



Deliverable 11.4

Modular Mobile Exhibition

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Disclaimer

The information included herein is legal and true to the best possible knowledge of the authors, as it is the product of the utilization and synthesis of the referenced sources, for which the authors cannot be held accountable.

Keywords

- exhibit ▪ citizen engagement



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Deliverable information

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¹ R=Document, report; DEM=Demonstrator, pilot, prototype; DEC=website, patent fillings, videos, etc.; OTHER=other; ETHICS=Ethics requirement, ORDP=Open Research Data Pilot

² PU=Public; CO=Confidential, only for members of the consortium (including the Commission Services); EU-RES Classified Information: RESTREINT UE (Commission Decision 2005/444/EC); EU-CON Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC); EU-SEC Classified Information: SECRET UE (Commission Decision 2005/444/EC)

Executive Summary

This deliverable provides information regarding the design of the modular exhibit that was developed and produced by NEMO Science Museum aimed for the general public (more specific: the public at Third Party European Science Centers) tackling the issues WATER-MINING seeks to address and building on the stakeholder engagement plan and on the results of the more technology related WPs. The issues addressed at the exhibit were the following: raising interest in the necessity for Water Mining; the idea of circularity in water usage; the idea of reuse of materials; the idea of Value Sensitive Design.

The information provided in this deliverable includes the following elements:

- A 3-D view of the exhibition
- A list of objects
- An introductory text to the exhibition
- A script for the audio tour that leads visitors through the exhibit

The Exhibit will be on display

- in the Netherlands (The Studio of NEMO Science Museum, Amsterdam, October 22-March 23),
- in Spain (Parque de las Ciencias de Andalucía, early '23, June 23 to August 23 and
- in Cyprus (through SciCo, hosted by The Water Board of Lemesos, December 23 to March 24

The exhibit will be locally adapted in each location. The coordination of the planning and the local adaptation of the exhibit is a responsibility of Ecsite.

The exhibit is made on time and within the foreseen budget.

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Acronyms

Overview of the project

WATER-MINING is a project funded by the European Commission (Horizon 2020 – Grant Agreement No 869474) with a total duration of 48 months (Start date: 01/09/2020 – 31/08/2024) and a total budget of approx € 19 million (EU Contribution: € 16,876,959.59). The project is entitled “Next generation water-smart management systems: large scale demonstrations for a circular economy and society” and it is a project granted under the call topic “[CE-SC5-04-2019](#): Building a water-smart economy and society”. Further information about all the sister projects funded under this topic can be found at the CORDIS website [here](#). The WATER-MINING consortium comprises 38 partners from 12 countries, led by the Delft University of Technology (TU Delft). More information about the project can be found at the project website (<https://watermining.eu>) as well as the dedicated website at CORDIS database (<https://cordis.europa.eu/project/id/869474>), while an overview is provided below.

The WATER-MINING project aims to provide for real-world implementations of Water Framework Directive (and other water related legislation), as well as the Circular Economy and EU Green Deal packages by showcasing and validating innovative next generation water resource solutions at pre-commercial demonstration scale. These solutions combine WATER management services with the recovery of value-added renewable resources extracted/MINED from alternative water resources ("WATER-MINING").

The project integrates selected innovative technologies that have reached proof of concept levels under previous EU projects. The value-added end-products (water, platform chemicals, energy, nutrients, minerals) are expected to provide regional resource supplies to fuel economic developments within a growing demand for resource security. Different layouts for urban wastewater treatment and seawater desalination are proposed, to demonstrate the wider practical potential to replicate the philosophy of approach in widening circles of water and resource management schemes. Innovative service-based business models (such as chemical leasing) are being introduced to stimulate progressive forms of collaboration between public and private actors and access to private investments, as well as policy measures to make the proposed water solutions relevant and accessible for rolling out commercial projects in the future. The goal is to enable costs for the recovery of the resources to become distributed across the whole value chain in a fair way, promoting business incentives for investments from both suppliers and end-users along the value chain. The demonstration case studies are to be first implemented in five EU countries (NL, ES, CY, PT, IT) where prior successful technical and social steps have already been accomplished. The broader project consortium representation will be an enabler to transferring trans-disciplinary project know-how to the partner countries while motivating and inspiring relevant innovations throughout Europe.

