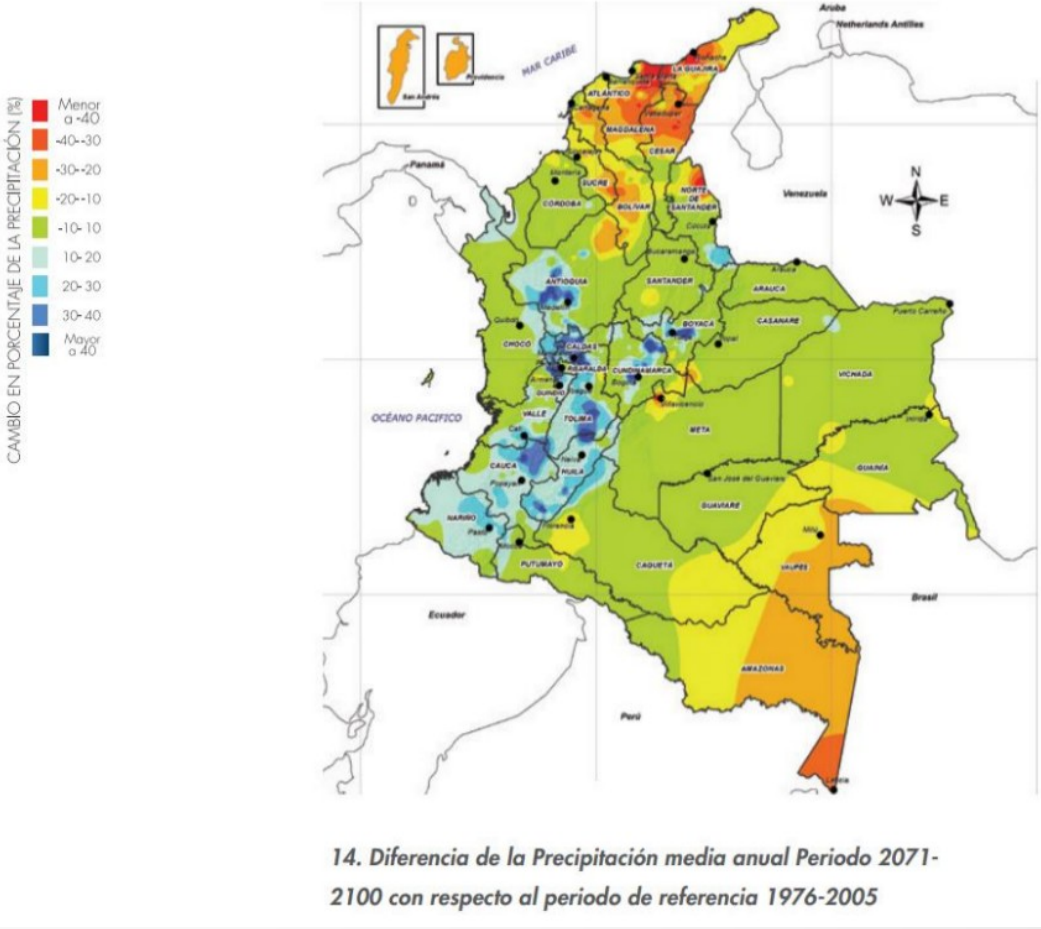

2019
20??
How many days to extinction?

Impact of climate change

- Climate change forces migration in Latin America, as this is one of the regions more vulnerable to natural disasters and climate change:
- Drought, floods have left more than 20 millon people displaced
- According UN climate change is more lethal than Covid

