEMUCO

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EL COSTE DE LA ENERGÍA

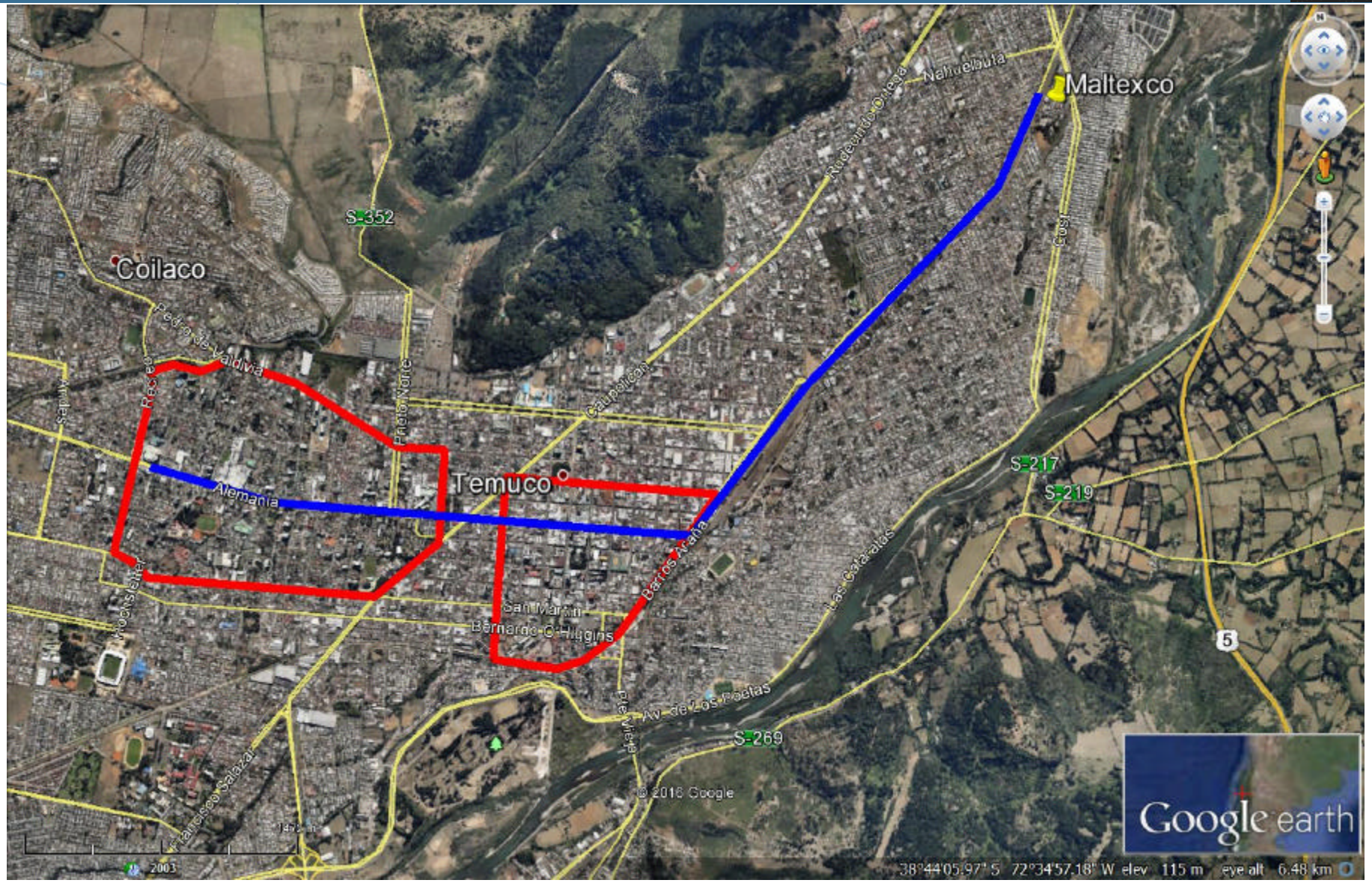
	Condominio Frankfurt	Traditional Home
Energy Cost per Year	$375	$1,700
Area	140 m^2	60 m^2
% of Income	< 1%	~ 15%

