## A sociology of household energy infrastructures: the case of the stove replacement program in rural Chile.

Some preliminary findings and Ideas

Tomas Ariztia, PhD. Universidad Diego Portales, Núcleo Milenio en Energía y Sociedad.











## Energy use and infrastructures (Overview of research projects).

Energy use in a "solar home".

- Following installation and use of solar panels in homes (net metering).
- 10 families + Solar Panel Company "Ciudad Luz".

Energy poverty: heating practices and infrastructures.

- Tracing intergenerational change in heating practices (three generations).
- Focus on economically deprived households.
- 2 Communities:

a) New social housing complex in Santiago.

b) Social housing in Temuco (Southern Chile).

Heating Infrastructures and Energy Use: the case of the stove replacement policy program.

## Stove replacement policy program.

Aim at replacing old "polluting" firewood stoves by new high end kerosene and/or pellet stoves.

- Several versions of this program since 2000's.
- Focus on air pollution not on energy efficiency.
- Current version: replacing old stoves with new high end stoves without cost to beneficiaries.
  - People choose between three different type of stoves: pellet, Kerosene and Gas.
  - Old stoves need to be destroyed (discourse of eradication).

Currently one of the biggest and more ambitious environmental policies at the household level.

- Approx. 3,4 Million Pounds (funded by Local government and MMA).
- Organized by a score system: More points to families with young children and/or old people.

#### Recambio de Calefactores

#### EN QUÉ CONSISTE EL PROGRAMA

El programa busca cambiar un calefactor antiguo y más contaminante por uno limpio y eficiente en los hogares de Temuco y Padre Las Casas.

Los interesados deben postular al recambio. Luego de esto, si son seleccionados, pueden elegir entre distintos sistemas de calefacción, según sus necesidades.

El objetivo es reducir las emisiones de material particulado, producto de la combustión residencial de leña.

Ingresa a esta página para conocer las localidades donde se implementará y los requisitos de postulación.

http://calefactores.mma.gob.cl

Ministerio del Medio Ambiente • • •

## Fieldwork (an overview).

10-15 families.

Following replacement process (Kerosene stoves).

After installation process.

- 3 Interviews: one, two weeks and 1 month after installation.
- Sporadic visits and participant observation.

Next steps.

- Following Pellet stoves replacement program (5 cases).
- 10 more cases in Temuco.
- Interviews "upstream": policy makers, stove designers and suppliers.



Access

Ministry of the Environment vs. Toyotomi (Stove company).

House visits.

- GPS, Pictures and Phone Calls.
- First visit. Installers + ME professional.
- Next visits. Shadowing Installers:
  - Don Victor" (installer with a vast experience on stove replacement programs)
  - Seba (Toyotomi Employee).
- Spending the whole day installing stoves and talking about their experiences.



## The households

10 families living in rural area near a middle size city (Rancagua). Donihue – Lo Miranda – Machali.

Mostly households with young children or third age members.

• But...Several generations in one plot of land.

Different incomes levels and different houses sizes and materialities.

• From low income and relative precarious shacks to big farms houses of middle income families.



## 4 snapshots.

- 1 The Stoves.
- 2 The installation.
- 3 Heating practices.
- 4 Competing Systems of provision.

## 1. The stoves.

### OLD STOVES. "Hand made Stoves (often from recycled iron artefacts)"

- ✓ Inexpensive, easy to use and to obtain (often inherited).
- ✓ Relative autonomous from a system of fuel provision: rely on collected firewood.
- ✓ Part of the habitual repertoire of heating appliances in the countryside (firewood kitchen, brazier)
- ✓ Part of an ecology of heating appliances that organize heating practices at different times and spaces: hot water bottles, gas and electric heaters, blankets.
  - E.g. Morning Gas heater school routines. E.g. Old Person: bed and hot water bottle.



