FIELDWORK REPORT CONCEPCION

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Summary

This report describes the fieldwork in Concepción, Chile, one of the cities selected by the Mapping Urban Energy Landscapes - MUEL research project. Through field interviews, transect walks, workshops and documentary analyses the projects gathered data on the city's urban energy landscape.

Interviews to those who plan, manage, produce, distribute and coexist with energy infrastructure provided a rich source of data on the city's energy system and its governance, as well as an entry point to the actors' perception of ongoing material and cultural transformation and future challenges. Transect walks produced first-hand maps and reports on how energy infrastructure, urban fabric and natural areas were assembled in the making of an urban energy landscape. Whilst workshops proved opportunities to approach both to the everyday life behaviour towards energy and representations of energy by urban residents, documentary reviews complemented the source of information of energy grid, conflicts and institutions involved in the city's energy system.

Overall, the fieldwork materials suggest a metropolitan landscape intensively shaped by the weight of its industrial infrastructure, and in particular by the role of an industrial scale production, distribution and consumption of energy. The governance of energy in this energy producing area emerges from the data as a highly disputed process, in which a diversity of actors, scales and spheres converge and diverge. As a result, the everyday life of the urban energy landscapes combines both coexistence between diverse land uses and the sprout of conflicts for land-use, landscapes and lifestyle.

1 Introduction

This report details the fieldwork research activities that took place in the metropolitan area of Concepción in Chile between 2 November 2015 and 14 January 2015. Nearly 500 km south of the Chilean capital, Concepcion is an industrial pole and head of the Bio Bio administrative region, nationally renowned by its forestry and paper industry, its fisheries and its energy industries.

The fieldwork was lead by Martin Calvet, a PhD student at UCL hired by the principal investigator. In accordance to the project's methodology a series of different research methods were displayed to gather data on energy landscapes.

Sixteen structured interviews to private sector, state and civil society stakeholders were conducted to gather qualitative data on the state of the energy system in the metropolitan Concepcion, on the schemes by which urban energy is governed, and on the perception of current challenges that will shape the future of energy. Five transects walks were performed in chosen energy producing and consuming areas to register -from a pedestrian perspective- how infrastructure is shaping the energy landscapes of the metropolitan area. Two workshops were developed to gather the perceptions of neighbours on the role and impacts of energy in their everyday life and territory. The analysis of documentary sources -such as energy maps, policy papers, official statistics, studies and newspapers- was directed to understanding the national, regional and local context in which urban energy landscapes are produced and facilitate the interviews sample. A set of auxiliary data produced by the fieldwork activity is presented in appendices.

Overall,

Table 1.1. Characteristics of population reached through the interviews.

	Interviews/ Sessions	Participants
Group		
Institutional representatives	17	17
Workshops	2	26
Gender		
Female		19
Male		22
TOTAL	**19**	**41**

2 Interviews

Through a purposive sampling twenty individuals were contacted and sixteen interviewed, representing some of the most relevant actors in the regional and metropolitan-scale policy-makers, regulators and local authorities, companies in charge of energy production and distribution, as well as community organisations of territories with operating or in project energy industries (Table 2.1).

2	Male	50s	Engineer in chief	LPG distribution company	Private sector
3	Male	40s	Regional secretary	Certifier agency	Civil society
4	Female	40s	Official for energy strategy coordination	Ministry of Energy regional delegate	Government
5	Male	40s	Official for energy efficiency promotion	Ministry of Energy regional delegate	Government
6	Male	20s	Community activist	Community organisation	Civil society
7	Male	50s	Electric engineering department	University	Civil society
8	Male	40s	Network maintenance	Electricity distribution company	Private sector
9	Male	40s	Director on energy doctorate	University	Civil society
10	Female	40s	Staff of regional planning office	Regional government	Government
11	Male	40s	Researcher	University	Civil society
12	Male	50s	Coordinator on social intervention	Consultancy	Private sector
13	Female	40s	Staff of environmental assessment service	Environmental assessment agency	State
14	Female	50s	Director of municipal environmental office	Municipality	Government
15	Male	50s	Chief external affairs officer	LNG company	Private sector
16	Male	50s	Community leader	Neighbours association	Civil society
17	Male	40s	Public relations officer	Electricity production company	Private sector
-	Male	60s	District representative	Chamber of representatives	Government
-	Male	50s	Manager of operations	Paper and cellulose plant	Private sector
-	Male	40s	Manager of community affairs	Petrochemical plant	State
-	Male	50s	Regional representative	Superintendence of energy and fuels	State

The interviews followed the project's ethical protocol, which recognised rights of information, anonymity and withdraw for each contacted person. Written or verbal consent to the interviews -and to recording- was always asked and respected. About half of the interviewees chose not to be recorded, and a similar rate preferred to give a verbal acceptance of consent rather to sign the consent form.[1]

The interviews aimed to capture data about five large themes: the role of the interviewee's organisation in the provision, governance or consumption of energy at a city scale; the interviewee's perspective of the current state of energy supply and consumption in the metropolitan area including infrastructure and landscape; a description of the governance schemes; and approach to future plans and challenges faced by the energy; and a glimpse on how innovation is -or is not- transforming energy landscapes.