FUENTE DE CALOR RESIDUAL, TEMUCO

- Two coal-fired boilers
- 16,000 MWh_{th}/yr is available
- Sufficient for 17 larger buildings

(Plus, 6,000 MWh_{th}/yr from RILES – heat pumps would be required)

FUENTE DE CALOR RESIDUAL, TEMUCO



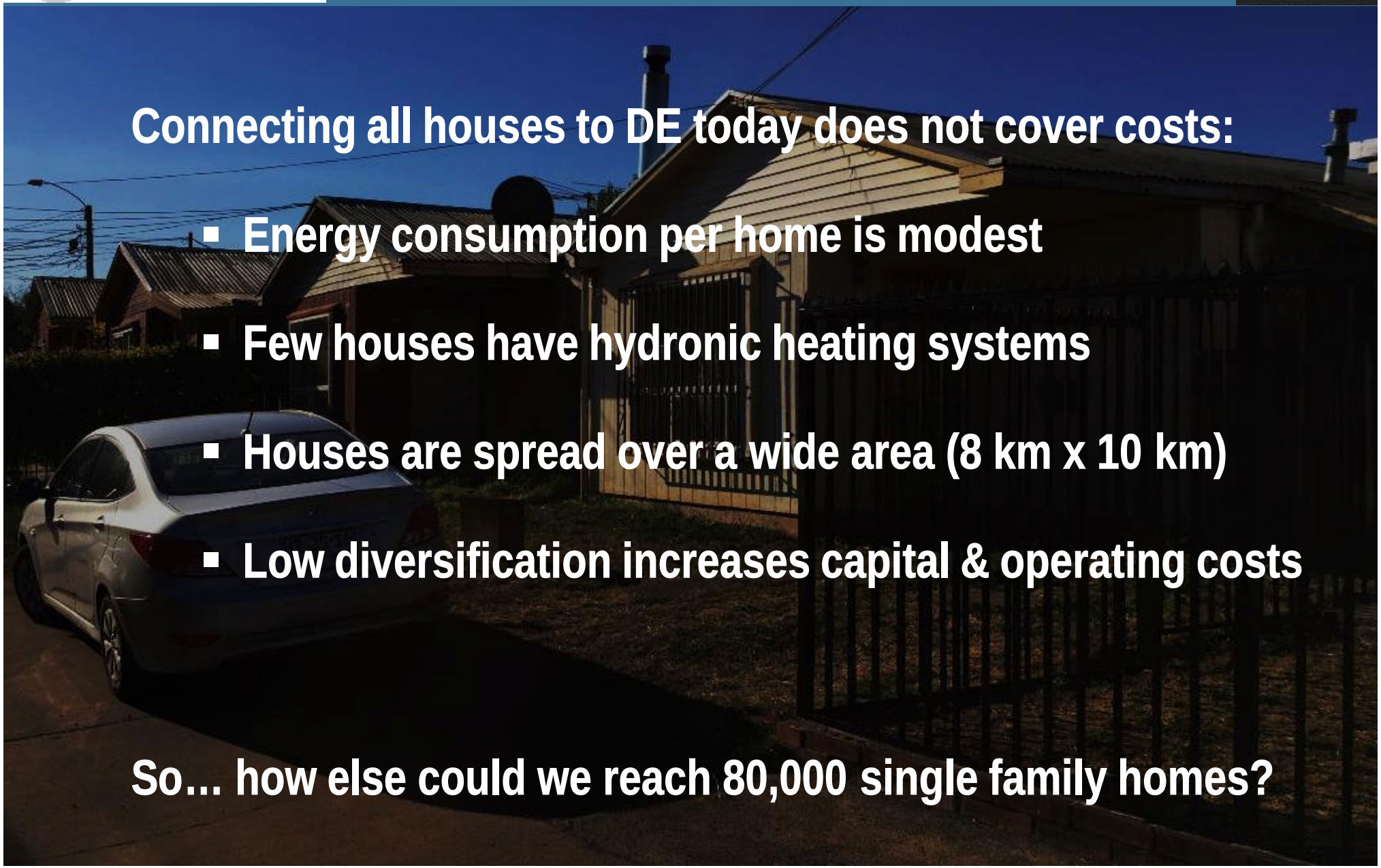
OBSERVACIONES, CALOR RESIDUAL

Challenges include timing of supply vs. demand

Benefits include:

- Low environmental footprint, low cost
- Industrial sites can share infrastructure, skills
- Opportunity for goodwill with the community
- At the industrial source:
  - Reduces thermal pollution to water, air
  - Reduces the cost of cooling (e.g. towers)
  - Can reduce water consumption
  - Can reduce air pollution

OTROS DESAFÍOS EN TEMUCO



Connecting all houses to DE today does not cover costs:

- Energy consumption per home is modest
- Few houses have hydronic heating systems
- Houses are spread over a wide area (8 km x 10 km)
- Low diversification increases capital & operating costs

So… how else could we reach 80,000 single family homes?