Scope of the deliverable

Within WATER-MINING project, Work Package 11 (WP11) is focusing on the “Dissemination and communication activities” of the project. WP11 is structured on the following four (4) Tasks:

- **Task 11.1:** Strategic Communication Plan;
- **Task 11.2:** Visual identity, Online Presence & Communication Materials;
- **Task 11.3:** Communication, networking, and information exchange;
- **Task 11.4:** Dissemination for exploitation and commercialisation support of WATER-MINING results;

The results from the implementation of this work package are presented through nine (9) deliverables:

- **Deliverable 11.1:** Strategic communication plan (associated with Task 11.1);
- **Deliverable 11.2:** WATER-MINING website (associated with Task 11.2);
- **Deliverable 11.3:** WATER-MINING newsletters (associated with Task 11.2);
- **Deliverable 11.4:** Modular mobile exhibition (associated with Task 11.3);
- **Deliverable 11.5:** Videos (associated with Task 11.3);
- **Deliverable 11.6:** Capacity building & citizen engagement (associated with Task 11.3);
- **Deliverable 11.7:** WATER-MINING Layman’s Report (associated with Task 11.4);
- **Deliverable 11.8:** Three sector specific role out events (associated with Task 11.4).
- **Deliverable 11.9:** Final conference (associated with Task 11.4).

The current deliverable comprises the fourth deliverable of WP11. The work was led by NEMO Science Museum within Task 11.3

This deliverable is also a “Public” deliverable, thus not containing any confidential information.

1. Introduction

This introduction sets the stage for the specific focus of Deliverable 11.4, the Modular Mobile Exhibition, within the broader context of the WATER-MINING project. The subsequent sections detail the scope, parties involved, and the design and elements of the exhibition, elucidating the significance of this deliverable in conveying project knowledge to diverse audiences.

2. Exhibit design

2.1. General remarks

The exhibition is aimed at the general public and more specific at the public at the science centers that engage as third parties in the WATER-MINING project (NEMO Science Museum, Parque de las Ciencias de Andalucía, SciCo Cyprus).

The subjects and the texts must be understandable for the general interested public and also for children of 15 years or older. Therefore the tone of voice needs to be accessible and entertaining.

The estimated duration of the visit is about 15 minutes. It is designed to be accessible for individuals and small groups.

The design of the exhibit is called modular, because it must be possible to adapt to local circumstances or to add or change object on display. This demand has been met by using an audio script as the main way for accessing the exhibit. This makes it possible to make adjustments for local needs or wishes.

2.1.1. Topics addressed

The exhibit addresses the following topics:

- General interesting facts about (the scarcity) of (sweet/drinkable) water.
- The idea of circularity in water usage (with the example of Floating Farm Rotterdam)
- The idea of water mining (with the example of Kaamera as material)
- The idea of Value Sensitive Design (with the example of Lampedusa)

2.1.2. The objects

See the List of objects (in The Addendum).

2.1.3. The audio script

The audio script is to be translated and recorded in the native language of each location. The tone of voice is informal and small audio effects are used to add to make it lively and funny. Because sense humour can vary from country to country and language to language, localisation is a delicate matter. The local host organisations have freedom to choose the translator and voice actor to adopt the script to their local wishes.

3. Parties Involved

3.1. The design team

Lead by Science Museum NEMO a team of educators, designers and communicators came together to develop the concept for the exhibit based on the issues that the Water Mining project aimed to address and to produce it.

Lead by Jeroen Wiegertjes the overall concept and narrative was developed together with science communicator Ilse van Zeeland. The production team leader was Leo van den Bogaert, the design was made by Pieter Aartsen and the script by Ferry Pieckart. NEMO had to isolate the information from the project that would be relevant to the public, would raise issues and themes for discussion that the project has as a priority carefully creating content that would then be able to be locally adapted and tailored to the cultural differences and local priorities of the Ecsite Third Parties that would then host the exhibition. The items were designed to be light, the materials to be inexpensive, the items of the exhibit to be easily displayed in different rooms and locations.

