GoNano energy

GONANO CITIZEN MEETINGS
FUTURE ENERGY AND NANOTECHNOLOGIES
INFORMATION MATERIAL

RMIT UNIVERSITY

ABOUT THE MEETING

Thank you for participating in the GoNano citizen meeting on the future of energy and nanotechnology! At the citizen meeting you will work together with other citizens to create an overview of your aspirations and concerns for innovations in nanotechnology by focussing on how they could affect your future everyday interaction with electronic devices, and how we produce, store and utilise energy.

WHAT HAPPENS AFTER THE GONANO MEETING?

1. GoNano researchers will analyse the insights you have shared about nanotechnology and its application in energy. In their analysis they will focus on the ideas and concerns you have expressed.

2. GoNano researchers will use the analysis in the second step of the project: expert workshops. Researchers, industry partners, civil society organisations and policymakers will be asked to use your insights as a starting point for designing future nanotechnologies.

3. In spring 2019 you and other citizens across Europe will receive an invitation to evaluate the innovation ideas produced from the expert workshops through an online consultation.

4. In the second round of expert workshops, the stakeholders will re-work the design suggestion based on the citizen's evaluation.

5. GoNano researchers will present the results to EU policymakers, and make the results available online, together with teaching material that shows how people can work with citizens to develop innovative product designs.

WHY ARE WE FOCUSING ON ENERGY FOR THE FUTURE?

Together as a society, we face an array of problems associated with rising energy costs, dwindling natural resources, pollution and climate change. If we wish to continue our present way of living, we must find alternative, more sustainable energy sources that have a lower impact on the environment. Nanotechnology could be key to making these a reality, for example, through the development of low-resistance power lines; super-efficient batteries; and cheaper, thinner, more flexible solar cells. To this end, governments must decide how much to invest in the development of nanotechnologies; however, this is a difficult decision as there are no certainties as to when the benefits of such nanotechnologies will be realised, and how much they might cost.

IN THE FOLLOWING SECTIONS, WE WILL:

- Provide you with a brief introduction to nanotechnology,
- Explain how nanotechnology could contribute to energy production and use in the future,
- Introduce questions and uncertainties related to nanotechnology and energy,
- Introduce scenarios of how everyday life could look like in 2030,
- End with a summary and information on how we will follow up on the meeting, and how you can follow the progress of the project as well as how you may get in contact with us.

WHAT IS NANO-TECHNOLOGY?

Nanotechnology is generally referred to as 'the science of the very small'. The prefix nano actually derives from the Greek νᾶνος (nanus in Latin), meaning dwarf.

A human hair can be used to illustrate size at the nanoscale. A human hair is approximately 80,000-100,000 nanometres wide. Another way to illustrate how small this is would be to say that comparing a nanoparticle to a basketball is roughly the same as comparing a basketball to planet earth. Nanomaterials can be found to occur "naturally" e.g. in dust or volcanic ash, in car exhaust fumes or in the smoke produced by a burning candle, or can be designed and fabricated artificially.

NANOTECHNOLOGY TODAY

Water-repellent fabrics: Some water-proof fabrics are not actually water-proof. In fact, the natural fabric may not repel water at all; however, nanotechnology can be used to create tiny patterns or nanostructures, or to add very thin layers, that then make the surface water-repellent.

Nano-cure for nail fungus: A new treatment for nail fungus is under development that combines nanoparticles with anti-fungal medication to deliver the drugs more effectively to affected area of the nail.

Nano-robots clear away bacteria and toxins: Researchers are developing tiny nano-robots (made from gold nanowires) that can be controlled with ultrasound. The nano-robots can be used to quickly clear bacteria and toxins from biological fluids like blood.