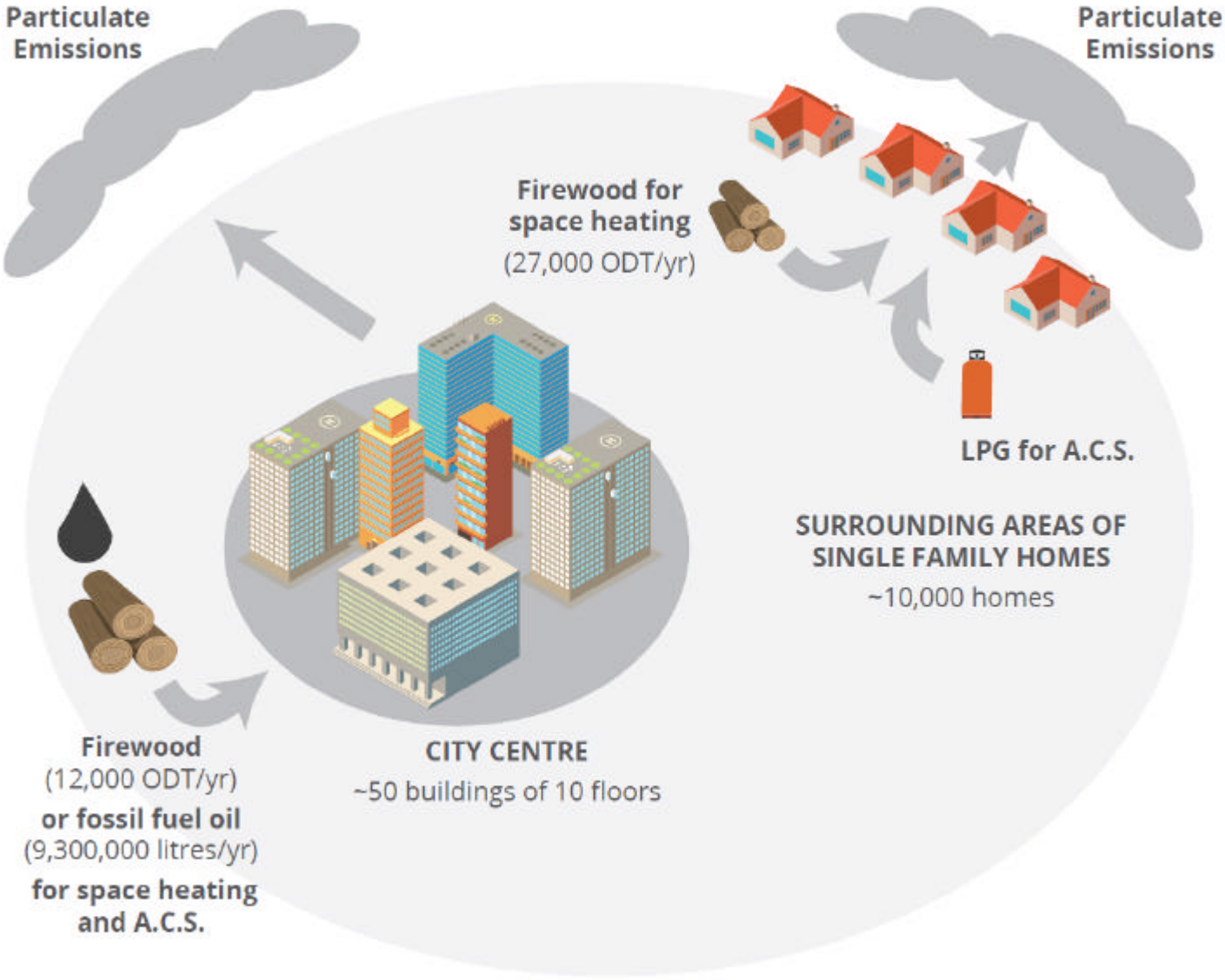
ENERGÍA DISTRITAL HÍBRIDO

What if we:

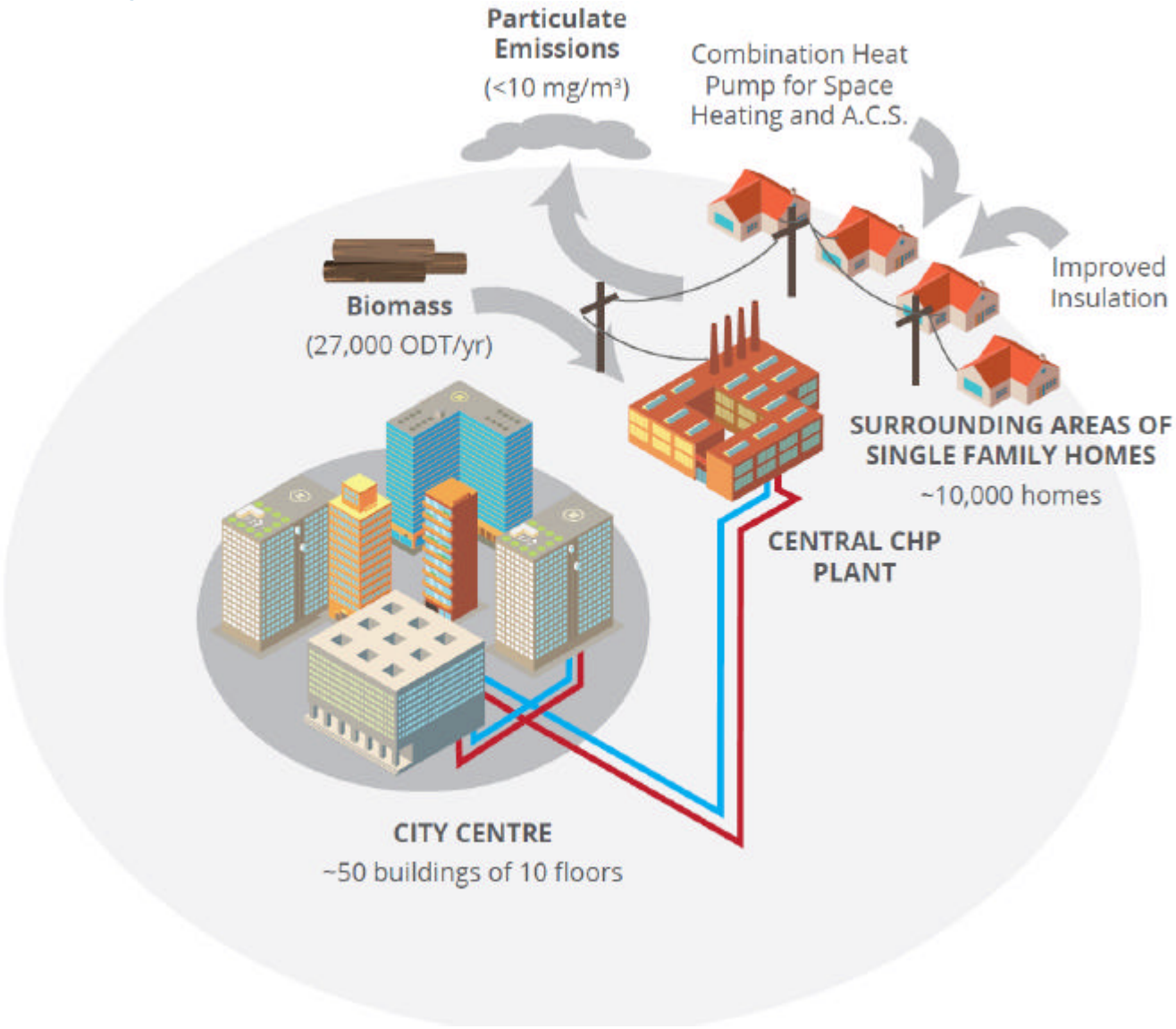
- Divert the wood now burned in single homes
- Burn this wood for heat and electricity in a central plant
- Distribute the heat to larger buildings in the downtown area
- Sell the electricity to the local distribution company
- Improve the insulation in single homes
- Provide CO_2 heat pumps for space heat and ACS
- Finance insulation + heat pumps at a guaranteed rate

