Summer - 2019

No-Regrets Negative Emission Technology (NR-NETs)

how to become more energy independent, & contribute to the fight against climate change

First

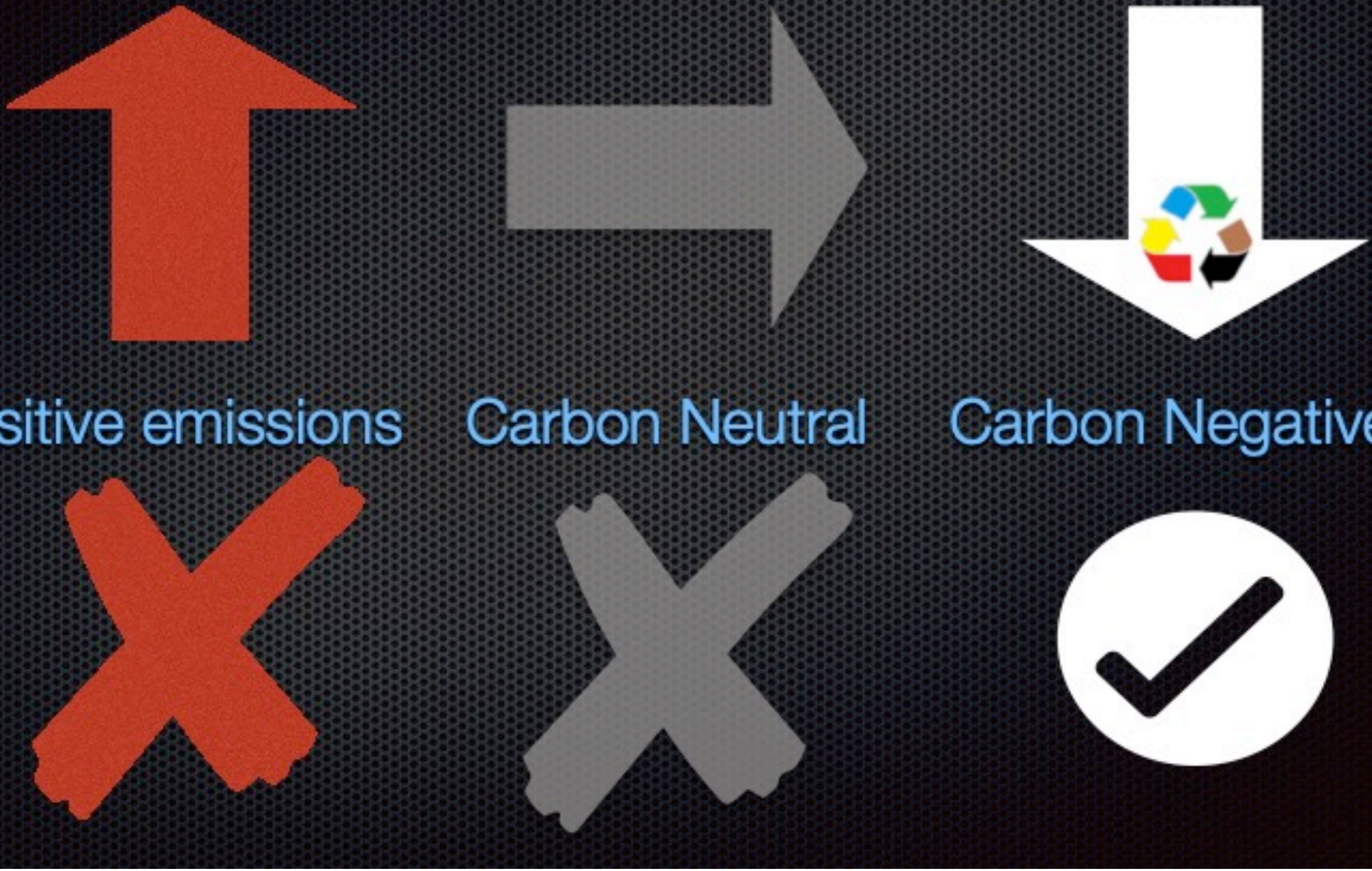
- Thanks to IBI, the organisers and the Finnish hosts for the opportunity to speak here today,
- What we want to talk about:
  - briefly tell you what we do and why and how we got here,
  - our current focus (solution, tech., market) and…
  - open a conversation

Climate Change & Status Quo

- The Intergovernmental Panel on Climate Change (IPCC) published a landmark report in October setting out what governments need to do if they are to fulfil the Paris Agreement.
- The IPCC said that meeting the 1.5ºC target implies reaching net zero CO2 emissions globally around mid-century, together with major reductions in other greenhouse gases, and that negative emissions will almost certainly be needed.
- Pyrolytic carbon capture and storage (PyCCS), is then also known as Bioenergy-Biochar Systems (BEBCS)

Please Note: Bio-energy with carbon capture and storage (BECCS) is something else! BECSS refer to carbon dioxide capture and storage (CCS) technology applied to a bioenergy facility.