**Variations in rain volume in Colombia in 1976-2005*



14. Diferencia de la Precipitación media anual Periodo 2071-2100 con respecto al periodo de referencia 1976-2005

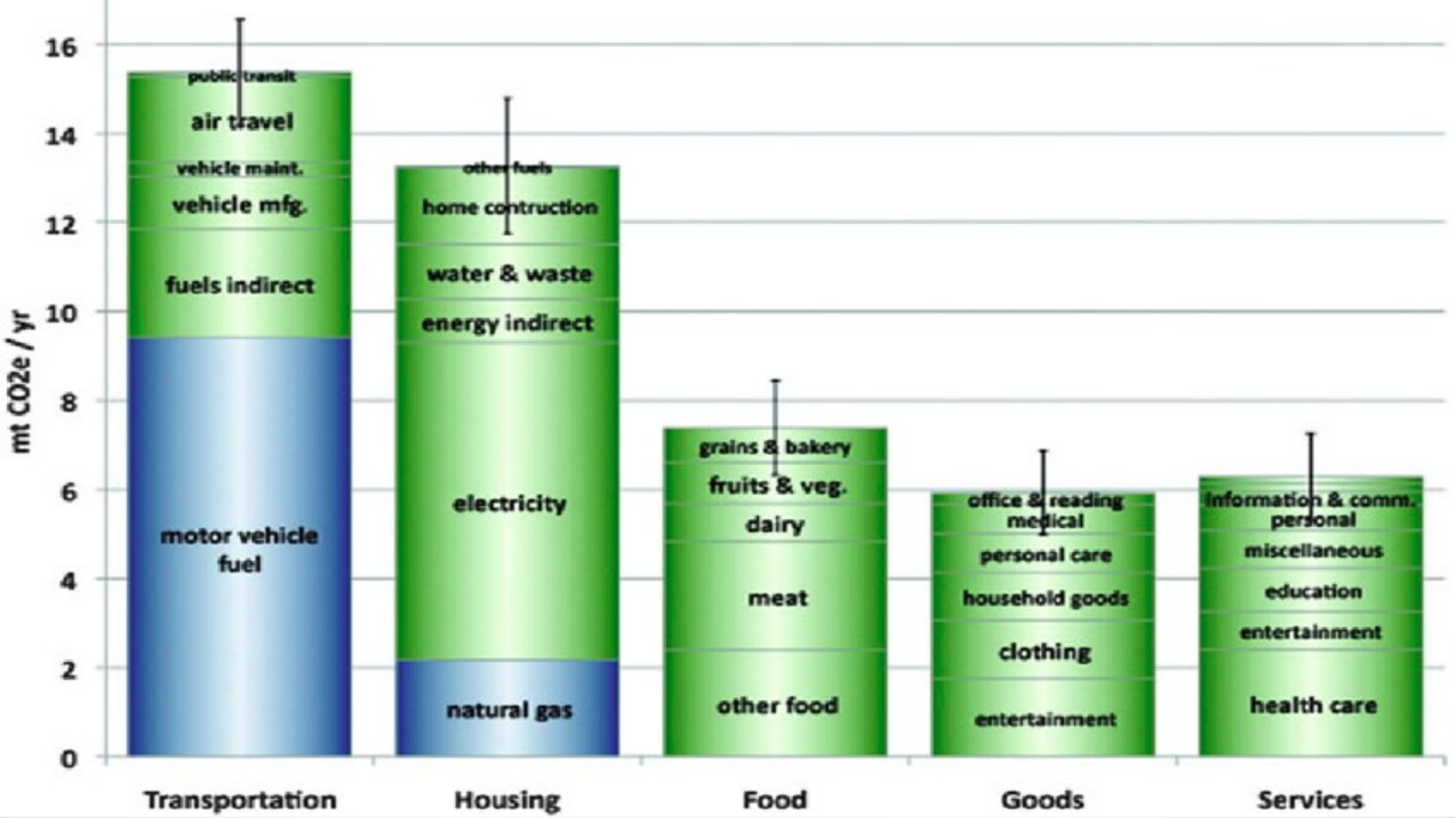
Carbon Footprint

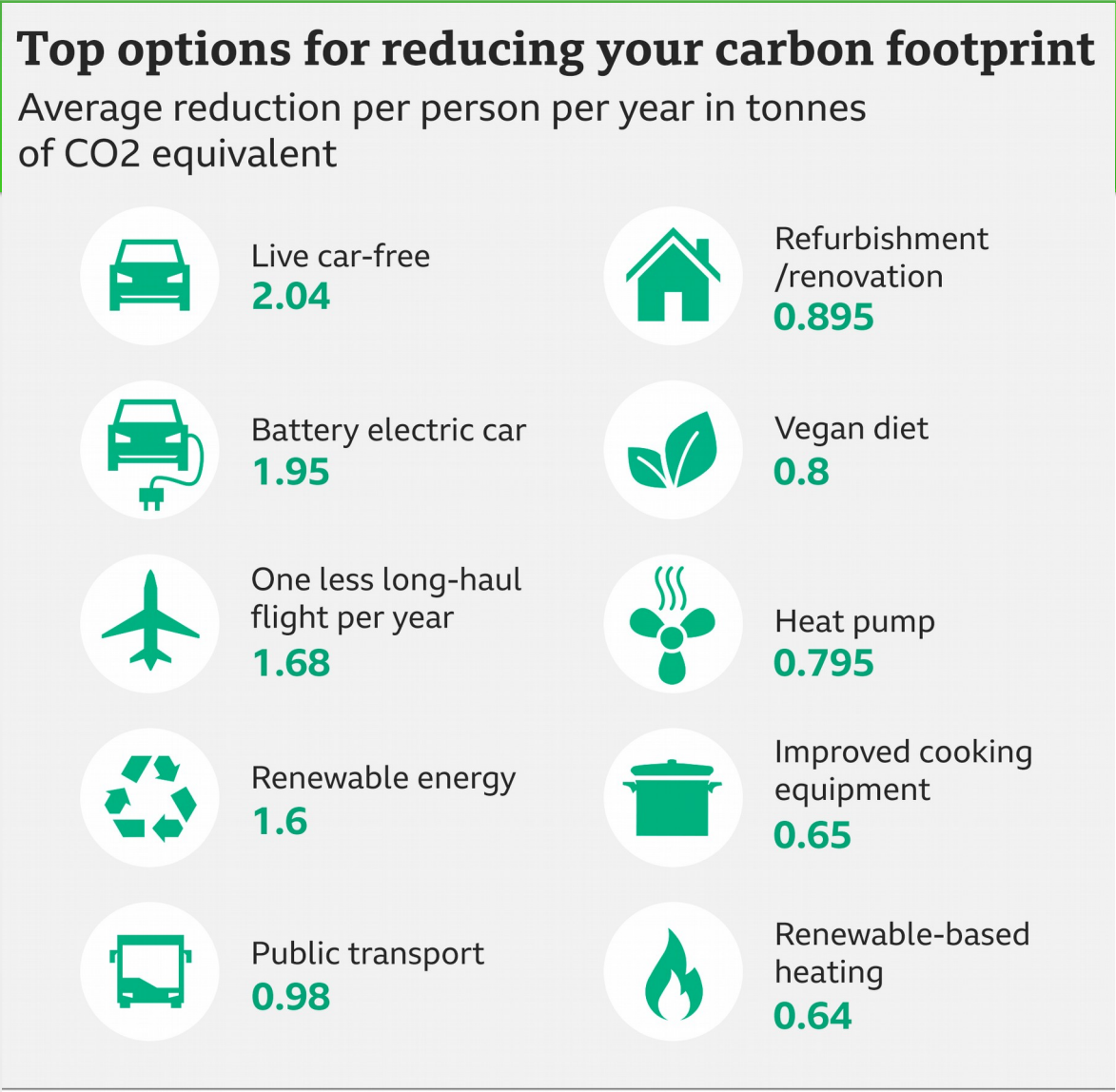
So, how can we help to reduce it?

The energy we spend in our homes impact the advance of the climate change

We can contribute by knowing how we use the energy, and optimizing their usage

But, how do we know it? The electric bill gives us only the total usage at the end of the month


mt CO2e / yr
16
14
12
10
8
6
4
2
0
public transit
air travel
vehicle maint.
vehicle mfg.
fuels indirect
motor vehicle fuel
other fuels
home contruction
water & waste
energy indirect
electricity
natural gas
grains & bakery
fruits & veg.
dairy
meat
other food
office & reading
medical
personal care
household goods
clothing
entertainment
information & comm.
personal
miscellaneous
education
entertainment
health care
Transportation
Housing
Food
Goods
Services



What's in our hands?