3.2. Exhibition venues

- The Studio of NEMO Science Museum (exhibition was hosted from October 2022-March 2023)
- Parque de las Ciencias de Andalucía (exhibition was hosted from spring 2023 to summer 2023, dates to be determined)
- SciCo Cyprus (fall 2023)

The design was produced in way so that if additional venues would be interested to host it is easy to copy and adapt. The script is publicly available for adaptation and localisation. Contact information : Jeroen wiegertjes (wiegertjes@e-nemo.nl)

4. Exhibition Layout

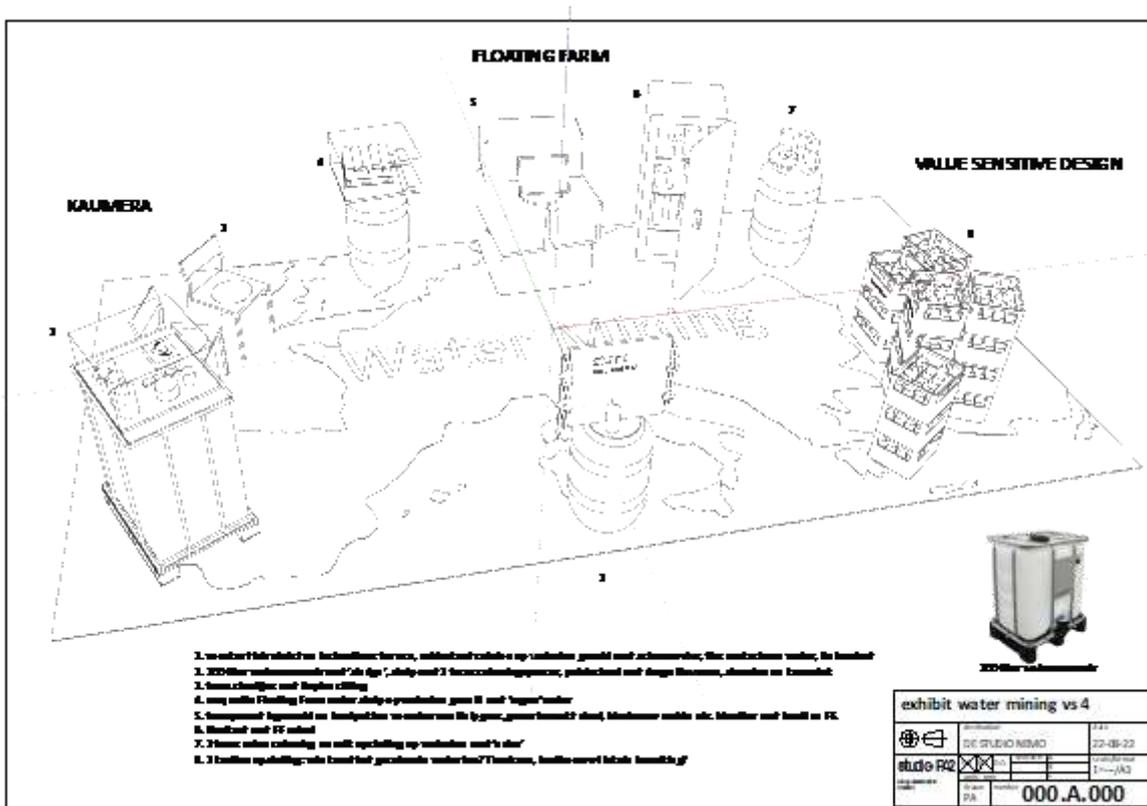


Figure 1: Exhibition Layout

The components according the design floorplan.

Number 1: intro

- Water tank 210 l. with an introduction board and ± 10 headsets
- On the back side of the board the colophon with all the logos.

Number 2:

- Water reservoir 300 l with:
- Glass jars with 3 stages of sludge
- Display case with products made of Kaumera

Number 3:

- Chairs with a seat made of Kaumera

Number 4:

- Water tank 210 l with a model of the Floating Farm

Number 5:

- Food for the cows in the floating farm
- Movie of the Floating Farm

Number 6:

- Fridge with products from the floating farm

Number 7 Water tank 210 l with

- 3 stages of urine of the cows and
- Fertilizer made of the shit of the cows

Number 8:

- Bottles to give your opinion by putting them in coloured crates

The floor:

Organisations receive the design of the floor in .pdf format. By printing it in their own country they save shipping costs. Of course the one that is used in NEMO can be shipped too.

