Production of vehicle fuel from landfill gas

– how to succeed

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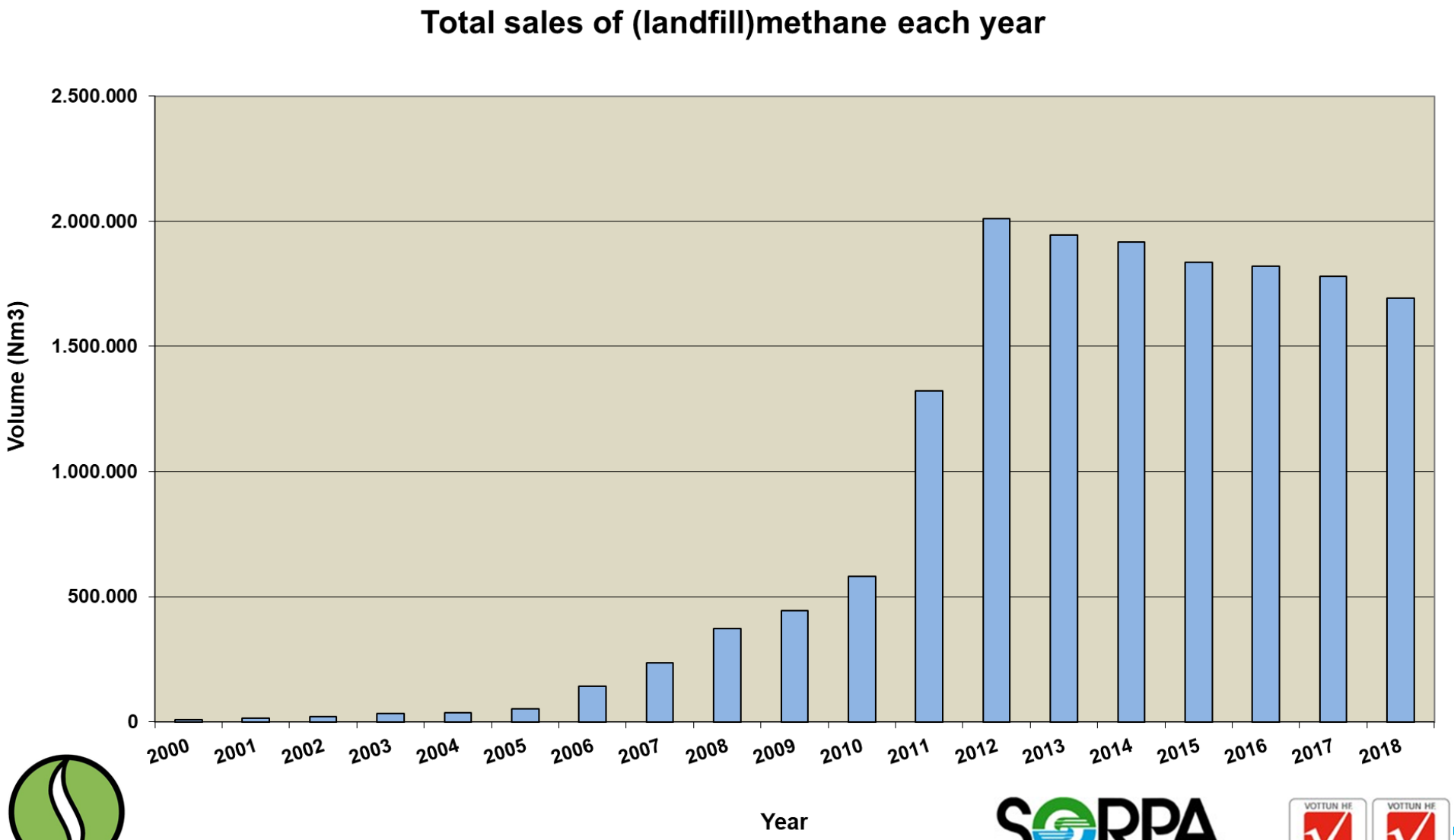
- A municipality owned, not-for-profit waste management company
- Inter communal company – largest owner of six is Reykjavík City
- SORPA runs 6 recycling centres, 80 drop-off centres, a shop for used household goods, receiving and sorting plant and a landfill with a biogas upgrading plant
- About 112 Man-years by 140 employees, annual turnover around 31 million Euros
- Reuse, recovery, recycle and landfilling

Pathway

- Collection of landfill gas at Alfsnes landfill started in 1996
- Upgrading to vehicle fuel started in 2000 – used a small water scrubbing pilot plant
- New plant installed in 2006/2007 using same technology
- First gas-pipeline since WWII installed in 2006/2007
- Increased number of NGV vehicles until 2011/2012
  - All waste vehicles operating in Reykjavík City
  - Two city buses
  - Many companies utilising Light service vehicles
- Then Competition Authorities introduced themselves!