The image of the institutional architecture of the energy industry emerging from the interviews depicts a scenario that combines strong national centralisation with sectorial independence, either in the public and private spheres. That is, in the public sector the Ministry of Energy is in charge of setting, implementing and controlling national plans and policies, the Superintendence Energy and Fuels regulates the industry, and the Environmental Assessment System set the conditions for the operation of the industry. These organisations are independent from each other and all have regional branches that control the enactment of national guidelines. Other public bodies, particularly regional and local governments (municipalities), have scarce legal and political powers to challenge public or private initiatives in energy production, distribution or consumption, what in the case of the metropolitan area is worsened by the absence of a unified metropolitan government. In the private sector, commercial and technical operations of large energy companies are remotely controlled by a headquarter located in Chile's capital, with regional branches limited to administrative and materialising centralised directions.

2.1 Institutional actors

Those interviewees working in private companies described the role of their organisations as the production and distribution of clean energy in the metropolitan area to facilitate the

[1] As it became clear from the interviewees justification, in Chilean culture signature is regarded as a legal contractual action. In this case, although the signature of the consent form was intended to protect the interviewee and bind the researchers to an explicit ethical procedure, it was instead perceived as a sort of legal obligation (with no clear limits) of the interviewee in favour of the researchers, and therefore resisted by the majority of the interviewees.

region's development, either through the distribution of Liquefied Petroleum Gas (LPG) in cylinders (Interviewee 2), the distribution of electricity in urban areas (Interviewee 8), the development of a LNG off shore terminal and a Liquefied Natural Gas (LNG) thermal plant (Interviewee 15), or the operation of coal thermal plant (Interviewee 17).

Interviewees working in the energy ministry emphasised the national-scale and strategic policy-making role of their institution (Interviewees 4 and 5), while regional authorities and regional government staff stressed their role as integrating national long-term policies and local short-term demands into a coherent regional planning (Interviewee 1; Interviewee 10). A regional authority from the environmental assessment system described their role as integrating more clean and efficient technology to the city as a way to stop conflicts and boost socio-economic development (Interviewee 13). A local government official described the role of her institution as develop pilot programs in energy efficiency and educate the municipal population in climate change mitigation (Interviewee 14). A representative from a public-private certification initiative described its role as both the certification of sustainable firewood producers and sellers and the fight for legitimacy for firewood as a fuel in a context of rising urban air pollution and large energy industries competition for the heating market niche (Interviewee 3).

Whilst a community activist fighting the LNG off shore terminal described his organisation role as the defence of a lifestyle and local development path (Interviewee 6), the leader of a neighbours association placed besides a petrochemical compound saw his organisation's role as improving the quality of life from the neighbours by achieving mitigation and compensations measures from the government and the company (Interviewee 15).

Although scholars firstly depicted themselves as researchers seeking the technological improvement of industrial and urban energy systems, they also stressed their role in driving cultural change -sustainability principles- in universities, the energy industry and the public sector (Interviewee 7; Interviewee 9; Interviewee 11). A private consultant (Interviewee 12) working for the energy industry emphasised its role in filling the gap left in the relationship with the nearby communities by the efficiency goals of the industry and the political priorities of the state agencies.

2.2 Energy scenario

Interviewees have stressed the position of the metropolitan Concepcion as a significant energy hub at the core of the leader Chilean region in energy production (Interviewee 7). However, interviewees are aware that within the metropolitan area either renewable energy or NCRE are scarce (Interviewee 4), and the largest share of energy produced is from coal (thermal plants) and oil (petrochemical compound). With regard to the consumption of energy, the city relies on energy from LPG locally refined and imported coal, as well as electricity from the national electrical grid, where electricity from different origins (mostly hydropower, coal, biomass and wind) are combined (Interviewee 2; Interviewee 7). Biomass plays a significant role in residential heating (as firewood) and as a new source of co-generated energy in industrial processes (Interviewee 3; Interviewee 9).

The presence of very large energy infrastructures for industrial activity and national distribution is acknowledged as the source of significant environmental impacts to the surroundings and triggers conflicts (Interviewee 10). As an environmental assessment authority states, “we all know they [energy projects] are needed, but no one wants them” (Interviewee 13). To some interviewees, the metropolitan landscape itself has been shaped by the impact of industrial infrastructures (Interviewee 11), in which specifically energy’s industrial infrastructure plays a relevant role in the way landscape is perceived (Interviewee 6; Interviewee 16).