- We can help reducing transportation and replacing by more ecologic options, but that is not an option for everyone as most of people uses public transportation
- So the next option is to do more efficient usage of renewable energy

Factors affecting measurement of CF

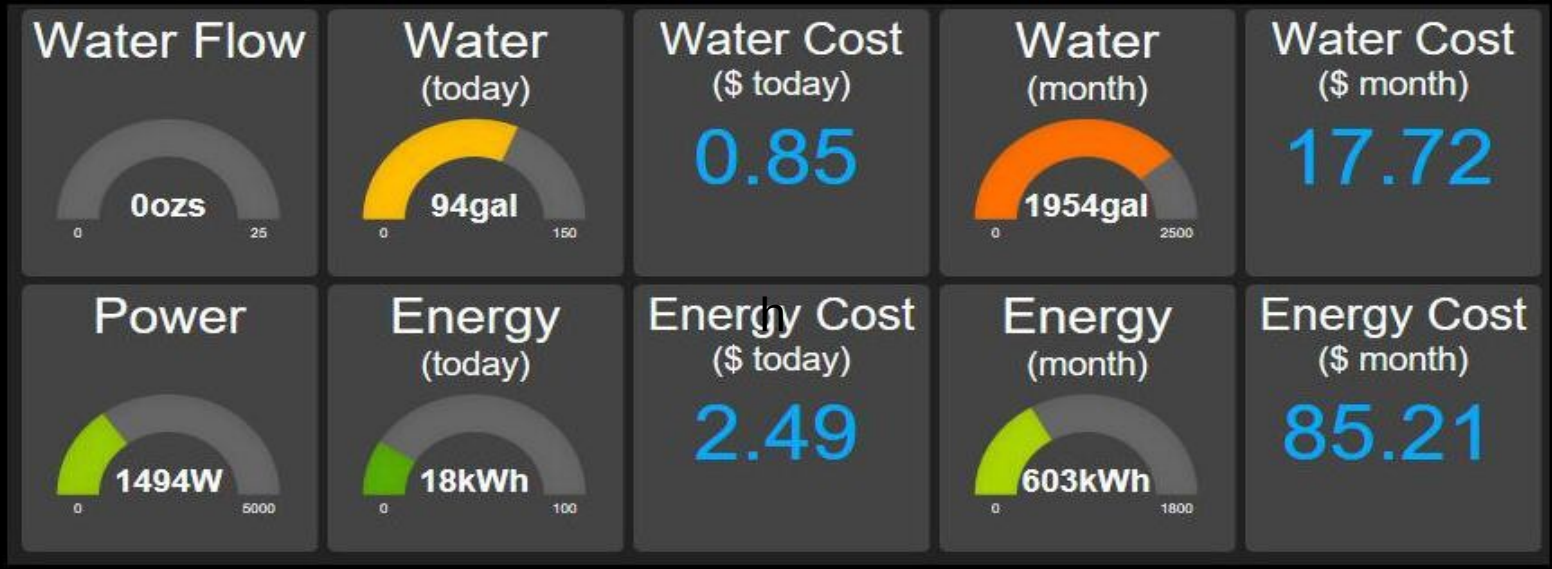
The impact for same amount of energy is different if it comes from coal plant, nuclear, hydraulic or clean energy like solar or wind power

Also water cost is not the same for everyone (water well, rivers, reservoir)

If we are going to measure our contribution to reduce carbon footprint it should be an automatic process with minimal human intervention, getting info from adequate sources of info and correlating it to the measurement data

Our project

- So, what if we could measure our consumption at home and at work (water, gas, electricity) in a cost effective and collect these measures in a reliable way, and in a longer way to get recognized by our efforts?