The "provider" could be a DE firm, the electrical utility, or an ESCO

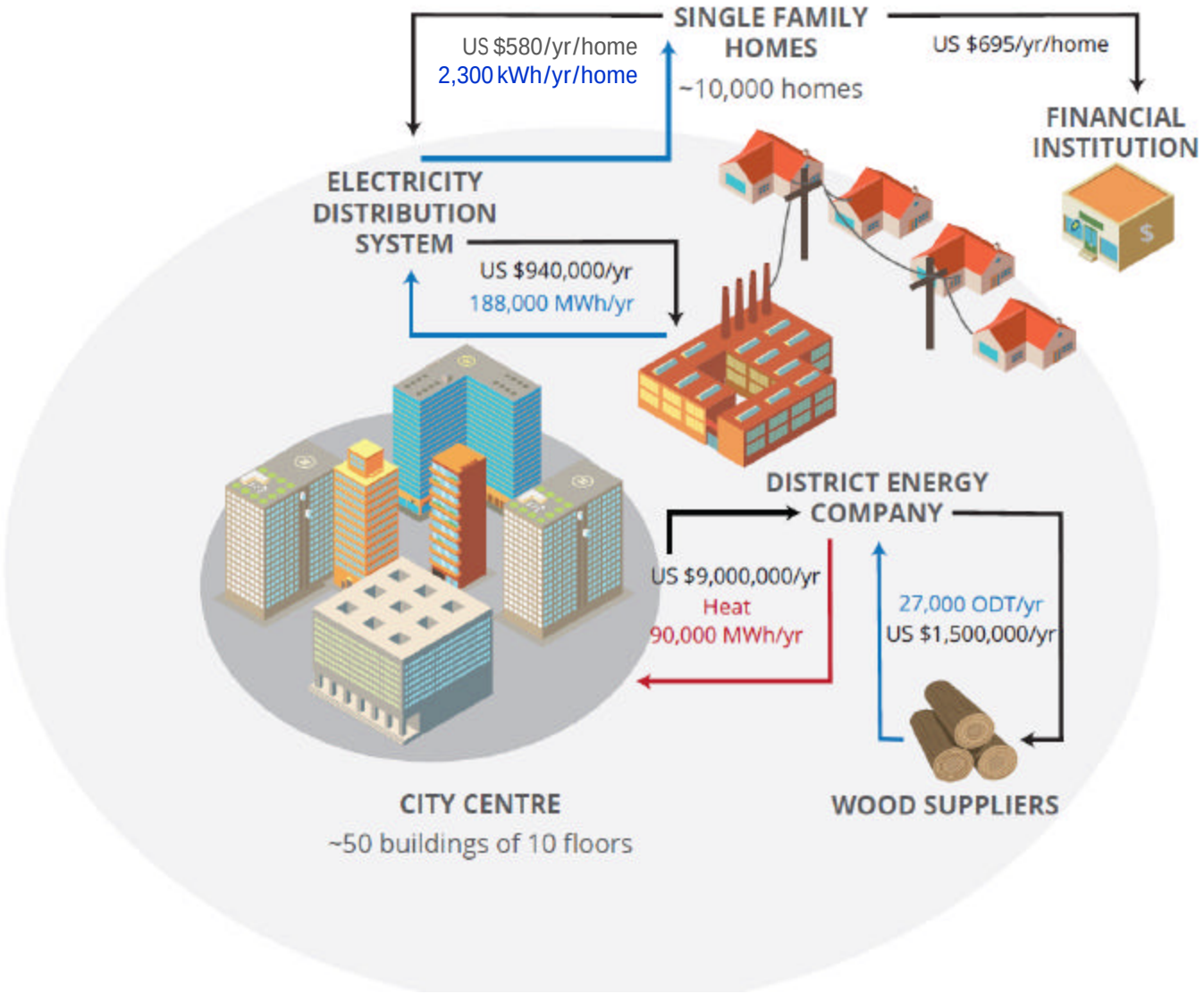
TEMUCO, CURRENT DAY