Development



Physical obstacles

- Mostly technical issues:
  - Choosing the right equipment
  - A landfill is a mine vulnerable to sudden changes!
    - Air pressure, rain, landfill cover material etc. influence the conditions in the mine from day to day
  - The landfill is unhospitable to many materials like iron and aluminium – they will fade away briskly!
  - Upgrading is fairly straight forward using a known method
  - Getting the fuel to the market is difficult (no gas grid)
  - Few vehicles available – limited demand

Non-physical obstacles

- Mostly „perceived“ obstacles in the mind of nonbelievers
  - Farting gas!
  - Electrical vehicles will make CNG/LNG vehicles obsolete tomorrow!
  - Hydrogen vehicles will make CNG/LNG vehicles.....
  - Why are you in the way of development?
  - It is too expensive
  - Biomethane can never change out the entire fleet, why then bother?
  - Engines using CNG don‘t provide same power as gasoline or diesel vehicles
  - CNG powered engines are more prone to failure than regular diesel or gasoline engines
  - The gas is so unclean that it damages the engines….
  - Nobody manufactures CNG/LNG vehicles

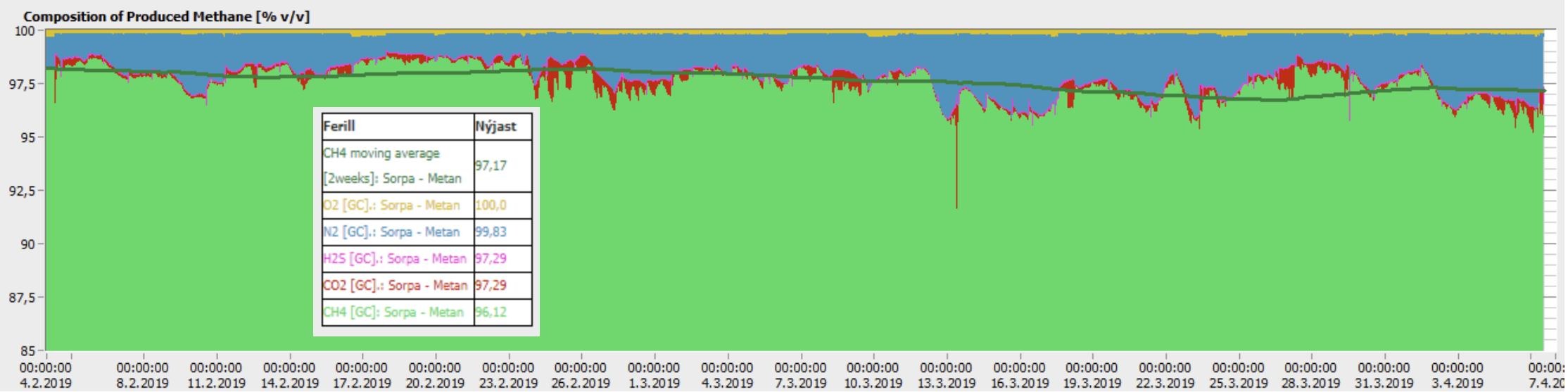
How to overcome obstacles

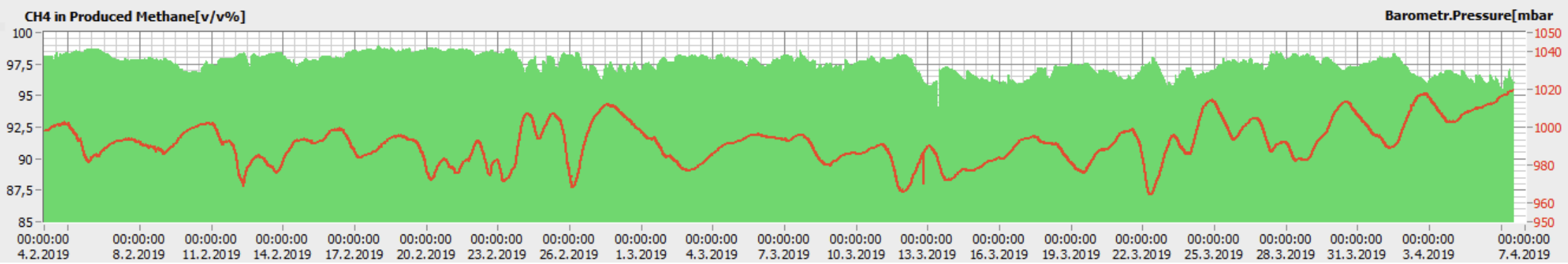
- Technical obstacles
  - Laws of physics!
  - Known methodical regular engineering measurements and sticking to a plan!
- Imaginary obstacles
  - Constant PR!
  - Political backup!
  - Faith – do not falter from plan!!
- Economic obstacles
  - Needs faithful customers that utilize the fuel
  - Political backup!

The collection system

- Move the focus from known upgrading process to the actual source of the gas – the landfill
- Monthly measurements to follow on outside environment variations
- Monthly adjustments of the system with network mesh approach and time analysis
- Outside partner for continuous systematic approach

Quality control





Present situation

- Around 1.700 NGV small vehicle equivalent on the roads
- SORPA is building the first biogas facility in Iceland
  - Will be operational 20.02.2020.
  - Volume of available CBG will double in the beginning
  - Interest in CBG usage is on the rise, both as vehicle fuel but also for use in industry:
    - Laundry
    - Drying of additive to cement
    - Crematorium
    - Printing industry
    - Convert to CO_2

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Future

- More biogas facilities will be installed – when is the big question:
  - Mostly in agriculture (manure)
  - Municipalites in northern part of Iceland will upgrade a composting process to biogas process in near future
  - Energy crops on set-aside land?
  - Organisms in the Atlandic ocean – a new source and/or feedstock?

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