Hometer

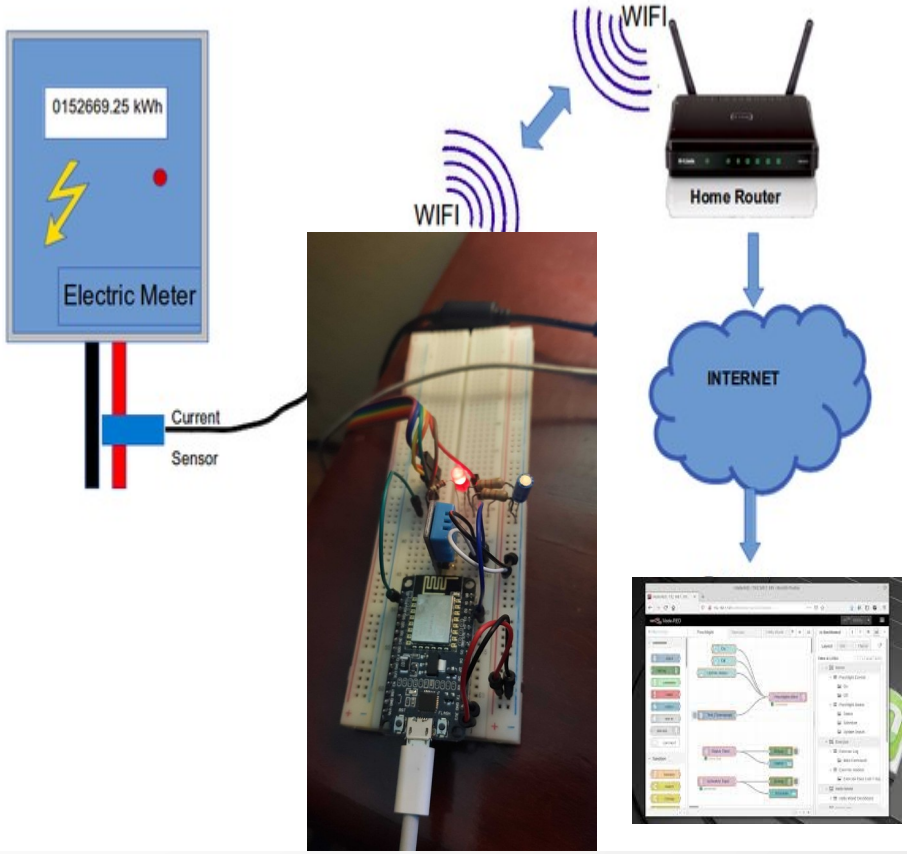
- All houses, even the poorest, have circuit breaker and several circuits to control devices at home:
  - One for freezer and kitchen
  - Other for illumination
  - Other for cooling or heating
- Usually secondary circuits behalf main breakers
- So we can plug the circuit in a single point and also control the usage of it.
- The same applies for gas or water

Description

- Our project considered the use of non invasive sensors to measure current and water lr gas flow to determine the hourly consumption and be able to measure also reduction in consumption in order to produce a carbon footprint bonus
- The placement is on the main electrical panel and uses 1 or two sensors (depending on the phases of the current)

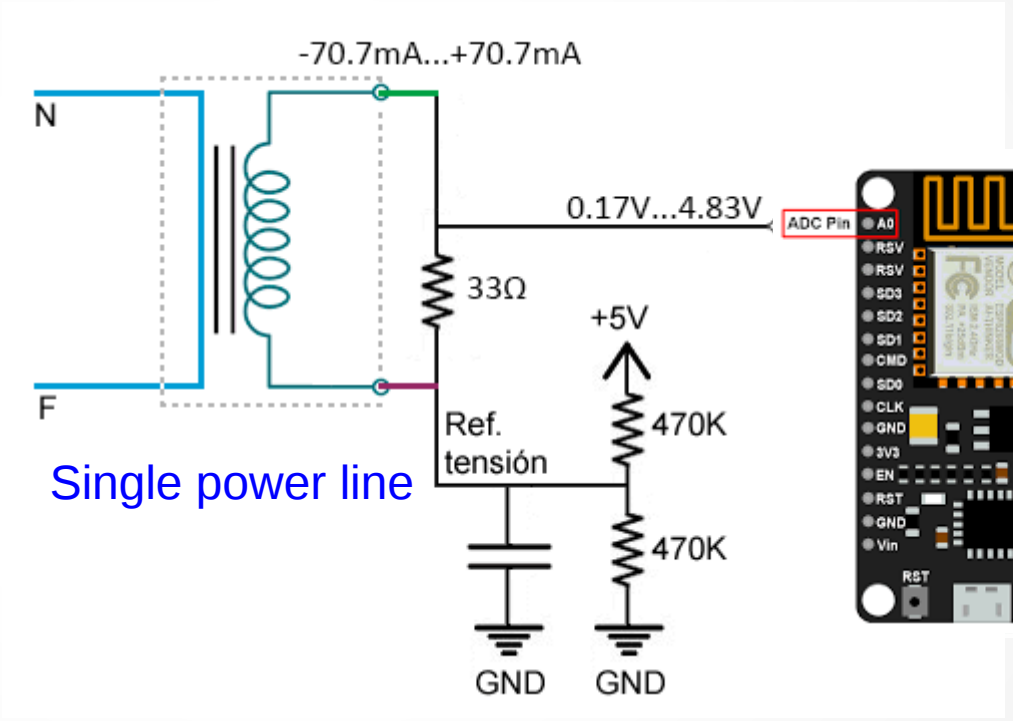
Connectivity

The measured data is sent thru home router (or mobile phone tethering) to Watson IoT and then to node-red app in where the consumption can be retrieved including historical data