5. Exhibition elements

The introduction board.

Local hosts receive a .pdf file of the colophon at the backside of the board in English

On the front side there will be the explanation how to use the podcast and your telephone with or without headset. The explanation will be in English.

On the places on both sides of the board hosts could replace the Dutch text for their own language. The colophon will show all the logos of the participants.

Number 1, the water tank.

To minimize the shipping costs the tank is empty. Hosts can fill it partly with water and chlorine .

The chlorine will keep the water clean. The water will make the tank stable, so they don't have to connect it to the floor.

Number 2, the water reservoir.

To minimize the shipping costs, NEMO did not send this huge reservoir. Our suggestion was for hosts to buy it in their own country. It's about € 200 and for sale in every country in Europe.

They receive a recipe how to make the water dirty and look like sludge.

They will receive 3 glass jars with the stages of cleaning the sludge.

Its easy to connect to the reservoir

Hosts will receive a display case with prepared possibility to connect it to the reservoir.

In the display case there will be:

Pottery (2 pieces)

Tiles of pottery (2)

A tile of Replex

A brooch

Kaamera powder

Number 3: chairs

Hosts receive 2 chairs with the seat of Kaamera

Number 4: Water tank

A water tank hosts can fill, with the model of the floating farm on top.

The model is easy to fit on the water tank.

Number 5: Floating Farm

Food for the cows in the Floating Farm, sealed. Partly visible

A player and screen with a movie from the Floating Farm.

Number 6: Fridge

Fridge with products of the Floating Farm.

Number 7: Watertank

Watertank with on top three stages of urine of the cows and fertilizer made of the cows dung.

Number 8: Crates for water bottles

Bottles to give your opinion by putting them in coloured crates.

6. Exhibit Script

Below there is the Water Mining Audio Script that was produced by NEMO in English and was proposed when needed to be translated in host's local language.

INTRO

Visitors stand with their own telephone (perhaps with headphones) in or close to the exhibition space. The narrator guides visitors to the starting point.

At the starting point (at the water barrel?) is a glass of clean drinking water in a small display case. It is attractively lit and presented as a museum piece.

The entire audio-tour is one track; the breakdown in stops below is for our information only.

CHRIS

Hello there! My name is Chris. Chris Bajema. You might know me from the podcast 'The Man with the Microphone'. But today I'm here as an expert on water. Not a scientific expert, mind... but as a BEING of water. My own body is made up of 60 percent water. My brain is 73 percent water. So, in a way, everything you hear today is largely being told to you via water.

And we're talking about ancient water too. Take a look at the display case here and you will see a glass of water. Now don't be alarmed, but that water is five billion years old. Which means that the contents of that glass have been drunk and peed out millions of times. By dinosaurs, by Neanderthals, perhaps even by Julius Caesar's troops. For thousands of years, it was ice on the North Pole, then it melted, evaporated, condensed into clouds, and rained down. People have cleaned with it, brushed teeth with it, it's been in Coke and manure and sweat... and now it's here in a glass.

Planet Earth has 1.26 trillion litres of water. That's been the case for billions of years. The Earth does not create new water, so nothing is added, but not much is lost either – perhaps a little water escapes into space. Which means that we have to make do with 1.26 trillion litres. It's a cycle. The Earth is very good at reusing water ... and we have to get good at that too. That's what we're going to talk about today.

Now, please take a walk to the centre of this exhibition.

PROJECT

CHRIS

Okay, here we are. Look at the floor and you will see a large map of Europe. I've dragged my watery body to France...

Blast of French accordion music and a voice says, 'Oh la la!'

CHRIS

...but you might be closer to Tyrol.

Blast of Tyrolean music, and a yodel.

CHRIS

Whatever! I'm going to take you on a short tour around Europe to a few places where they do 'water mining'. I'll explain what that is a bit later on. But for now, turn your attention to the map on the floor and look at Spain. You've probably heard about the desertification happening in that country. And if you go a little further north, to France...

FRENCH VOICE

Oh la la!