Energy industry in the metropolitan area is itself in transition: projects for an offshore maritime LNG terminal and a 20 MW wind park project have been already approved with fierce opposition from local communities arguing landscape and lifestyle impacts (Interviewee 1; Interviewee 6), whilst environmental policies are promoting gradual restrictions to firewood as a heating source (Interviewee 3; Interviewees 4 & 5).

2.3 Governance

Being both the political centre of an energy producer region and a hub itself for large energy projects, energy governance in the metropolitan Concepcion is represented by interviewees as a very complex issue in which a multiplicity of stakeholders intervenes. State actors display urgency in overcoming a potential energy-supply crisis and decreasing the energy costs to

improve the local industry competitiveness (Interviewee 10; Interviewee 13). Allowed by national strategic regulations and a free-market framework, localisation of industrial energy infrastructure overcomes the city's masterplan (Interviewee 6; Interviewee 10; Interviewee 13). As a planner from the regional government asserted, "the link between energy and urban planning? None. Indeed this absence is the cause of these problems" (Interviewee 10). Many interviewees also acknowledged the persistence of a culture of omitting social and environmental dimensions (Interviewee 1; Interviewee 6; Interviewee 12). The lack of a unified city authority is also depicted as a handicap to manage and integrate a diverse pool of energy-related activities and projects at the metropolitan scale (Interviewee 10).

Energy projects are often perceived as reproducing an uneven distribution of impacts and benefits, or as a regional councillor asserts, "there are those who make profits, which are the companies, right? And there are other people who are the losers and have to pay with their health the negative externalities". Interviewees acknowledge that, by adopting a wider conception of sustainability, some large energy companies have slowly begun to shift from charity policies to more socially-environmentally aware projects (Interviewee 7; Interviewee 12). However, even new non-conventional energy projects -as the off shore gas maritime terminal or a windpark- are being contested by those who consider its impacts -either economic, social or environmental- surpass any compensation (Interviewee 7; Interviewee 13; Interviewee 16).

Landscape impacts, which assemble visual impacts, loss of territorial identity, and flows disturbance, are consistently reported as a main issue (to be either mitigated or fought) by state officials, energy companies, scholars and activists (Interviewee 1; Interviewee 6; Interviewee 7; Interviewee 13; Interviewee 16).

Large energy companies are perceived as powerful stakeholders lobbying with governmental authorities to overcome local regulations (Interviewee 1) and lobbying with representatives to soft energy efficiency policies (Interviewee 1) as well as displace other competitive energy sources, as in the case of the large and well-regulated gas and electricity companies disputes with the less-regulated and more informal firewood industry (Interviewee 3). Stakeholders from the energy industry and energy authorities consider that conflict arise by lack of information/knowledge in communities, what turns them vulnerable to political use (Interviewees 4 & 5).

The Ministry of Energy, created in 2005, is widely seen as a proactive actor in promoting innovation and strategic planning (Interviewee 9; Interviewee 10; Interviewee 14). Regional authorities try to integrate energy production; distribution and consumption in the development strategy (Interviewee 1; Interviewee 10), and meanwhile local metropolitan authorities are perceived as irrelevant (Interviewee 9), although some municipalities have launched some small-scale initiatives in accordance with broader concerns of energy efficiency and climate change (Interviewee 14).

2.4 Future of energy

The content of the interviews reveal that energy provision and consumption is widely perceived as an activity already in transition, subjected to increasing market, institutional and cultural pressures and challenges.

Many of the interviewees referred to driving-change pressures as market originated, such as the eventual scarcity of oil, variations in the price of energy commodities and lower cost of technological innovations either to increase energy efficiency or to develop new energy sources (Interviewee 9). To some the priority is to overcome energy dependence and risk of crisis by increasing the country's capacity by welcoming new -and cleaner- energy projects (Interviewee 1; Interviewees 4 & 5; Interviewee 7). As a public official asserted, "people think it's an excuse, but I do believe there is still an energy crisis. Thus, these energy projects are needed" (Interviewee 13).

State actors mentioned the 2050 national energy goals in increasing renewable energy and energy efficiency as the major institutional challenge faced by the country. Many interviewees also identified as an institutional challenge -and opportunity- the materialisation of regulatory reforms, such as the net metering law, which may democratise the energy industry by allowing small-scale energy consumers to produce and sell their energy surplus to the national grid (Interviewee 4). Other stressed the challenges the new metropolitan atmospheric decontamination plan will pose to energy producers and consumers (Interviewee 9). Interviewees from local organisation such as universities and municipalities emphasised the development of ongoing projects of energy efficiency both for the organisation itself and for the organisation public (Interviewee 7).