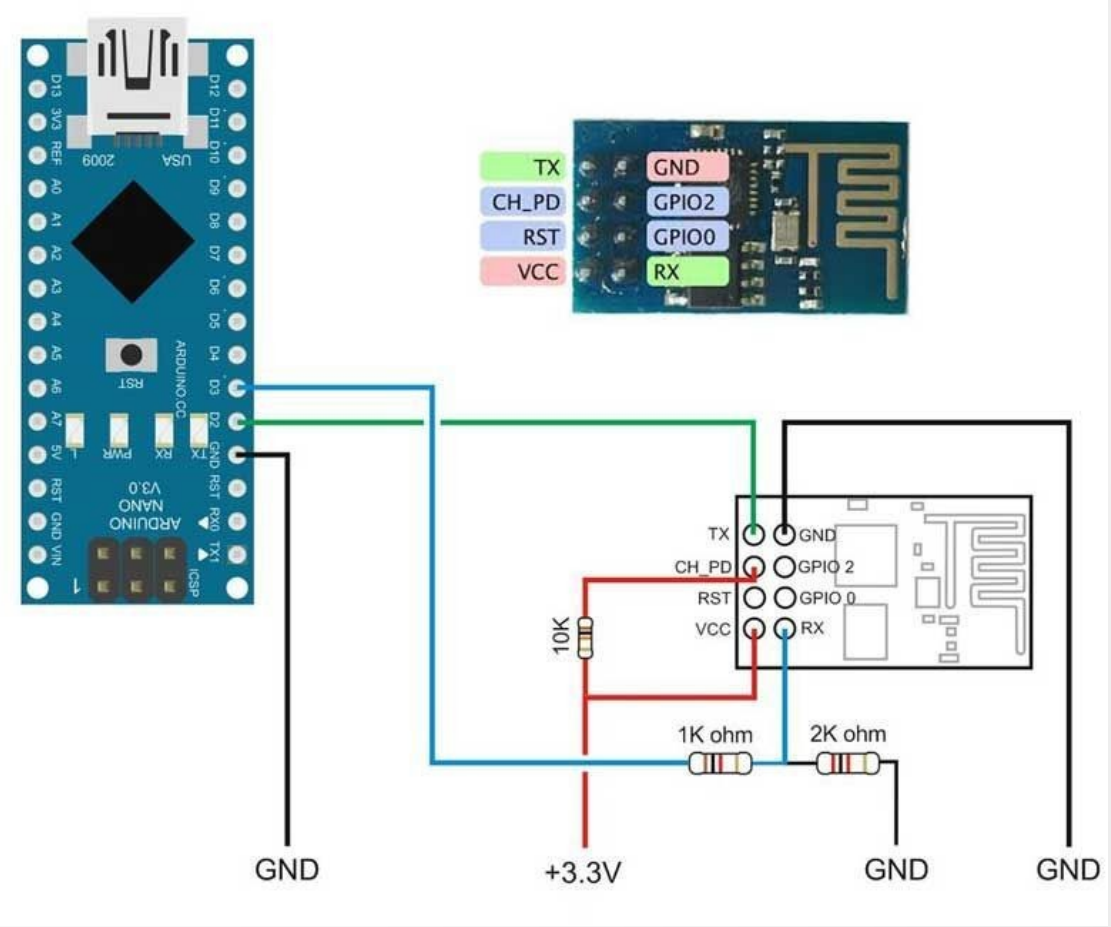
IoT Device design

- Single design and single chip design for minimal costs
- Energy sensor SCT-013-000
- WiFi microcontroller: nodemcu ESP8266
- Temperature and humidity sensor DHT11
- Optional G3/4 flow sensor to attach to water or gas pipes



Other device designs

- Multiple analog lines, for example for bifasic and trifasic lines, need to switch nodemcu board by arduino nano plus ESP01



