**TEDx Talk Kitty Nijmeijer**

**Amstelveen**

**March 10, 2018**

If everyone on this planet would live the way I live, we would need four planet earths to live in a sustainable way. Four earths! We use and consume three times more than our planet can ever provide!

I always believed, or maybe I wanted to believe, that I care about our environment.

* I recycle almost all waste I produce, we have seven different waste containers at home!
* I care about water and energy and try not to waste it
* I decreased my meat consumption,….in short:
* I do everything I can to preserve and protect our planet!

At least, I think I do. But I still need four earths to satisfy all my desires. I am deeply ashamed.

How about you? Who thinks you do better than me?

Well, nice to see so many hands. But I have bad news: in developed countries, on average we need even four planet earths to satisfy our needs. So big chance that we are in the same league.

Why do we do that? Why are we unable to foster our planet and to reduce our footprint such that we need only one planet earth?

The reason for that is that our current economic system is designed in a linear way. Let me explain what I mean with that. We take the limited amount of natural resources that our planet provides. We use these resources to produce a new product. For example, a mobile phone. We use that phone, and once it is broken or as soon as there is a newer version on the market, we throw the old phone away and buy a new one.

We use, consume and dispose. At the same time, we produce tremendous amounts of waste. Waste that we produce at home, but also the waste that industries produce to make for example our mobile phone, our jeans, our food. If we take that into account as well, each Dutchman produces 10 kg of solid waste per day! So, we simply use, consume and dispose, and we spoil the limited amount of resources that our planet provides. That is exactly the reason why I have seven waste containers at home and why it is so important to recycle and reuse our waste.

But there is even more: there is also waste that we do not see, that we do not feel, but that is everywhere around us: carbon dioxide or CO2. With our current way of living, we not only produce solid waste, we also produce tremendous amounts of CO2. And the impact on our planet of the amount of CO2 I produce daily is probably much bigger than this 10 kg of solid waste that I produce per day. You already experience the consequences of increasing CO2 levels in our atmosphere, in our air: an increase in temperature on earth, rising sea levels, heavy storms and rainfalls at certain places and severe drought at others.

What should we do with all the CO2 that we produce? How can we manage this? How can we prevent that CO2 destroys our planet?

An option is to store CO2 in the underground, in empty gas fields. You know that here in the northern part of The Netherlands, for example in Groningen, we have some empty gas fields where we can store the CO2. Sounds simple, isn’t it?

But storage of CO2 does not solve the problem, it hides the problem! If we store CO2 in the underground, we lack responsibility and make the generations after us responsible for our problem. Moreover, CO2 storage on such a large scale in a densely populated area has never been done before. Nobody knows if it is safe to store such large amounts of CO2 in the ground.

So are we doomed? Is this the end of mankind? Or is there a durable, permanent solution to deal with all the CO2 that we produce?

The answer to this question is: yes there is a solution. Just like with our solid waste, we can recycle the CO2 that we produce and we can reuse it! I will explain you how that works.

For that we first have to go back to nature. When plants and trees grow, they need CO2, water and energy. CO2 is absorbed from the air, water is taken from the soil and the energy comes from the sun. As a result, plants and trees make their leaves and grow. So plants are little factories that convert CO2 into something useful. When these plants and trees die, this organic plant material is converted into biomass and finally into fossil fuels: oil, coal and natural gas. This process happened during millions of years and under very high pressures.

When we burn these fossil fuels, for example in an industrial power plant or at home, we produce energy, water and CO2 again. Burning fossil fuels is very effective and attractive: it provides huge amounts of energy and is very cheap. For only 2 euro 50 per day, the price of a cup of coffee, I can heat my house, I have hot water and I can cook my food.

So, this is a closed cycle: Plants use CO2, water and energy to grow. When these plants die, they turn into biomass and finally into fossil fuels. We burn these fossil fuels and produce energy, water and CO2 again. With that, the circle is complete.