Breaking away from status quo



Carbon Negatives come in different flavours

?	CO2 in the ground (BECCS)	Air Carbon Capture (DACCS)	Tree Planting (Afforestation)	Biochar	PyCCS (BEBCS)
What is it?	While extracting fossil fuels, large oil company refine CO2 and pump it in the oil field miles underground	Very large plant extract CO2 from the air and stores it in liquid form and make it available for other uses	Tree absorb and store CO2 from the atmosphere when they grow	Biochar stores carbon in agricultural land for at least 100 years	Techs for capturing CO2 from "burning" biofuels and storing it underground. Among several there is also PyCCS
It is ready?	Yes, but only available to large oil conglomerates because (plant cost in the hundred of millions of Dollars /Euro)	There are 2-3 experimental plants in the word. It requires large initial capital investments.	Yes. There are well established and certified project in the developing countries for which they were thought for.	Yes. Technology for biochar is proven, however there are fewer std. method for calculating the benefits that with trees.	Yes/No. There are several techs but very few facilities operating commercially.
How muchCO2?	Undetermined. Each plant can store thousands of tons, but both environmental concerns and steep initial costs limit it.	Undetermined. Each plant can store thousands of tons, but steep initial costs limit it.	Up to 100% of emission from the human activities for several decades, depending on available land.	Estimates between 9 &15% of annual emissions from human activities. Sustainability of biomass sourcing is the critical element.	Estimates 6 to 15% of annual emissions from human activities. Sustainability of biomass sourcing is the critical element.

SOURCE: CARBON TRACKER, ROYAL SOCIETY: "GEO-ENGINEERING THE CLIMATE" (2009) AND OWN CALCULATIONS.

BiokW, in brief

Tech-CO2

Nimble gasification technology

Very poor biomasses transform into

- bio-energy (syngas) and
- bio-charcoal (biochar);

Immediately (really) renewable energy

Some energy independence

Capture of CO2 (NET)

Contribute substantially to the "Agenda 2020" and "2030" objectives.

1:1 demo plant in a research centre (TRL6)

We test many scenarios for our clients before we deploy the full technological solution;

Targets:

1. fruits & veggie+ nurseries (horticulture)
2. green waste management

3 to 6 months

Circular economy circuits for the next 10+ years;

Our strategy

- We solve problems for very specific customers, or group of customers in proximity,
- We try to understand what is wrong with the business status quo (i.e. energy costs, waste, environmental impact, Co2 etc.), and what is wrong with the current service offering of our direct and indirect competitors, and exploit it.
- We did not design our system for “average”, because nobody likes the same thing

Why energy and biochar?

- One fundamental starting point is that pyro-gasification of secondary biomass as opposed to composting, mulching, sometimes digestors or infield burning results not only in net sequestered CO2 in the biochar, but also, and maybe most importantly in a marked reduction of airborne pollutants [PM2.5, SOx, NOx, CH4, and NMOCs] and smog precursors that have a great impact on public health.
- Henceforth the energy and the environmental sustainability can and must go along together.

BiokW combines economically the energy and the biochar

BiokW combines and optimises the **transformation** of **secondary biomass** into energy and charcoal, specifically it transforms up to 95% of waste material into a gas (**syngas**) and at least a 5% in carbon (**biochar**), though biochar production can be pushed up to 30% of the input depending on the client's objectives.