#### THE NEW STOVES. Toyotomi Kerosene Stoves with forced draught.

- ✓ Expensive: 1500 pounds, but free to beneficiaries.
  - Most of expensive kerosene stove in the market.
- ✓ Sophisticated : "estate of the art" in kerosene technology.
  - Programming is compulsory.
  - Rely on sensors and automation (easily "blocked").
  - Its use needs to be explained: Instructions, induction (to be discussed).
- ✓ Entangled.
  - System of provision: kerosene market and electric supply.
  - Formal network of technical maintenance.



Aporte del Beneficiario: \$0

Marca: Toyotomi Potencia: 5.5 kW + 3 kW= 8,5 kW Eficiencia: 92.7%



Modelo FF- 55T



Modelo FF-V30T

Opción 2: Sistema de calefacción compuesto

Características	
Modelo: ESTUFA LÁSER TIRO FORZADO FF-55T	
<ul> <li>Proveedor: Comercial e Importadora BBR S.A.</li> </ul>	1
- Marca: Toyotomi	
- Potencia: 5.5 KW	
- Eficiencia: 92.7 %	
- Capacidad del estanque: 7.6 Litros	
- Consumo combustible máximo por	
hora: 0.62 litros	
- Dimensiones:	
(Ancho x Alto x Profundidad)	
(49.5 x 60 x 32.5 cm)	
2)Modelo: ESTUFA LÁSER TIRO FORZADO FF- V30T	
<ul> <li>Proveedor: Comercial e Importadora BBR S.A.</li> </ul>	
- Marca: Toyotomi	į.
- Potencia: 3 KW	i.
- Eficiencia: 92.7%	
- Capacidad del estanque: 5.3 Litros	
<ul> <li>Consumo combustible máximo por hora: 0.34 litros</li> </ul>	
- Dimensiones:	
(Ancho x Alto x Profundidad) (46 x 54 x 30 cm)	
Ambos calefactores cuentan con:	Í
<ul> <li>✓ Sistema de evacuación de gases al exterior.</li> </ul>	
✓ Termostato.	
1 Made de constitute constitute	

automático

## 2. The replacement.

Defining the right place for the new stoves (knowing "flows of heat").

Removing firewood stoves.

Creating a hole in the wall for the forced draught (use of templates, practical knowing by repetition)

Installing the stoves and their electric plugs. Critical moment in the process involve extending the electric supply to the stove. Closing existing ventilation holes and sealing. Instructions: teaching beneficiaries how to use and maintain the new stove. Delivering the manual.





# The installation: adapting the house to the new stove.

- Installation problematize the relation between new and existing heating appliances and infrastructures.
  - Discussion often resolved in favor of "technical" reasons.
    - E.g. Presenting the stove as a fireplace.
- New stove technical affordances redefine spaces, things and uses.
  - E.g. 1. Making space and re organizing the room. Moving and throwing up old furniture.
  - E.g. 2. Kid with mobility problems and the partition wall.
  - E.g.. 3. New stoves in the new houses (or how the house reshape the whole house)



# 3. Heating.

### Heating practices.

A new temporality. New stove reconfigure the temporal organization of heating.

- Beginning and end of heating is automatized. E.g.: waking up in the morning to light the firewood stove.
- It required a different type of "attention" (instead of keeping the fire alive be aware of fuel and electricity).
- Redefines the place of other heating appliances and practices (ecology of heating appliances).

A calculated heat. Heating with the new stove requires a new competence: calculating.

- Programing as a core aspect of the new stove's operation.
- Metrics of heat comfort (C<sup>o</sup>) as key new component in the organization of heating: 20-35 c<sup>o</sup> as the "comfort zones".
- Multiple devices for "calculating" heat: stove screen, instructions, Internet calculators.
- Entangled with other type of calculations: economizing and budgeting (C<sup>o</sup> degrees and money come together)



## **Other practices.**

An "invisible heat". While old heat was visible (flames), new heat is invisible and circulate.

• E.g. Discussion about were to place the new stove and how the heat flows inside the house. Using the stove as a fireplace vs. place the stove in a secondary place.