Already taking place cultural change driven by environmentalism -either related to ecological or economical concerns- as a powerful source of market and institutional change towards a more sustainable urban energy (Interviewee 1; Interviewee 7; Interviewee 9; Interviewee 11; Interviewee 17). Some consider that the rise of more sustainable initiatives -often originated in the civil society- into urban policies and regulation demand a shift from the state's pro-growth position to a more sustainable and decoupled paradigm (Interviewee 1; Interviewee 12). As an ecologist regional councillor explains, current unsustainable paradigm produces conflict between energy and ecology: "[this] unsustainability means we have to choose between having health and ecosystems conservation... versus heating, transport and electricity" (Interviewee 1). To others, this rising cultural change needs to be reinforced by educating the population in energy efficiency and climate change mitigation (Interviewee 14).

3 Transect walks

Adapted from ethnographic and ecological methods, urban transect walks proved a valuable source of two main types of primary data produced from the researchers first-hand observation in the field: qualitative notes and photos.

Although the transect walks were defined by the researchers selection of an area with an observable and often large-scale energy infrastructure or energy flow, the specific route of the walk was partially defined by field choices (perceived attractions or constraints). Thus, landscape perceived and registered in the notes and photos does not match a cartographic model, rather it is a production that combines dynamic physical and human geographical variables, such as weather, topography and human activity. As the visual perspective of the pedestrian changes as he/she walks, this production of the landscape by a walk does not represent a fixed neutral perspective but a unique experience of the energy landscape.

Qualitative notes introduced the researchers own subjectivity in the assessment of the landscape, providing researchers with a primary source of data to be contrasted with interviews and literature information. The two main aims of this method were: a) to develop a street-level (pedestrian) perception of the energy landscape, what was registered in the notes as sensorial impact of energy infrastructure and energy flows; and b) to register how were the everyday interactions between people and landscape mediated by energy infrastructure and flows.

Five transect walks were conducted in four metropolitan boroughs of Concepcion, in industrial, residential and districts of mixed income groups, of focusing on the observation of infrastructure and flows linked to the production, transmission/distribution and consumption of energy (Table 2).

Table 3.1 Transect walks data. Source: Martin Calvet (2015).

Date	Transect	Borough	Area (land use)	Area (income groups)	Energy production	Energy distribution	Energy consumption	Notes
09 Nov	1A	Coronel	Industrial Residential Peri-urban Industrial port	Low Middle-low	Coal power plant	Maritime coal terminal High-voltage lines Low-voltage lines Coal strap Coal storage	Port Residential	4
09 Nov	1B	Coronel	Industrial Residential Industrial port Fishermen port	Low Middle-low	Coal power plant Biomass power plant	Maritime coal terminal High-voltage lines Low-voltage lines Coal strap Coal storage	Industrial Residential	3
10 Nov	2	Hualpén	Industrial Residential Natural reserve	Low Middle-low Middle	Petrochemical compound	Pipelines Oil/fuel/gas tanks High-voltage lines Low-voltage lines	Industrial Residential	3
19 Dec	3	Talcahuano	Industrial Residential Industrial port Fishermen port	Middle-low Middle	-	Pipelines Oil/fuel/gas tanks Tanker trucks High-voltage lines Low-voltage lines	Industrial Port Residential	3
26 Dec	4	San Pedro	Industrial Residential Horticulture Suburban	Middle-low Middle High	Biomass power plant	Pipelines Fuel station Tanker trucks Gas cylinder trucks High-voltage lines Low-voltage lines	Residential Industrial	3

3.1 Interpreting the area's socio-spatial configuration

Transect 1A was defined by a series of sections from the Eastern flank of the coal power station, where the electricity lines run to meet the national high-voltage lines, to the Western horizon of the beach, where a long industrial pier served to disembark the coal (Figure 3.1). The researcher's walked from the energy plant to the industrial port area where the coal was disembarked and the dirty waters of the plant discharged, exploring both the northern area of the supply/discharge lines (low income neighbourhood) and the southern area (peri-urban brownfields). Overall, the configuration of this landscape is represented by the idea of a very diverse area that is simultaneously united by and segregated by energy and transport infrastructures.

Figure 3.1 Transect T1A (red line). Martin Calvet (2015) by capture from Google Maps Engine 2015.