- **Syngas** can then fuel an industrial burner, with which we can produce either heat or chill or electricity
- **Biochar** is a soil amendment which stores the CO2 for hundred of years and can be used in agriculture in many ways

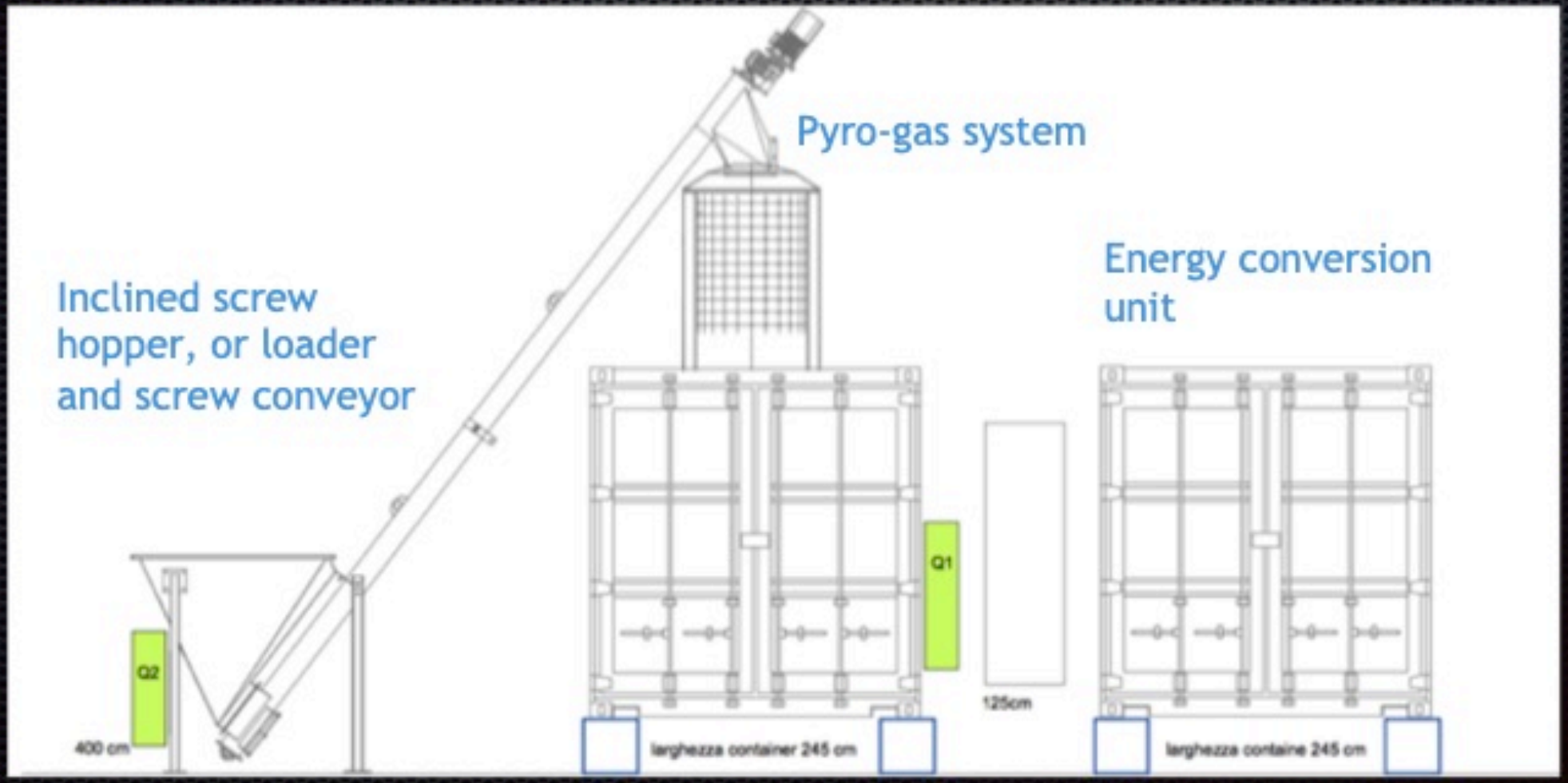
BiokW's economics of energy and the local use of biochar

- Our system is optimised for the on-site **transformation** of **secondary biomass. BiokW does not need** prime wood harvested purposedly for energy consumption like fire wood, chip wood, pellets, etc. It can use also a blend of feedstock.

- The "energy" produced by BiokW's system **pays for itself** and creates an **economy for "secondary biomasses" and char.** This secondary biomass would generally be disposed of, as waste or worse, and would be in an *open-end-cycle* like going to a landfill or be burned in the fields

- The biochar, transformed in the same process, is available for several uses; a substitute for peat, or an amendment in several types of crops, or used in animal farming practices.