So what is the problem? If the circle is complete, why does our way of living have such a big impact? Why does the amount of CO2 in the atmosphere keep on increasing?

Making a mobile phone, producing our clothes, purifying water, processing food, heating our houses, fueling our cars and airplanes, or in short, everything, costs energy. To generate that energy, as just explained, we burn fossil fuels. However, because our current way of living requires so much energy, we thus produce tremendous amounts of CO2. We produce much more CO2 in a very short time than all the plants in the world can ever absorb in that time! The circle is no longer complete, we broke this natural circle. That is the big problem.

So, the solution is also clear: restore the circle. We need to restore the circle. We have to think circular. We have to change our linear economic system into a circular system in which waste is a resource for the production of new materials and products.

Maybe you think this is not possible? But it is possible! We recycle plastics, paper, glass, water and even cloths. That is why we have seven different waste containers at home. Exactly in the same way, we can also recycle CO2.

It is not that difficult. Let me explain it to you. Imagine that we could copy the process occurring in plants and trees. Imagine that we could build a factory that can convert CO2 into something useful. That would be wonderful!

You may be surprised, but the solution is as simple as that. The magic is chemistry. Chemistry, that may sound difficult. But it is not. Let me guide you through that process.

We can build a chemical factory, just like the little natural factory, our plant. In that factory, the CO2 that we produce is combined with water and energy from the sun. To keep it simple I will not discuss all the specific details, but in this process, CO2, water and sunlight are chemically converted into a mixture of different gases. Of course, the more pure the CO2 that we provide to our factory the more pure the end product will be. So we do not only convert the CO2 we also purify it. We purify the CO2 with membranes. A membrane is a filter, a sieve, just like the sieves in your kitchen. It contains very small holes. The holes in this membrane are so small that this membrane can separate and purify CO2.

After conversion and purification, we finally have only two gases left: carbon monoxide and hydrogen.

Carbon monoxide and hydrogen? It probably does not ring a bell, so how is this going to change the world?

Carbon monoxide and hydrogen is chemical Lego. Imagine, just like normal Lego, we can use this chemical Lego made out of CO2 to build virtually everything we want. Moreover, we can do that at any time we want. With these chemical Lego blocks we can build almost everything: fuels to produce energy and to fuel our cars or to heat our houses, but also plastics to make for example our mobile phone, cosmetics, detergents, chemicals.

We exactly follow the natural process happening in plants, but we now do that in a chemical factory. There are two crucial advantages of this chemical approach compared to the natural process: In the first place, the chemical approach is much faster. Because it is faster, we can as soon as we produce CO2 convert that CO2 back into Lego. So different than with the natural process where we produce much more CO2 than plants can ever use, we can now convert all CO2 we produce immediately. So with the chemical approach we can restore the natural cycle. With chemical Lego we transform our linear economy in a circular economy.

In the second place, the chemical conversion of CO2 into Lego gives a very high flexibility: comparable to the normal red, yellow and blue Lego blocks, we can use our chemical Lego blocks to build everything that we want at every moment that we want to do that.

This process, to convert CO2 into useful products and resources, is called CO2-valorization. A fancy word for ‘Giving value to CO2.’

Does it sound exotic to you? Do you feel uncomfortable with CO2-valorization?

I do not think so. CO2-valorization is nothing exotic. It is already applied on an industrial scale. Fuel for our cars already contains about 10% of bio-fuel, fuel made from CO2. Also, more and more plastic products, like plastic bottles for soft drinks or plastic cups for coffee, are to a large extent made out of CO2.

With CO2 conversion we turn something useless into something useful and we complete the circle again! You do not do this for me, you do not do this for the government, you do this for the future of your children and grandchildren, for the future of our planet earth!

We, you and me, we all together, need to embrace this idea of circularity. So, every time you separate your garbage, you buy new products or you drive your car, think about that message: Can we recycle and reuse all these materials and the CO2 produced to make this product? And if not: Consider buying something else.

If we all do that, I am sure that one day we can say: We have only one planet earth and we need only one planet earth!