RISKS AND REGULATIONS

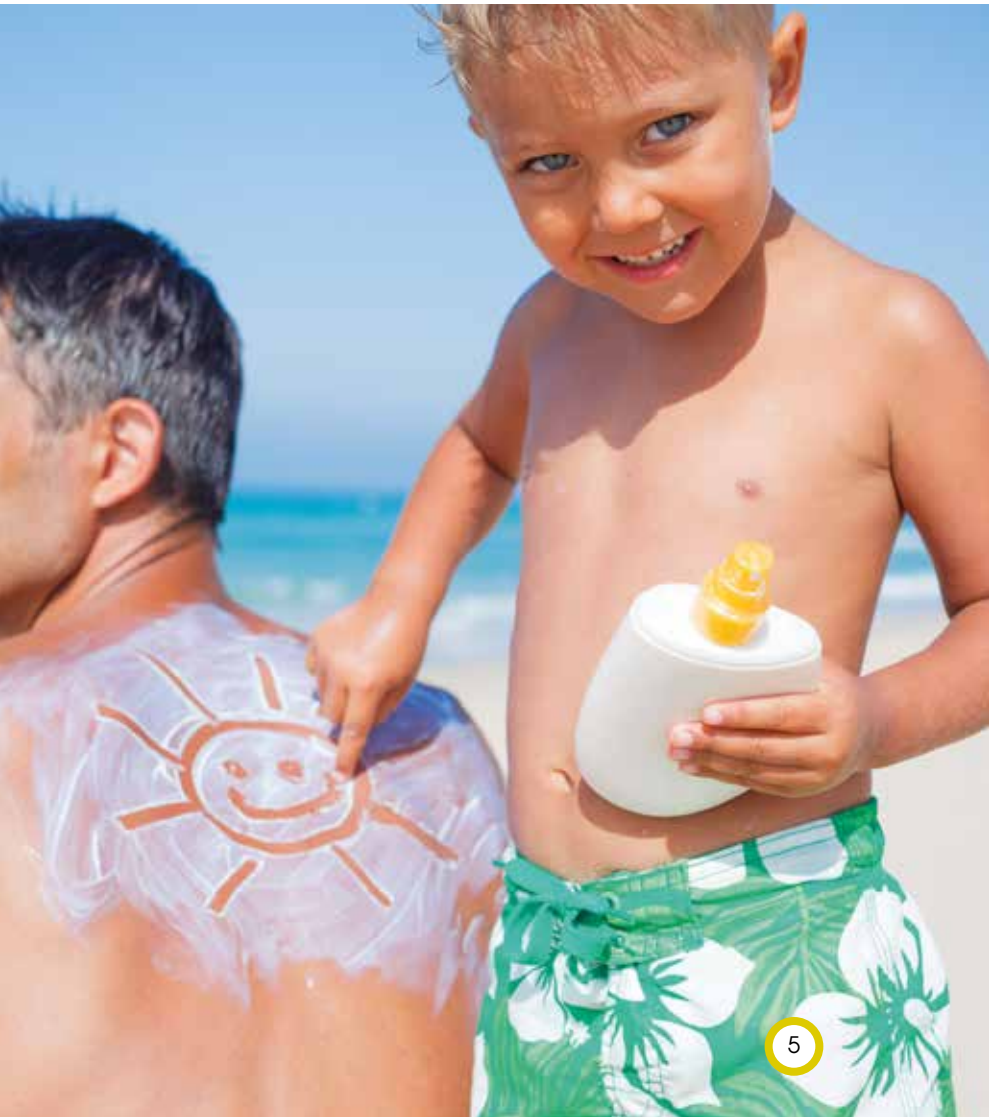
NANOTECHNOLOGY, HUMAN AND ENVIRONMENTAL HEALTH

There are many types of engineered nanomaterials; some are potentially hazardous but can be used safely under controlled circumstances. Most safety concerns relate to nanoparticles in free form, where they are harder to control and are not particles bound up in solid materials or fluids. But even then, are we able to control them? Are they toxic? Do they evade the natural defences of the body, and what are the implications of this? Do they damage cells? Could nanotechnologies have different effects on men than women, and could there be differences in effects across ethnicities?

Some people argue that we already use many dangerous technologies and substances in our everyday life (e.g. gasoline). They think we should talk about how we regulate and use dangerous technologies and substances, instead of talking about if we should use them. Others worry that the very properties that make nanomaterials desirable, are the very properties that make them hard to control and regulate. They therefore think that we should talk about whether or not we should be developing nanotechnologies as all.