Space: < 100 sqm



Energy to transform and cold-store crops or heat/chill buildings

- F&V/Horticulture (nursery, plants production, industrial conservation of products and transformation)

- *Animal Farming (conservation, pasteurisation…)*

- *Crops transformation and food productions*

- GW; closing open-ended cycles in-house (no+ landfill or incinerators), up to starting collaborations where public and private buildings (cooling, heating, sanitary water…) get ***energy-as-a-service***

A containerised solution

To meet **energy needs+uses** the available Biomass is **transformed**

- **1.000 tons** of feedstock/biomass could match the equivalence of **1.000.000 Kwh** / year of renewable energy readily available for several uses:

- fuelling a fridge (heat pump)

- fuelling a heater (hot air or boiling water, etc.)

- fuelling a generator (making electricity and heat)

BiokW's NET solution captures **CO2 efficiently**

- Overall the system delivers a **boosts in climate change mitigation** in the form of **averted** emissions, **replaced** emissions and in **captured** CO2, where out of **1.000 tons** of secondary biomass we get:
  - **1550 tons Averted Emissions** (emissions which would have occurred had we left said biomass to rot on the ground or be burned in the fields)
  - **200 tons Replaced Emissions** (emissions substituted by using a renewable fuel rather than fossil fuels)
  - **5-600 tons Captured and Stored**, the 5-600 tons of CO2 "locked" in the biochar, which will be laid to rest in the soil for >100 years

BiokW's **biochar rocks**

From pruning to cold-storage

With the **Salvi Group**, BiokW is currently studying the first ever implementation of a “closed system” in Fruits+Vegetables production & Nurseries, where pruning from the Group's own fields will become *fuel* for the industrial fridges and cold storage facilities, and the biochar becomes a substitute for peat and a CO2 capture tool.

BiokW makes energy from *really* renewables biomass (agri-food)

BiokW is optimised for using secondary biomass from agriculture, food production, transformation and animal farming…

These are readily available biomasses that need a minimal effort to be made into feedstock

Advanced Urban Forestry

We are working at the implementation of a “closed cycle” also in the towns and cities. We are supporting service providers of many municipalities in the North of Italy, to transform their management practices of Public Green Areas, in order to store CO2 and produce energy

Changing the practices

- Thanks to our technology, our clients can implement (what we call) “advanced urban forest management” services. Where the management of public green areas (parks, gardens etc.), instead of being just a sunk cost, becomes a source of revenues in the form of lower costs for waste management, lower cost of energy (heating or cooling offices of the local school or the municipal buildings, or even the swimming pool etc.), and the biochar is used instead of peat for example, when planting trees in the cities and by capturing CO2, it helps the city to reach its CO2 targets

- Most importantly, we enable a reverse of the strategy used to manage green areas. As of today, these are managed in the logic of minimising the growth of biomass with highly aggressive pruning. With our approach the green areas can be managed in order to maximise the amount of secondary biomass said areas can produce. This also delivers a much greener “green area”, with lush trees, healthy plants and in general a better quality of air and water.

BiokW makes energy from *really* renewables biomass (green waste)

Green Waste management of our cities urban and peri-urban forests, parks, garden also could provide large amount of renewable “fuel” reduce disposal costs, and improve the resilience of cities thanks to biochar.

Next? Composting + Biochar

So, what?

- We have a proven technology, a clear approach to specific market segments (and way to finance our tech), and an extended organisation plus strategic partners to support our approach internationally,
- We have a 1:1 demo plant in a major research centre in the heart of Europe where we can pre-test any scenario we might be faced with,
- The biochar we transform in our plant, is compliant to the most demanding regulatory frameworks and fully certifiable as soil amendments or CORC
- Our solution is nimble, scalable, market ready and can be configured for different application scenarios very quickly (time to market 3 to 6 months) and has a life expectancy of +10 years
- On top of the direct sale model, we are ready to develop a lease and rent-2-buy model in order to serve more customers, faster and across the continent
- We have a roadmap of new evolutionary and revolutionary improvements (i.e.: micro-algae…) and new sets of patents/IP to pursue in the near future

BiokW Core Team

Tomaso Bertoli

CEO / Chief Engineer

Italy
Sweden

Alberto Cornia

Sales coordination & Operations

Italy
Sweden

Filippo Zanella

Business & Sales Development + Investors Relations

Norway, Italy, UK

May 2019

Thank you for your time

Do not hesitate to contact us:

info@biokw.it

BiokW.it