ENERGÍA DISTRITAL HÍBRIDO



ENERGÍA DISTRITAL HÍBRIDO

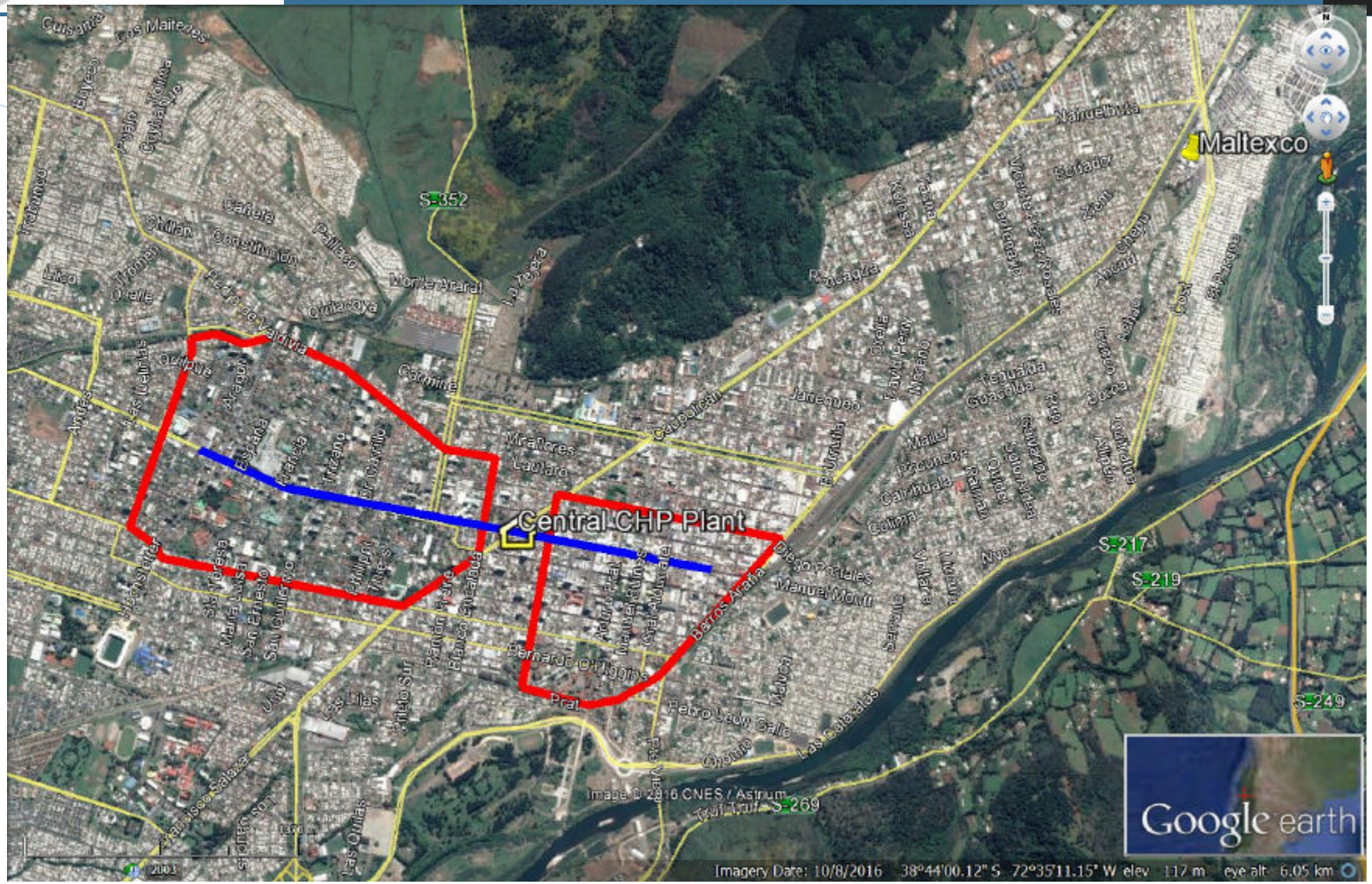


ENERGÍA DISTRITAL HÍBRIDO

Estimated results:

- 20% lower energy cost for homeowners (+ benefits)
- 99% reduction in particulate emissions
- 98% reduction in greenhouse gas emissions
- Diverted wood heats the 10,000 homes + 50 buildings
- Estimated IRR for the proponent ~15%
- Revenues for the electricity distribution company

PLANTA DE COGENERACIÓN CENTRAL



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UN CONCURSO DE BELLEZA

Natural Gas Boiler
PM ~ 8 mg/m^3

Biomass Boiler
PM ~ 4 mg/m^3

OTROS GASES DE EFECTO INVERNADERO

Source (per 10,000 homes)	Methane Emissions (tonnes/y CO_2e)	Black Carbon Emissions (tonnes/y CO_2e)
Older Woodstoves	8,400	42,800
Central CHP Plant	100	600

That's Good News: reducing particulate emissions significantly reduces greenhouse gas emissions

CONCLUSIONES PARA TEMUCO

District energy takes many forms: context is opportunity

Greenhouse gas emissions can be significantly reduced

District energy appears to be viable today, based on:

- Industrial waste heat
- Heat-only district energy in the centre of Temuco
- Heat and electricity with ‘hybrid’ distribution

PRÓXIMA OBRA PARA TEMUCO

A deeper assessment will be completed in July, 2017 to:

- Identify potential locations of systems and CHP plants
- Refine the economic estimates for the first DE systems
- Engage stakeholders
- Identify further barriers
- Recommend steps to address barriers

CONTEXTO, RENCA

DESAFÍOS EN RENCA

Fewer areas of high energy density

Most of the city is occupied by single family homes

Low energy demand per home

OPORTUNIDADES EN RENCA

A large source of industrial waste heat exists in the East (AES Gener – Nueva Renca)

A cluster of demand for industrial heat exists in the West (e.g. Coca Cola + 50 others):