YOUR SUNBLOCK COULD CONTAIN NANOPARTICLES

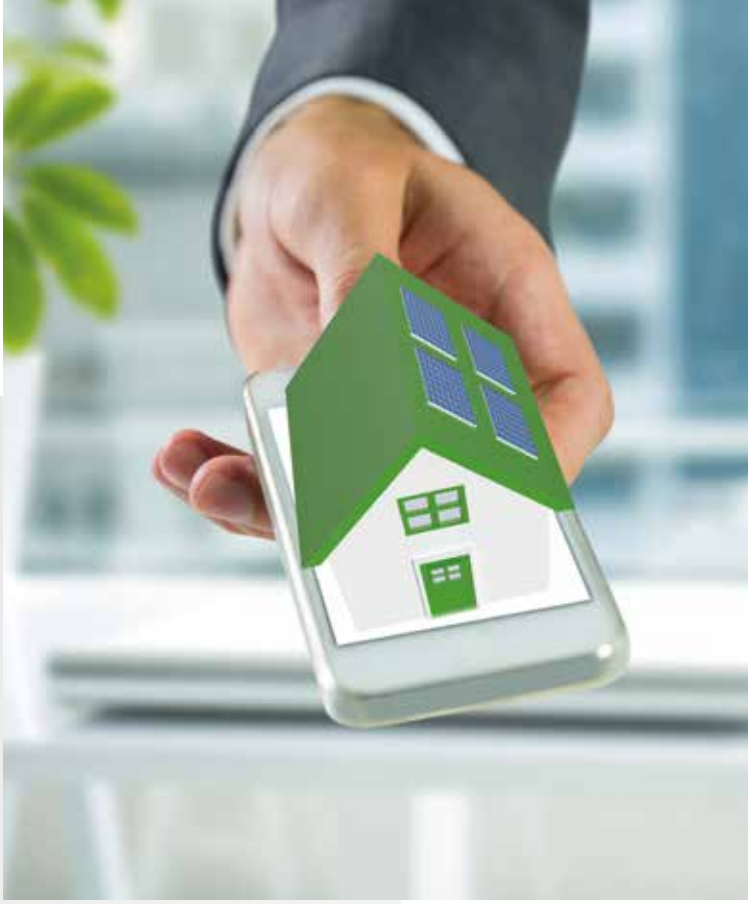
Many products already contain nanoparticles. E.g. A sunblock that rubs in clear on your skin could contain nanoparticles. Producers of sunblock are obliged to indicate on the label if your sunblock contains nanoparticles. A lot of research has been carried out to confirm that sunblock containing nanoparticles is safe to use for humans, but what about when we wash the sunblock off our skin? Has enough evidence been gathered about the possible environmental impacts of such products before allowing their use?



HOW IS NANOTECHNOLOGY REGULATED?

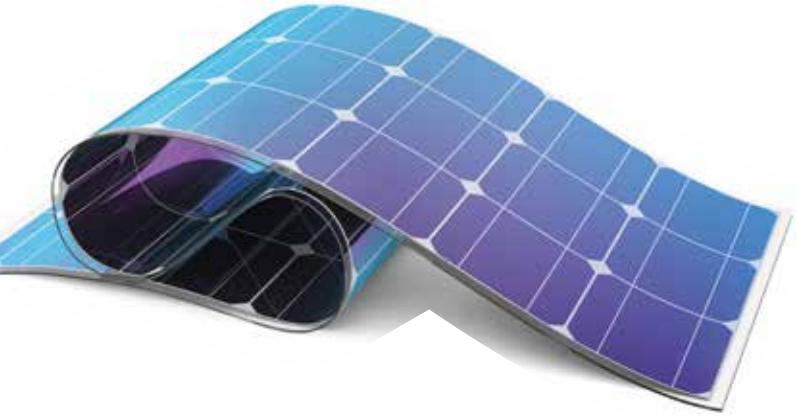
The question of whether and how to regulate nanomaterials has been ongoing in the European Union (EU) for over a decade. The EU was the first jurisdiction in the world to provide nano-specific legal provisions to address health and safety concerns of nanomaterials. Implementation of the EU legislation has, however, proven challenging. The various EU agencies need time to figure out who has the responsibility to implement oversight and regulation. Regulators need time to keep up with scientific developments. Industry and business need time to understand how to categorise and index their products.