CHRIS

...then you've also probably heard about the huge forest fires, caused by droughts, which seem to be getting worse every year. And if you go even further north, you will arrive in the Netherlands, where people believe there will always be enough water. Let's face it, we don't think twice about flushing our toilets with drinking water! But even here, there are sometimes water shortages. I said earlier that there are 1.26 trillion litres of water on Earth and that this doesn't really change. Well, 97.5 percent of that is saltwater. That's almost all of it! And you cannot drink saltwater, nor can you irrigate your land with it. You need fresh water for that. And fresh water is becoming increasingly scarce, because more and more of it is needed worldwide. Which means, we need to do something about water.

CHRIS (CONT'D)

About wastewater, about dirty water. We shouldn't just flush it away – we should reuse it. And there are projects all over Europe for 'water mining'. But before I get into that, let's talk about 'circular thinking'. For this, we first have to go to Rotterdam in the Netherlands. Just walk north for a bit where you will see a model on a rainwater barrel. It's about where Ireland is on the map.

Blast of Irish music and a man shouts, 'Fancy a Guinness?'

CHRIS

No, it's not literally in Ireland! It's in the Netherlands, but we don't have the space to put all the objects on the right countries. Come on ... You get it, right?

FLOATING FARM

CHRIS

Are you standing in front of the model? There really is a floating farm like this in the port of Rotterdam.

Sound of mooing cow, followed by a loud 'splash!'

CHRIS

Although I'm not so sure that the cows ever go for a swim! But together with the water, they are part of a large circle of sustainability. First, rainwater is collected on the roof of the floating farm. Under this model is a barrel full of rainwater. This water has been filtered and is therefore suitable as drinking water for the cows. What if there's not enough rainwater? Then more water is filtered from the river.

When the cows have drunk the water, they will eventually pee it out. Now, you want to be able to reuse it, right? So, to find out how that works, let's take a walk to the right, towards Russia on the map.

Blast of Russian music.

CHRIS

No, we're still in Rotterdam, okay?

Now, here you can see another barrel, except this one has urine in the water.

The floating farm is looking into ways to filter the cow urine so that you can get clean water from it. In the future, maybe even drinking water, but for now, the aim is for water to be at least clean enough to go back into the river.

On top of the barrel, you can see a small installation that purifies urine into clean water in three stages. Can you smell it? Go on... I dare you to take in a good sniff! Ha! Ha! Just kidding! We're not actually allowed to use real urine in an exhibition because it's unhygienic. What you can smell is fake urine. But still... what goes through your mind if you imagine cow pee being filtered so that you can drink it? That's super circular!

Okay, take a step back into the North Sea... and there you will find some sealed bales of feed for the cows. The black one at the bottom is full of hay, but above that you can see bales in transparent plastic, full of so-called 'waste'. For example, pruning waste from the city. Yes, even the mowed grass from De Kuip football ground! Suddenly, Feyenoord is also part of the circle!

It's a shame to throw away all that mowed grass. And the same goes for the fruit and vegetables that get thrown away by, for example, Rotterdam's cafés and restaurants. All of it can be cow food. Now that is circular: to reuse everything in the vicinity. There is a video here about the floating farm which offers a much better picture. Just put me on pause and have a watch! And if you open that fridge nearby, you can see the products that the floating farm produces.

KAUMERA

CHRIS

Okay, we're now going to head east. If you go to the middle of the Atlantic Ocean, you will see a couple of chairs.

Sound of whale song.

CHRIS

Whales have got nothing to do with this! Nor the Atlantic Ocean come to that, but we had to put the chairs somewhere! Anyway, folks, just take a seat. Make yourself at home. How does that feel? Is it comfortable? Now, stay sitting down while I tell you ... that the chair is made of poo. Don't get up!

All right, I'm exaggerating. It's not poo exactly, but the chair is made from stuff that comes straight from the sewer. As a society, we flush away huge amounts of toilet paper and the thick sludge in sewage water actually contains a lot of fibres from that paper. Those fibres are what were used to make these chairs. It's a material called Re-plex. Just stand up and examine it with your hands. It feels a bit like fake leather, right?

Re-plex is the end result of water mining, which I mentioned earlier. Water mining involves extracting raw materials from wastewater. Re-plex consists of toilet paper fibres, as well as something else that also came from the sewer: Kaumera. Ever heard of it? Probably not. But you can make anything out of Kaumera. On the right, you will see a pallet with a water tank completely full of sewer sludge. If you like, you can even have a taste ... kidding! Ha-ha, no, you can't taste it, and the sewage sludge is fake too. Hygiene rules, remember?