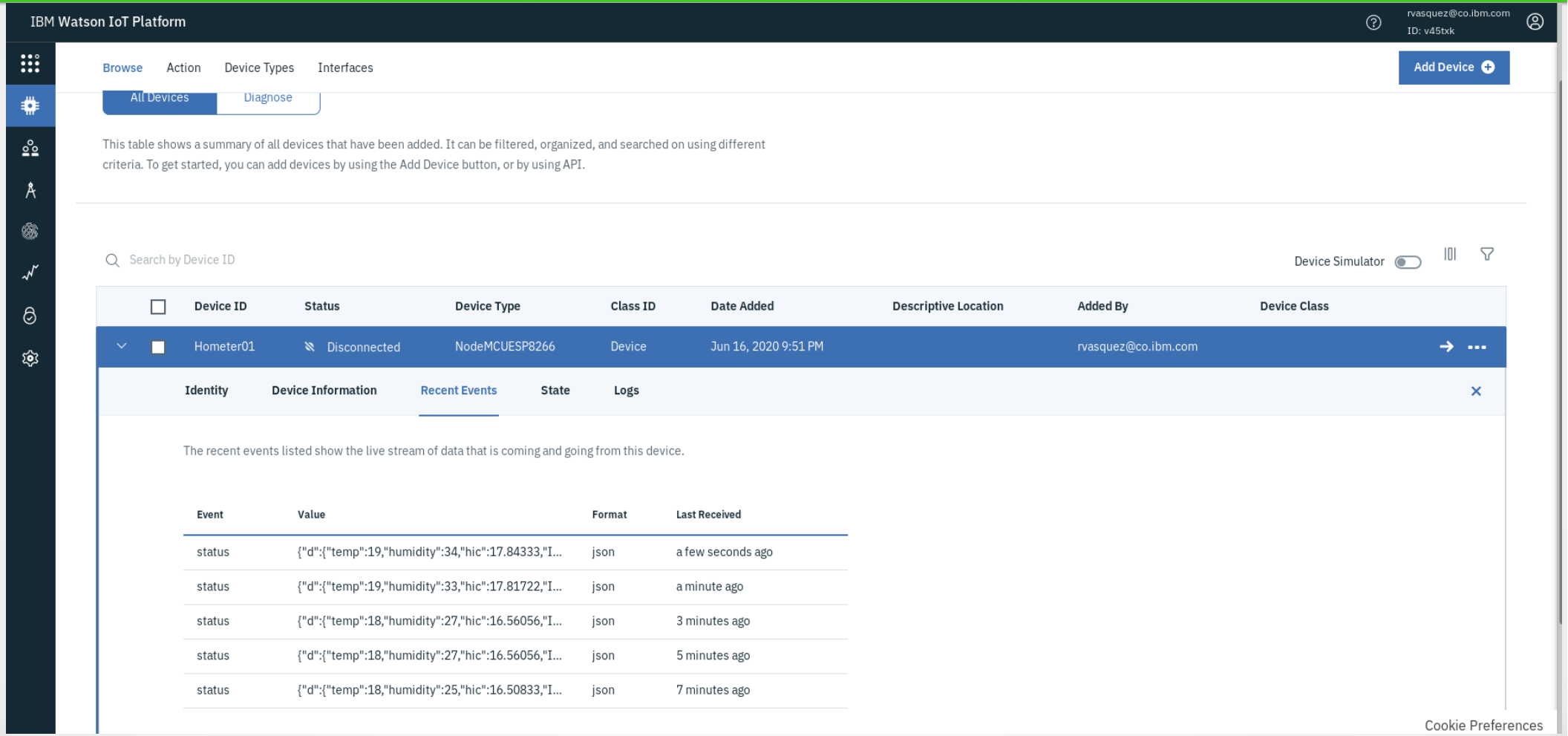
So here is me with the device used

In the device used we considered also relays (in the concept we used low power) but tested with solid state relays So the Hometer also can control expense in a daily or weekly by switching off circuits once it reachs its quota