NANOTECHNOLOGY AND ENERGY: WHAT ARE THE VISIONS?



GREEN ENERGY PRODUCTION

Imagine a future with flexible solar panels, which were only possible to manufacture due to the incorporation of ultra-thin layers (nanolayers) of light absorbers, or a paint full of semiconductor nanoparticles that could convert any surface into a photovoltaic panel. The widespread use of such technologies could help reduce our dependence on fossil fuels, and thus help reduce the emission of CO2 and other greenhouse gases.



PORTABLE ENERGY DEVICES

What if we could harvest the energy we produce when we walk and drive around every day? You could, for example, have nanofibers integrated into your clothes. The clothes would transform the energy produced by walking into electrical energy for powering your cell phone or smart watch. And what if the batteries in your cell phone had a higher storage capacity, a shorter charging time, or a longer shelf-life? More efficient batteries could prolong the useable life of our electronic devices, and therefore reduce the waste coming from them.

ENERGY IN THE HOME

Today you can harvest and store your own electrical energy at home, using solar panels and large batteries like the Tesla Powerwall, but nanotechnology could make it possible to create and store energy in places you never imagined. You could install “smart windows” with a special nano-coating that would keep your house cool in Summer and warm in Winter – and generate electricity at the same time. The electricity could be stored in the structure of your house: the bricks in the walls, in wireless charging coils on the floor, on the kitchen worktop and in the furniture. Your smartphone and laptop could then be charged automatically no matter where you left them.

HOW SHOULD WE DESIGN NANO-TECHNOLOGIES?

WILL NANOTECHNOLOGY LEAD TO GREENER, CHEAPER AND MORE SUSTAINABLE ENERGY SYSTEMS?

In order to work, nanotechnology innovations need to be implemented in our societies, everyday lives and (inter)national systems. However, we are not sure how nanotechnology applications would affect the organisation of our energy systems, or how vulnerable future energy systems would be to cyberattacks and surveillance. Will we keep a system with large cooperations in control of energy production, or will we decentralise and allow the small scale production of energy? How will our energy consumption patterns be affected? Will we use more or less energy? Will all consumers be able to afford nano-batteries and nano-windows?

Energy producers already use sensors to collect information on the performance of systems and customers' energy demands. Nanotechnology could improve the speed and sensitivity of the sensors, thus increasing the quantity and quality of the information collected. However, such systems are vulnerable to cyberattacks and surveillance because they are often connected to the internet. The question then is how should nanotechnology fit into our energy policies for the future?

HOW COULD NANO-TECHNOLOGIES BE DEVELOPED TO SUIT YOUR NEEDS?

HOW DO WE MAKE SURE THAT:

- We design nanotechnologies that fit with the wishes of citizens across the world?
- We avoid the risks and enjoy the benefits of nanotechnologies?

Research has shown that because nanoscience is dominated by men, ideas of future nanotechnology products are also male oriented. Men and women also think differently about risk. Perceptions of risk vary between some ethnic groups, with some men having a lower perception of risk. Women are more likely to think nanotechnologies are dangerous, and are less likely to engage with nanotechnologies because of this.

Research has also shown that religious beliefs and differences in culture can play a role in how we judge the potential of nanotechnologies, as well as how we believe nanotechnologies should or should not be used.

WHAT DO YOU THINK?

- Do you think culture, gender or religion influence how you think about using nanotechnologies for energy production, storage and use?
- Do you think there are some traditional and cultural values we should support with new technologies for energy production, storage and use?
- How should nanotechnologies for energy be developed?

FUTURE VISIONS OF NANOTECHNOLOGY AND ENERGY IN 2030

A SELF-POWERED MOBILE

It's Sunday Morning. Andrew is sitting with his family around the breakfast table. An article on his news feed catches his eye; it's another piece about the latest trends in mobile phone technology. Six months ago, Andrew bought two new, self-powered, mobile phones; one for himself and the other for his daughter Emma. The mobile is coated with a nanomaterial that generates an electrical current when it interacts with common clothing materials – for example the lining of your pocket.