Transect 1B was mostly developed as an East-West section from the low-income plain neighbourhood of the fishermen in Lo Rojas (including their artisanal port) to the hill in the Western end of the bay (Figure 3.2). In the centre of the area, the transect explored the industrial compound (and its piers) made by a large coal thermal power plant and a set of fish industries producing fishmeal, canned fish and frozen fish. The configuration of the landscape gives the idea of concentration and overlapping of industrial, artisanal and residential infrastructures activities in a reduced area flanked by a hill (North) and the beach (South).

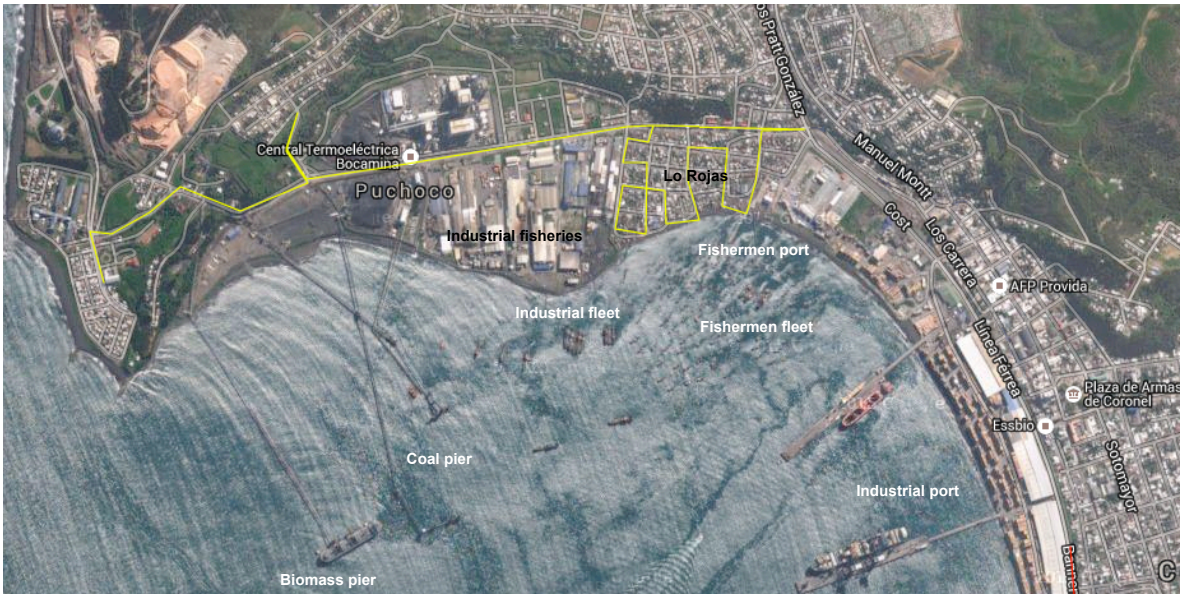

Figure 3.2 Transect T1B (yellow line). Martin Calvet (2015) by capture from Google Maps Engine 2015.

Transect 2 was developed around the large petrochemical compound in Hualpén, including the industrial oil pier, the nearby low-income neighbourhood named *Emergencia* (emergency), the slag deposits from the Huachipato steel company, and the roads to the natural conservation areas (Figure 3.3). The configuration of the area reflects the succession of conflicting land uses, first the industrialisation over a natural reserve and later the urbanisation of the petrochemical compound surroundings.

Figure 3.3 Transect T2 (green line). Martin Calvet (2015) by capture from Google Maps Engine 2015.

Transect 3 developed in a North-South direction along the industrial area in the San Vicente bay. In the northern part of the bay the transect walk explored the commercial port, the fishermen cove, the fish industries and residential area, and then the large steel and chemical industry compound south to San Vicente (Figure 3.4). The configuration of the area suggests the impacts of industrial-scale energy consumption-transport-production are deeply integrated into the urban landscape.

Figure 3.4. Transect T3 (blue line). Martin Calvet (2015) by capture from Google Maps Engine 2015.

Transect 4 explores a relatively new area of a suburban and peripheral residential sectors (developed since 1960), that contain wealthy (El Venado), middle class (Villa San Pedro) and low-income (Candelaria) neighbourhoods. Energy infrastructure and flows are predominantly for the transmission of electricity to homes and commerce, although the area also hosts a pulp and paper industry built before the neighbourhoods. Some high-voltage lines cross the area from the southern coal thermal plants (Transect 1A and 1B) to reach the metropolitan boroughs north from the Bio Bio river. Social stratification follows a clear topographical distribution: low income in the sea and river plains, middle income in the piedmont plains, and high income up in the hills surrounding the lagoons. The configuration of the energy distribution/transmission lines contributes to the variegation of the landscape according to class/income (inequality).