But on that water tank, you can see a few things that are not fake. Jewellery designed by Yuemei Lin. Ceramics by Billie van Katwijk. All beautiful things ... and all made from sewage sludge. From Kaumera. By the way, that name comes from the Māori word for 'chameleon'. It's an apt name, don't you think? Because as you can see, Kaumera can transform itself into anything.

Kaumera is created by a process called Nereda – sorry about hitting you with all these new terms. And Nereda is a process of purifying sewage water which leaves sludge granules as a residual product.

And out of these sludge granules, Kaumera can be extracted. This is the wonderful material that is so versatile for making so many things, while at the same time reducing the amount of sludge waste that has to be destroyed. So, it's a win-win. Unless, of course, no one wants to walk around with sewage sludge jewellery around their necks...

That brings me straight to the final chapter of my story. I've already spoken about circularity and water mining. Now all that is left is to talk about dilemmas... because there are quite a few. Let's take a walk across the map to Greece...

Blast of Sirtaki, and the sound of a plate smashing.

VALUE SENSITIVE DESIGN

CHRIS

The floating farm and Kaumera might sound like good news, but new things always bring new dilemmas with them. Researchers and designers are already thinking about that, with a process they call 'value sensitive design'. This means that the design process includes thinking about the dilemmas that a new design might encounter. Doing something differently will always raise difficult questions. For example, I began this story by saying that water was scarce, so one question it raises is: if you can make clean water, who decides what happens to it?

These crates contain bottles of desalinated water. That is, saltwater from the sea which has gone through a filtering process to become fresh water. We are now in Greece...

Sound of Sirtaki.

CHRIS

Yes, thank you! But the example I want to talk about is on the island of Lampedusa. Here, they are trying to desalinate seawater using solar energy.

The desalination process always took up a lot of energy and was therefore not financially viable until now. But if it can be done using solar energy, it would be worth it and you would have desalinated, fresh water. But who should it belong to?

Some people say that as fresh water is a basic necessity of life, it should belong to everyone – as public drinking water, for example. Others say that our agriculture should have more water for irrigation, which would in turn benefit food production. In practice, that means the water would go to the private sector. Still others say: if farmers can suddenly use more water, they will start growing crops that require a lot of water, such as avocados. Then before you know it, we'll be suffering a water shortage again. And there are also people who say: these desalination plants are ruining the coastline, which is disastrous for our tourist industry! There goes our economy! And it's also harmful to the flora and fauna! Is your head spinning yet?

So, I would like to ask you to do something for me. Take a bottle of desalinated water, and put it in the crate where you think it should go: drinking water for the public, irrigation water for agriculture, or should we think of the tourist industry?

Clink of bottles.

CHRIS

There are many more dilemmas on this subject, but you'll come across them naturally the more you look into water mining. Meanwhile, my story here is finished, but feel free to look around. To make our world and the supply of water 'futureproof', we are moving towards a future with cows on floating farms and jewellery that comes from the sewer. We have to think differently, that's for sure!

Thanks for listening, and I hope to see you again soon!

7. Concluding remarks

In conclusion, Deliverable 11.4 of the WATER-MINING project, the Modular Mobile Exhibition, stands as a testament to the collaborative efforts and innovative spirit fostered under this project. Led by NEMO Science Museum, this exhibit, developed under Task 11.3, not only addresses crucial issues related to water scarcity but also embodies the project's commitment to communication, networking, and information exchange. The exhibition, designed for general audiences and hosted in science centers across Europe, seamlessly integrates topics such as circularity in water usage, water mining exemplified by Kaumera, and the principles of Value Sensitive Design demonstrated through a journey across European landscapes. As the exhibit travels through the Netherlands, Spain, and Cyprus, it exemplifies the adaptability of its modular design, promoting engagement and dialogue on the pressing challenges and innovative solutions presented by the WATER-MINING project. This deliverable underscores the successful collaboration between the consortium partners, emphasizing the shared commitment to disseminate knowledge and foster public awareness in the pursuit of a water-smart and sustainable future for Europe.



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