Andrew thinks about some of the other news articles he has read recently about the different nanotechnologies used in mobile phones these days. Most of the articles emphasise how the mobiles use much less energy and last much longer than they used to. However, a number of articles have raised questions about the environmental impact of the manufacturing process of the nanomaterials like the one used in the power-generating coating on his phone. An additional problem is that many of today's self-powered portable devices end up in the wrong bin at recycling centres because, at the moment, recycling centres are still not sure how to treat the waste from portable devices coated with nanomaterials. Andrew is not sure what to think. After all, many electrical devices have an environmental impact, and if we had to consider the environment at every turn we would still be living in the Stone Age.

Andrew's thoughts are interrupted by Emma, who announces that she needs a new mobile phone. Andrew is surprised. He asks her if her mobile has stopped working. Emma explains that the mobile works perfectly, and the battery is never a problem. The problem is that there is new model on the market, and she needs it because all her friends already have it!

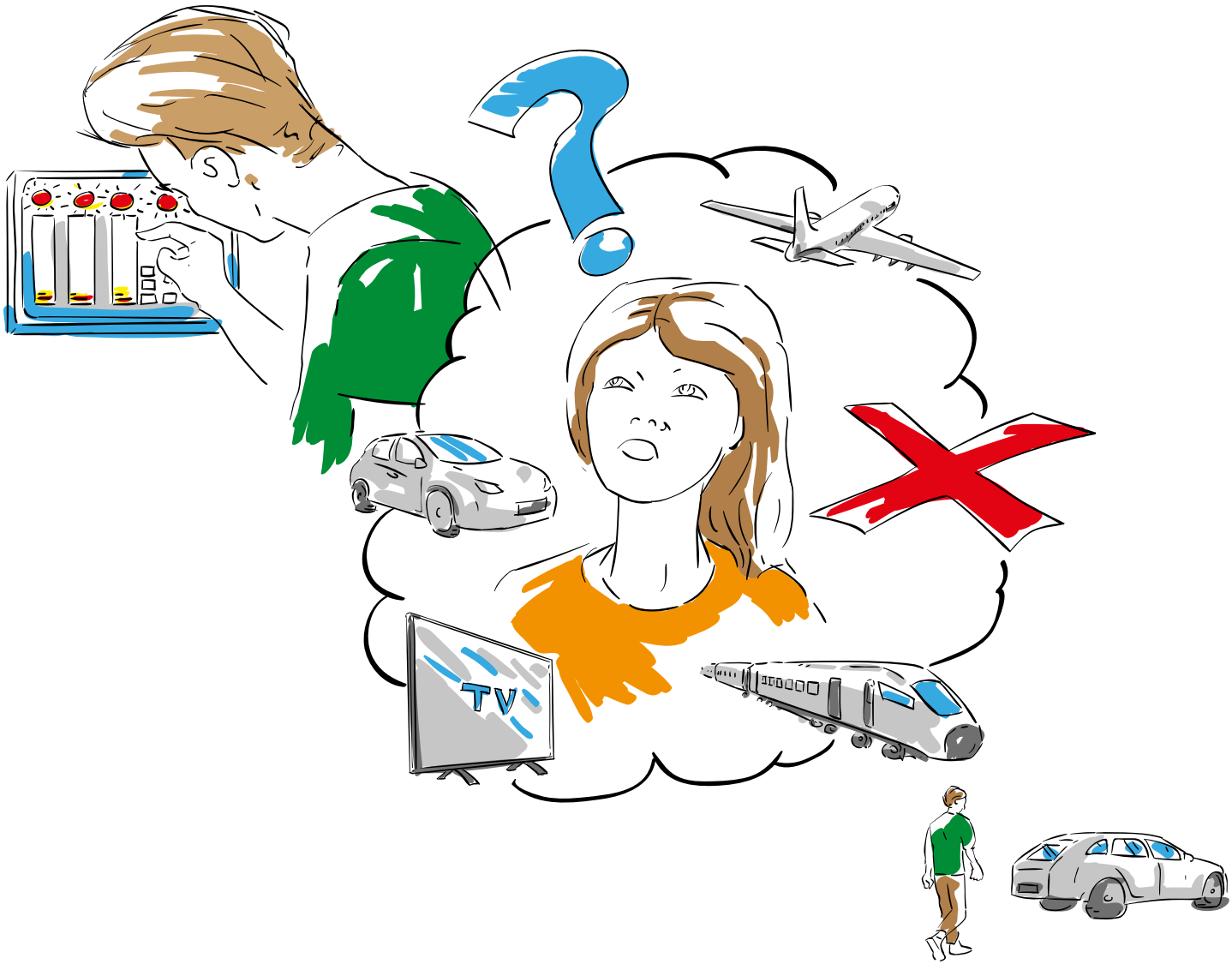
DOING THE LAUNDRY

Anna and Emma are playing outside in the sun. The girls are playing in Anna's parents' garden. After a while they are hungry and go inside the house. As they search for food, Emma looks around. She sees laundry piled high around the house. It is very warm in the house. Emma cannot help but compare the house to that of her parents. Their house is always very comfortable to be in, and they can do laundry whenever they want. Emma knows she is lucky. Her family makes some money by selling energy to larger distributers, and they are able to produce much of their own energy as well. Her parents were able to buy new nano-windows that regulate the temperature in the house, and they also have nano-enhanced solar panels for producing their own electricity.

Emma thinks about how her dad complains about the bullying tactics of the larger energy distributors. They pay almost nothing for his electricity, but they ask for twice the amount when they want to sell it back. Her mom is advocating for the right of small energy distributors, like her parents, to be allowed to sell their electricity directly to consumers. Emma knows that Anna's parents cannot afford the new nanotechnologies that her family are so fortunate to have, which is why she never complains about the temperature in the house whenever she goes to visit Anna.

A MALFUNCTION IN THE SYSTEM