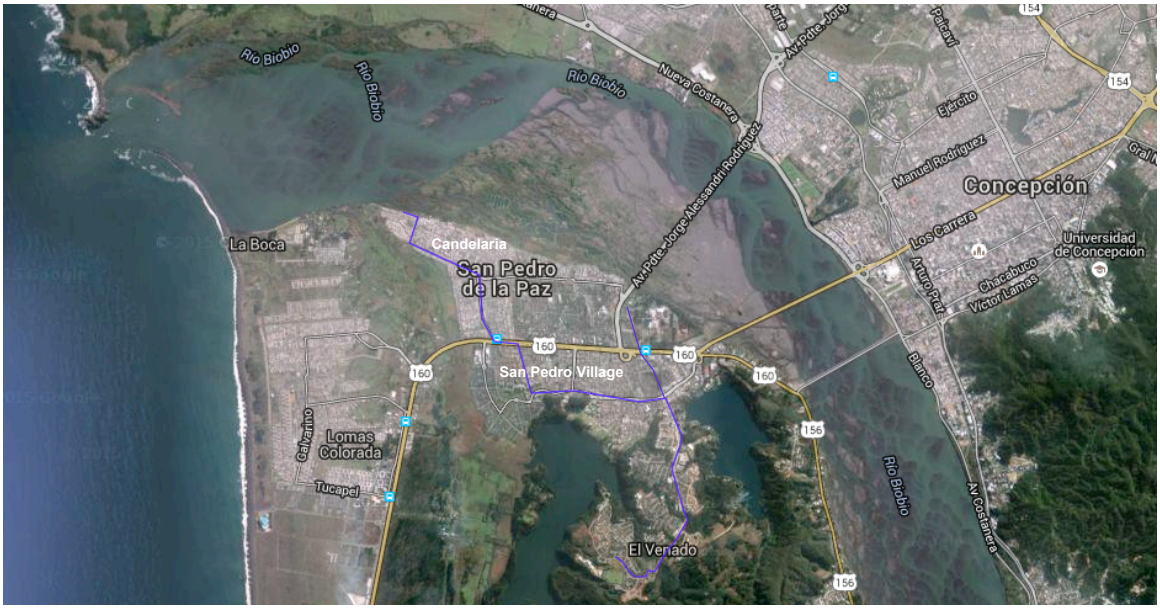

Figure 3.5 Transect T4 (violet line). Martin Calvet (2015) by capture from Google Maps Engine 2015.

3.2 Perceiving urban energy landscapes

The perception of visual impact of the energy infrastructure and flows in the landscape varied largely between the areas where energy was produced, stored, transmitted and consumed.

By their scale, the coal thermal power plant (T1A and T1B) and the petrochemical compound (T2) were partially spottable from almost everywhere in a large radius, even from adjoining neighbourhoods. In some cases, what was visually observable was not only the infrastructure for production, but also the storage areas, either hills of coal (T1A and T1B) of tanks for oil and derivate (T2 and T3). Transport and transmission infrastructure was observable as networks of pipes or wires immediately departing from the energy plants (T1A, T1B and T2) or alone crossing other type of territories such neighbourhoods, peri-urban areas with plots (T2, T3 and T4). Whilst low-income residential neighbourhoods (Transects T1A, T1B, T2, T3 and T4) coexisted with both visible (electricity lines and fuel/gas pipes) and invisible (fuel/gas pipes) energy networks, in high-income neighbourhoods (Transect T4) all the energy networks (electricity lines and fuel/gas pipes).

Noise -as metallic bangs and motor buzz- was constantly perceived immediately besides the energy plants (T1A, T1B and T2) and in some cases also as an electric hiss below/besides the high-voltage power lines (T1A, T1B, T2 and T4). However, few meters away the source the noise faded or was cloaked by urban noises, particularly that produced by transit in the nearby

motorways and avenues, in some cases by the sound of the sea, and even by the sound of street markets (T1B and T3).

Although invisible, smell produced a strong impression in the researcher's perception of landscape. Remarkable, each place had its own smell signature, even when related to similar energy flows. In Transect 1A an occasional and thin coal smell could be reported from the very new coal thermal power plant. Along the boundaries of the nearby urban area the smell of coal was covered by the stench of the water stream flowing from the plant to the sea, and when nearby the beach the dominant smell was a marine smell. In Transect 1B a stronger spell of coal could be perceived everywhere, although mixed with an even stronger odour of fishmeal produced in the fish industries in the area. In Transect 2 the pungent odour of fuel was everywhere, with variable intensities (sometimes even producing nausea) in accordance with the wind speed. In Transect 3 the smells perceived were often mixed (industrial, natural, urban) such as sea smell, oil odour, or raw/cooked food scent. In Transect 3 the smell of processed fish is overwhelming, decreasing accordingly to the wind direction. In Transect 4 sea breezes and grass scents were perceived in the low-income coastal plains, whilst typical suburban smells from cars and lawns were recognised in the middle-income plans and high-income hills.