With this new modality of heat, some heating related practices are questioned and other redefined:

- Drying clothes in winter (Sun?).
- Stay and talk in front of the stove. Drinking mate.
- Boiling water.

New practices of maintenance. New Stove requires performing new maintenance practices.

- Cleaning temporalities change: from dealing cleaning to a monthly revision.
  - This in turns redefine and problematize preexisting practices of care (ashes).
- New *fragile* objects are brought into the house: sensors, filters, buttons.
- New stoves are attached to an extensive and formal network of maintenance.
  - Closed to anyone but experts. ("it can be broken").
  - Technical service and call center as new actor.



From collecting firewood to buying Kerosene: changing infrastructures of fuel provision.

### **Old Stoves and Firewood.**

Old firewood Stoves mostly rely on collected firewood (often coming from pruning residues and/or sticks people collect from nearby industries and or hills).

In some cases, firewood stoves rely on a year long purchase of firewood which is stack up in the garden.

Firewood provision temporality is relative wide (annual cycle) and involve several practices:

- Yearlong purchases and or regular collection.
- Related to a bundle of firewood preparation practices: stacking, cutting and drying.



## Kerosene.

With the new Stoves heating became attached to formal system of provision organized as a market.

Important shift on how fuel provision is organized in time and space.

- New Stoves requires users to buy fuel on a regular basis.
  - Kerosene has to be bought in a weekly, daily basis (Liters or even less for every purchase).
  - The provision involves different volumes (kerosene is more difficult to accumulate).
- Needs organizing a supply chain (petrol station near home, house reseller, kerosene drum)

Marketization: New stoves involves people to became kerosene consumers.

- Price fluctuation: different supply, national discussion.
- Cash: needed for heating.
- Budget: How do heating enters into the family budget?



## Some ideas

# 1. Stoves and the reconfiguration of heating practices: fluidity and rigidity of heating infrastructures.

New stoves reconfigure heating practices.

- a) New competences (calculation).
- b) New temporalities.
- c) Redefine the place of existing heating appliances and practices.

They also reconfigure adjacent practices which are related to heat.

- a) New type of heat.
- b) Drying clothes, socializing, relaxing, cooking and using rooms, etc.
- c) Involves a new set of practice related to maintenance.

How rigid are the technical affordance of the new stoves?

How do new stoves dialogue with existing practices and routines?

Zimbabwe Bush Pump Success of a technical objects depends on its "fluidity" (de Laet & Mol 2000).

"In travelling to 'unpredictable' places, an object that isn't too rigorously bounded, that doesn't impose itself but tries to serve, that is adaptable, flexible and responsive - in short, a fluid object may well prove to be stronger than one which is firm" (de Laet & Mol 2000, p 226).

Can we understand Stoves fluidity in terms of their ability to reconfigure energy demand taking advantage of existing practices?

### 2. Competing infrastructures of provision.

Stoves are entangled in energy provision infrastructures (fingertips).

- Competing infrastructures.
  - Different possibilities associated to different appliances: electricity, firewood, pellet.
  - New stoves requires owners to start buying kerosene in oils stations (to become consumers of kerosene).
- New stoves also take part in an infrastructure repairing and maintaining.

Different infrastructures are not only material arrangements: involves an interrelation of social and technical elements (institutions, regulations, standards). They define normative modes of organizing energy supply and demand.

- In this case, with the new stoves families move from a relative informal and flexible system of provision (firewood collection) to an standardized market which requires purchasing kerosene in a weekly basis.

"String attached": an untended consequence of the stove replacement program is the marketization of heating practices: what was once a relative autonomous practice is now entangled in the market of kerosene supply.

#### Temperatura de confort



#### Tipo de calefacción actual

Corresponde a la tecnología que usas actualmente para calefacción.

ara



Para continuar, complete todos los campos solicitados



#### \*Considera una casa tipo 2, calefaccionándose durante 8 horas al día a una temperatura de confort de 18°C. v una demanda térmica mensual de 871 kWh