It is 6.15 am on Monday morning. As usual, Andrew is awake before the alarm clock rings. He needs to get ready to go to work. He goes into the kitchen to get a cup of coffee and check the news. He looks around to see if his daughter, Emma, is already awake. She isn't. He will have to go and wake her up soon. As he picks up his laptop from the kitchen counter, he notices the red light for low battery is still on. That's strange. The laptop should have charged itself overnight through contact with the kitchen worktop, one of the multiple wireless charging stations they have around the house. He probably just needs a new battery for his ancient laptop but he walks out to the hallway to check the house's system control panel. All the lights on the panel are flashing red. Great! He can forget about that cup of coffee before work. Emma has heard him in the hallway and comes out to see what is happening. Andrew tries to call the maintenance service to arrange for someone to come and fix the installations in the house but there is no signal. Emma thinks the whole situation is very exciting. It's the first time she has experienced a malfunction in the control system for the house. Maybe it's a cyberattack! She looks at her dad and tells him that one of her friends told her that if the country's energy control system were hacked, then everything would stop working. There would be no trains, no gas, no power, no TV, no air conditioning. Andrew looks at her and tells her to calm down and stop being so dramatic, as he makes his way toward the garage to check if the car has enough charge left to get him to work..



SUMMARY

- Nanoparticles are very small,
- Nanomaterials have different properties than the materials we are used to,
- Nanotechnology is imagined to be a key development for a shift to a more sustainable and environmentally friendly energy cycle,
- There is uncertainty about how dangerous nanotechnologies could be to humans, animals and the environment,
- It is difficult to implement regulation and control of nanotechnologies,
- (Inter)national trade, governments and large energy companies are likely to influence how nanotechnologies will be implemented,
- Culture, gender and other societal traditions (e.g. religion) are likely to influence how nanotechnologies will be implemented in our societies.

FOLLOW-UP TO THE CITIZEN MEETING ON ENERGY AND NANOTECHNOLOGY

In spring 2019, you will receive an invitation to evaluate and respond to the design suggestions from the expert workshops. You can always follow the progress of the project on the website: http://gonano-project.eu/ and you may always write the project coordinator: Danish Board of Technology Foundation (lb@tekno.dk).