The perception of touch was rare, although in some areas strong wind could be felt (T1A, T1B, T2, T4): in one case sand grains (T1A) and in other brought wood chips' particles (T1B) hit the researcher skin.

Although at first the idea that a perception of taste could be related to energy landscapes seemed awkward, during a transect (T2) the researcher bought and ate a locally cooked seafood samosa (empanada) besides the wetlands and with direct view to the petrochemical compound, what gave way to reflections on the intersections of energy landscapes and cultural landscapes.

3.3 Reporting socio-spatial interactions in energy landscapes

In Transect 1A the interaction between people and energy infrastructure and energy flows developed by transport, residential and industrial activities. Transport activities meant the transit of vehicles with fossil fuels motors by the existent motorways and main roads. Residential activities reported included the use of street light and the consumption of energy by households, mainly electricity from the urban grid, commerce of gas in cylinders, and

commerce of firewood. Industrial activities meant the work inside the coal power plant and port. The artisanal shipyard had a pole connection with electricity.

In Transect 1B people interactions with energy in the landscape were also transport, residential, industrial and artisanal activities as those reported in Transect 1A. What seemed new was that fishermen families also used sunlight and wind to dry fish. Symbolic interaction with energy included graffiti protesting against the coal thermal plant in the road to the area.

In Transect 2 the interaction of people and energy were reported in the following modes: transport, residential, industrial, tourism and sport. In this case, industrial included not only the import and storage of materials for the production of energy but also its storage (oil tanks) and distribution by industrial pipes or by cylinders in trucks. Tourism meant people visiting the traditional food sector in the beach, passing along the petrochemical compound. Sport meant the use of roads along the petrochemical compound as bike routes by metropolitan bikers, as well as the use of the plains below the large high-voltage lines as football field by teams from the low-income neighbourhoods.

In Transect 3 people interact with energy infrastructure and flows in many modes. The large industrial sector in the area employs thousands of workers and is a huge consumer of coal for steel production, what produces visually striking and environmentally polluting large deposits of slag. Two sites of large fuel tanks -supplied by underground pipes- from different companies show a busy activity of tanker trucks movements for refill. Fish industries and container parking in the beach block the vision to the see from the residential sector. Also, restrictions for digging holes in the pavement, to protect the many fuel and gas pipelines, prevents the existence of trees in the residential sector, what adds to the inhospitable character of the place. Two high-voltage lines -and its restriction zones- slice the area widening the existence of voids. Despite the many constraints imposed by the industrial sector, life in the residential sector seems to follow its own pace, kids can be seen in the playground and the street market thrives of movement.

In Transect 4 commerce of gas cylinders was spottable in the low-income neighbourhoods, while the two petrol stations in the middle-income area showed busy activity in both the pump area and the commercial area beside. Despite the existence of underground gas pipelines both the middle-income and wealthy neighbourhoods show high degree or arborisation. Space below high-voltage lines is occupied as green areas of very different standard depending on the neighbourhood: empty green-brown in the poorest area of the

Candelaria sector and nice garden areas with walkable and cycle lanes in the commercial strip of Villa San Pedro. The density of hanging low-voltage wires and electrical transformers often interrupts the vision in the low-income sector; in the middle-income sector the hanging wires are more evenly distributed and organised while in the high income sector low-voltage wires are underground and electrical transformers are more discretely placed.

4 Workshops

To register way the everyday use of energy perceived by households two workshops were developed in the two largest boroughs with residents of different districts (Table 3).

Table 4.1 Workshop information. Source: Martin Calvet (2015).

Date	Borough	Place	Participants	Female/Male	Adults (30+)	Income group
23 Nov	Concepcion	Secondary school	14	8/6	5/14	Low/Middle-low
16 Dec	Talcahuano	Neighbours association	12	7/3	7/12	Low/Middle-low

The non-probabilistic sample was set by an opportunistic procedure, which followed the readiness of a headteacher and a neighbours association's leader in contributing to organise the workshop. In both workshops the main methodology was the work of participants in groups on their everyday use of energy, which started with a motivation by the researcher, followed by a short introduction[2]. In the secondary school workshop the introduction was followed by the display of images of energy infrastructure and fuels, what led to a dialogue between the participants. While most of the participants acknowledged the usage of charcoal and firewood, teachers and school staff was well informed on diverse sources and modes of use of energy -such as thermal, hydropower, biofuels and LNG- and students recognised coal power plants, domestic cylinders of gas, wind farms and solar panels.