- Industry pays a high price for energy
- Demand is continuous

AES GENER, RENCA

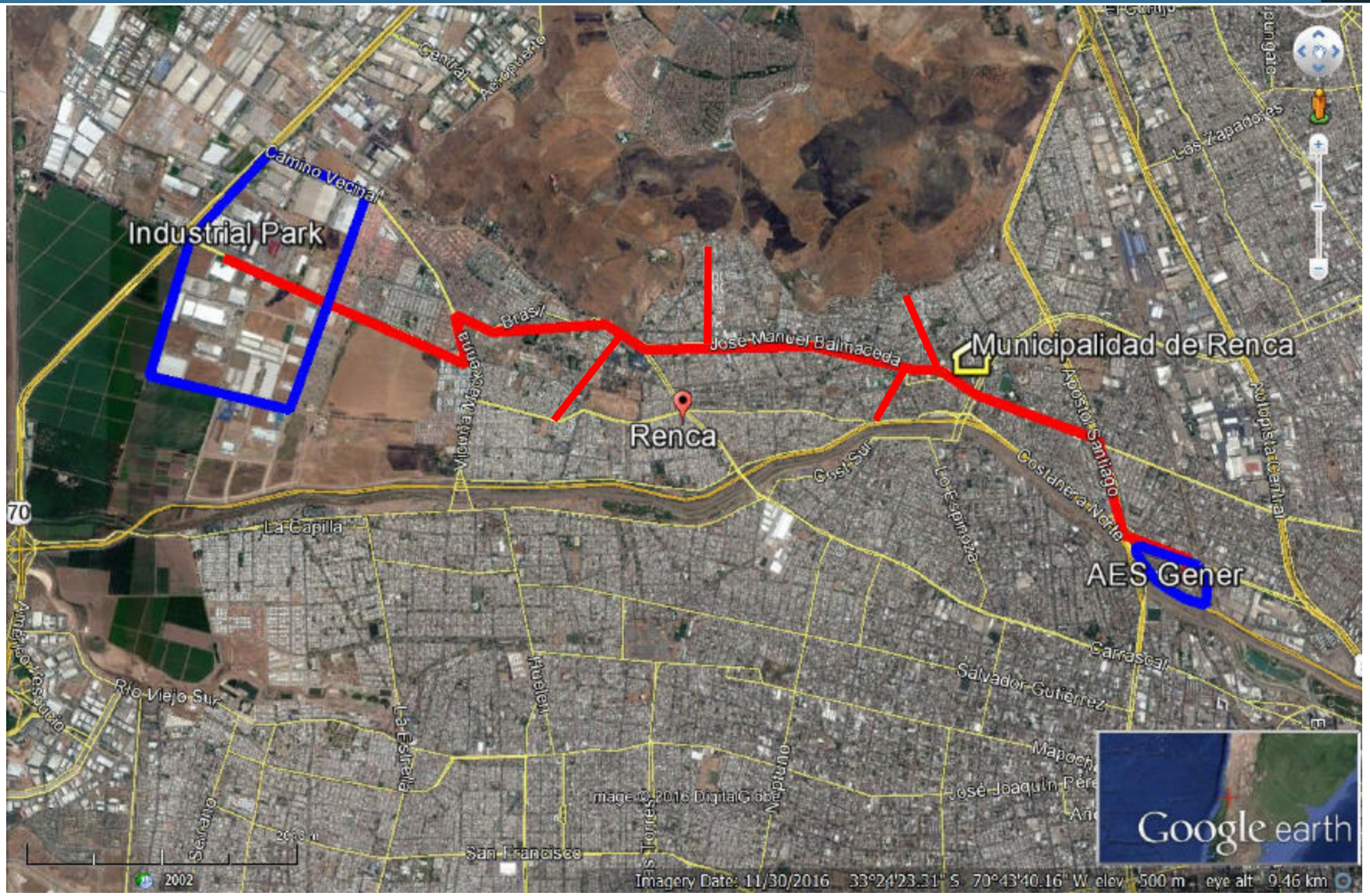
OPORTUNIDADES EN RENCA

Waste heat could supply one cluster in the East…

But what if:

- A utility corridor is built across Renca
- A back-up boiler is located at AES Gener
- The corridor carries heat, irrigation water, services

RENCA CORREDOR DE SERVICIOS



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CONCLUSIONES PARA RENCA

Industrial energy can enable district energy:

- With 2 DE clients like Coca Cola, costs are covered
- DE can connect to buildings over time
- With industry as anchor loads, could residential heat be offered at a lower price?
- Cooling could be provided by adsorption chillers
- Waste energy could make irrigation water available

OBSERVACIONES: MEDIO AMBIENTE

Water, energy, and climate change are strongly linked

Woodstoves cause high emissions of black carbon & methane

We can create two “goods”: health and climate change

DE can make forest resources available for higher-value uses

High-density Cellulose Insulation: $1,200 per tonne

Biomass: $60 per tonne

OBSERVACIONES: SOCIAL

Heating larger buildings with fossil fuels is expensive

Heating homes with firewood is even more expensive

Current methods cause other issues (e.g. under-heating)

Energy is less affordable in the south:

- Heating costs are higher
- Incomes are lower

Owners of large buildings can make investments to reduce emissions, but householders cannot

Cleaner energy will need more knowledge, less muscle

OBSERVACIONES: NEGOCIOS

Competition among strategies and business models is vital

Interest rates strongly affect the cost of district energy

A level playing field is also vital, to:

- Accelerate innovation
- Ensure district energy reaches smaller communities

District energy requires support, but subsidies require caution

OBSERVACIONES: TÉCNICO

Industrial waste heat is an important energy source

Many configurations of district energy will be needed:

- Central biomass plants for heat and electricity
- Clusters which could grow over time
- Hybrid and other configurations

SUGERENCIAS Y RECOMENDACIONES

Can we begin as we intend to continue:

- Raise our standards for insulation?
- Use made-in Chile insulation materials and methods?
- Use Life-cycle Analysis to compare energy sources?
- Help existing energy firms make their transitions?

SUGERENCIAS Y RECOMENDACIONES

Can we profit from the experience of others?

Can we modify existing regulations, not write new ones?

Can we ensure the success of the first DE systems, with:

- Integrated planning?
- Open competition & a level playing field?
- Partnerships between Chilean and international firms?

CONCLUSIONES PARA CHILE

Chile is very fortunate:

- Few fossil fuel resources
- Abundant sustainable energy resources
- Resourceful people, with ***bríoo!***

Context is opportunity, and...

We have more opportunities than challenges!

¡GRACIAS!

"*The future has already arrived. It's just not evenly distributed yet*." W. Gibson

"*El futuro ya ha llegado. Todavía no está distribuido equitativamente.*" W. Gibson

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