YOUR NOTES

FOLLOW US:

Web: http://gonano-project.eu/

Twitter: https://twitter.com/GoNano_EU

Facebook: https://www.facebook.com/GoNanoEU/

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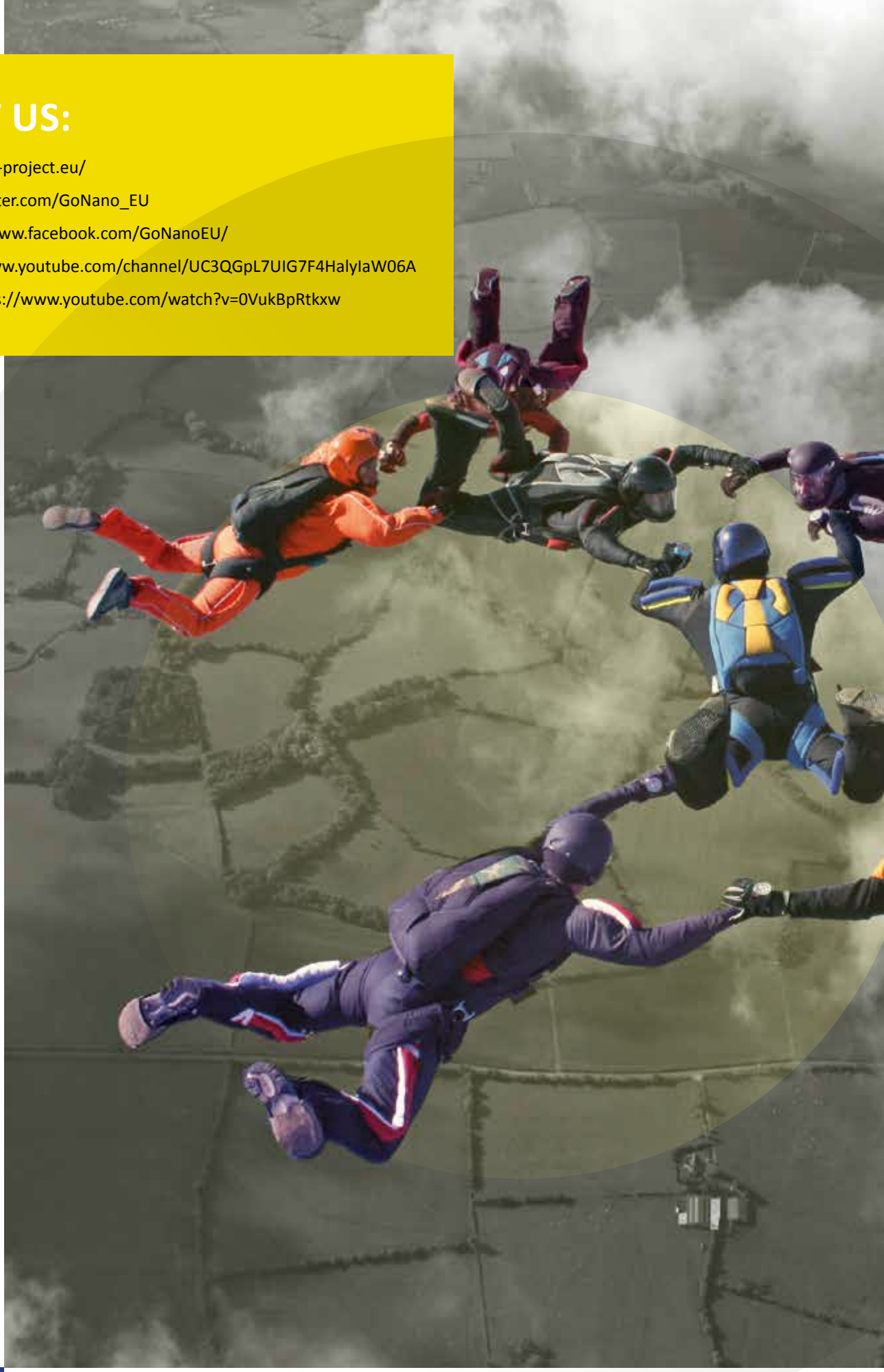
GoNano video: https://www.youtube.com/watch?v=0VukBpRtkxw



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