The groups were asked to debate on the participants' everyday use of energy devices and infrastructure for cooking/nourishment, lightning, thermal comfort, mobility and communication. Some of the most interesting debates workshop 1on the groups were on cost

[2] Clear information on the research was provided in this early step, including information about the research institution, objectives and the workshop's methodology. Anonymity was set as a standard for workshops and permission was asked to take notes and photos.

of eco-efficient devices, questions on human energy and difficulties to classify batteries either as energy source, transmission or storage mode.

In transport, all groups in workshop 1 identified the usage of fossil fuels in public transport and human energy for walking. Some participants reported the use of electricity in the urban train, and only one mentioned a horse-pulled cart. No one mentioned bikes as a transport mode. In workshop 2 participants mentioned petrol-powered taxis and buses as workdays transport modes, and skate, bike and walks in weekends. Some members of fisher families mentioned diesel-powered boats as transport modes.

For cooking, most of the participants in workshop 1 mentioned electrical devices as water heaters, microwaves, electrical ovens, fridges and freezers, as well as stoves of cylinder-gas, although while speaking the resource to other more traditional sources of energy emerged, such as firewood kitchens and charcoal barbecues for celebrations and parties. While gas was mentioned to cook lunch, electrical devices were mentioned related to heating water and food to breakfast or teatime. At first older women in workshop 2 found hard to link cooking with energy sources. Only when deepening in the detail of the cooking activities information on specific devices and energy sources emerged, such as lightning gas stove or collecting wood for the kitchen. Older woman linked traditional recipes to the usage of different energy devices, and weather, season and holidays to the cooking of traditional dishes. Students described their use of microwave and electrical oven as the main devices for cooking.

Participants in workshop 1 declared use of either electrical showers or gas-powered water heaters. In workshop 2 participants mentioned gas-powered water heaters only.

Groups in workshop 1 identified a diversity of devices and energy sources for thermal comfort: most of the participants mentioned their usage of gas-cylinder heaters and electrical heaters and radiators, whilst some mentioned chimneys and burning stoves. Air-conditioned for cooling was not mentioned, although some mentioned the use if ice coolers for camping. Groups in workshop 2 compared devices and energy used for thermal comfort in a winter and a summer day. Bad weather and early sunset was mentioned as the reason for increased energy consumption (heating, cooking and communications), as family members spent more time at home. Electric devices as radiators and electric blankets were mentioned as used in combination with firewood and paraffin stoves, which were used both to heat, cook and dry clothes.

For lightning the mention of electrical lamps was widespread in workshop 1, although the participants were divided on the economic benefits of use of LED and other eco-efficient technologies. The groups agreed on placing electricity from the grid as the most important source for the use of communication devices, mainly mobile phones and computers. In workshop 2 participants mentioned seasonal variation in lightning needs and also debated the cost efficiency of LED and low consumption bulbs. Members of fisher families mentioned the usage of oil lamps. Participants also mentioned the need to have alternative lightning devices for earthquakes.

Young participants in both workshop 1 and workshop 2 mentioned smart phones and computers as their main mode of communication, whilst older participants mentioned mobile phones, TV and post. Smart phones users stressed how they were permanently scanning walls for sockets and Wi-Fi bands for open networks. Participants in workshop 1 debated on the energy source and devices used in traditional postal deliveries.

Participants in workshop 1 also produced the record of a list of three short opinions by each participant on positive and negative impacts of energy as well as on the future of energy. A synthesis of the answers by category is presented in the table below, and show environmental and economic issues as the main concerns of this community workshop.

Table 4.2 Participants answers on energy impacts and future. Source: Martin Calvet (2015).

Category of answer	Negative impacts	Positive impacts	Future
Environment	8	1	
Inequality	3	-	-
Lifestyle	1	-	-
Environment + Inequality	2	-	-
Quality of life	-	8	-
Lifestyle	-	5	-
Security	-	1	-
Economy	-	-	5
Sustainability	-	-	3
Efficiency + Sustainability	-	-	1
Security + Sustainability	-	-	1
Economy + Sustainability	-	-	2
Cultural change	-	-	1
No change	-	-	1

In workshop 2 many participants mentioned the use of electric iron, sewing machines, ovens and electric tools as needs for family run food commerce or service provision. The second workshop considered a walk on the surroundings of the neighbours' association headquarters, in which residents were grouped by neighbourhoods and were asked to draw energy-related infrastructure and flows in a map of the borough. Digital copy of these maps can be found in appendix.

In both cases, most of the participants mentioned cost and environmental impacts as negative characteristics of energy. Substantial contribution of energy in wellbeing and work are mentioned as positive impacts. The future of energy is seen as one in which of this resource is both clean/efficient and cheap.