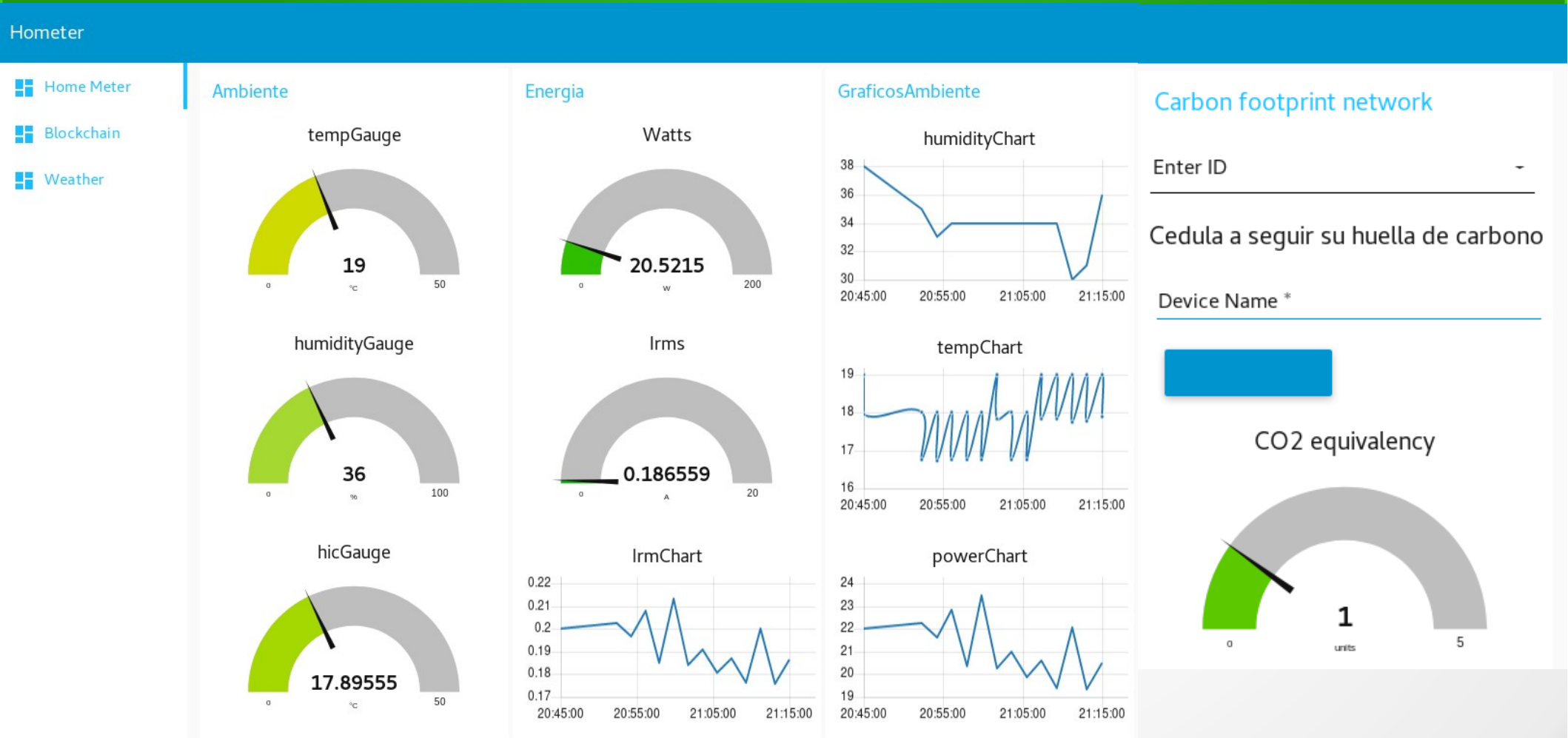
Registration of the device

- In order to register the device (both in Watson IoT and in BlockChain) first we need to configure WiFi
- First the device creates a hotspot on a private network. The cell phone the connects to this WiFi to 192.168.4.1
- Then the user registers the SSID for wi-fi. Can be used mobile phone tethering to connect to internet
- The ID for device is a combination of device mac-address and the Name (owner ID)
- The variables measured depends on sensors adapted to device (in the example power, temperature and humidity)

Registration on Watson IoT for multiple devices



The personal meter



Next steps

Develop additional capabilities for Hometer IoT device

- Energy remote control
- Device mesh network

Develop additional capabilities for Cloud app

- Historical decrease of consumption
- Energy efficiency in correlation with hourly power and water costs

Integrate CO2 equivalencies to the carbon footprint network

- Sources from energy companies and operation scheduling (operation of coal and natural gas power plants)
- Real consumption for home appliances

Funding for financial compensation of CO2 contribution

- Sources from energy companies and operation scheduling (operation of coal and natural gas power plants)
- Real consumption for home appliances