Slide 1		
Slide 2	Content of presentation	
Slide 3	Some background on the dark soils in areas where tropical forest grows (Amazon area, forest grows on poor sois but there are spots with dark fertile soils)	
Slide 4	Some facts on what is biochar	
Slide 5	…and what is not. Bottomline, biochar is a term that needs to be used carefully	
Slide 6	What is the frame in which TNO participates in biochar: as a soil improver and also as a high-tech supplement	
Slide 7	Biochar fits best in a cascade approach, between low value high volume and low volume high value chain.	
Slide 8	A brief overview on feedstocks and technology combinations: the possibilities are infinite, dry & wet feedstocks, low and high value feedstocks, wastes as well as energy crops can be used for biochars. Various thermal conversion technologies can be applied, slow pyrolysis, fast pyrolysis, gasification	
Slide 9	These large number of combinations between feedstocks and biochar production technologies lead to a large number of different types of biochars with various properties	
Slide 10	A well explaining graph from a recent paper on the pyrolysis process that aims to produce biochar	
Slide 11	This is the pyrolysis unit at TNO (The Netherlands), with which biochar research was carried out the last years. An indication on the energy balance is shown.	
Slide 12	Gasification research and development at TNO the last ~15 years has also led to biochar co-production in the last years.	
Slide 13	Other technologies exist as well: at TNO wet torrefaction / hydrothermal carbonization is developed=> TORWASH as a spin off	
Slide 14	Concluding on the relation: feedstock – technology – properties of biochar. Presenting the quality and safety standards for biochar very briefly	
Slide 15	Check our database Phyllis2: free database, funded by EU H2020 project BRISk2	
Slide 16	Presentation of an LCA work on one biochar application with Carbon Capture aspects	
Slide 17	We need to: reduce fossil energy use and to preserve peat bogs (reduce carbon loss). Biochar offers a solution for sustainable horticulture	
Slide 18	Here we present the combined gasification and biochar production to replace natural gas and peat in greenhouses. The system helps to close a cycle, using agro-waste for high value horticulture substrates, which can be landfilled after their end of life	
Slide 19	Crucial quality is the stability of biochar produced from the gasification. Various methods are developed for evaluating	

	the long term carbon stability: the more stable, the longer it can stay in the soil (CCS)	
Slide 20	This slide shows briefly the data / facts of the studied system	
Slide 21	Data inventory from various sources: laboratory, literature, national emissions inventory	
Slide 22	Detailed CO2 balance was carried out: The plants grow at different rates than the CO2 released during combustion, organic matter decays in soil, biochar decays slow, pear decays faster than biochar but less fast than fresh biomass.	
Slide 23	CO2 results over the lifetime of a system, when considering the bioenergy (syngas that is combusted to heat) as the main product and biochar the dependent product (Functional unit = energy)	
Slide 24	If our system is a pyrolysis unit that produces mainly biochar and secondary energy (heat), inputs look a bit different	
Slide 25	The results in this case depend on the stability of the biochar: lower stability chars decay faster and offer smaller carbon capture than high stable biochars. But, highly stable biochars are produced at the cost of mass yield. In any case, producing more biochar offers of course more CCS potential	
Slide 26	Key messages	
Slide 27		
Slide 29		
Slide 30		