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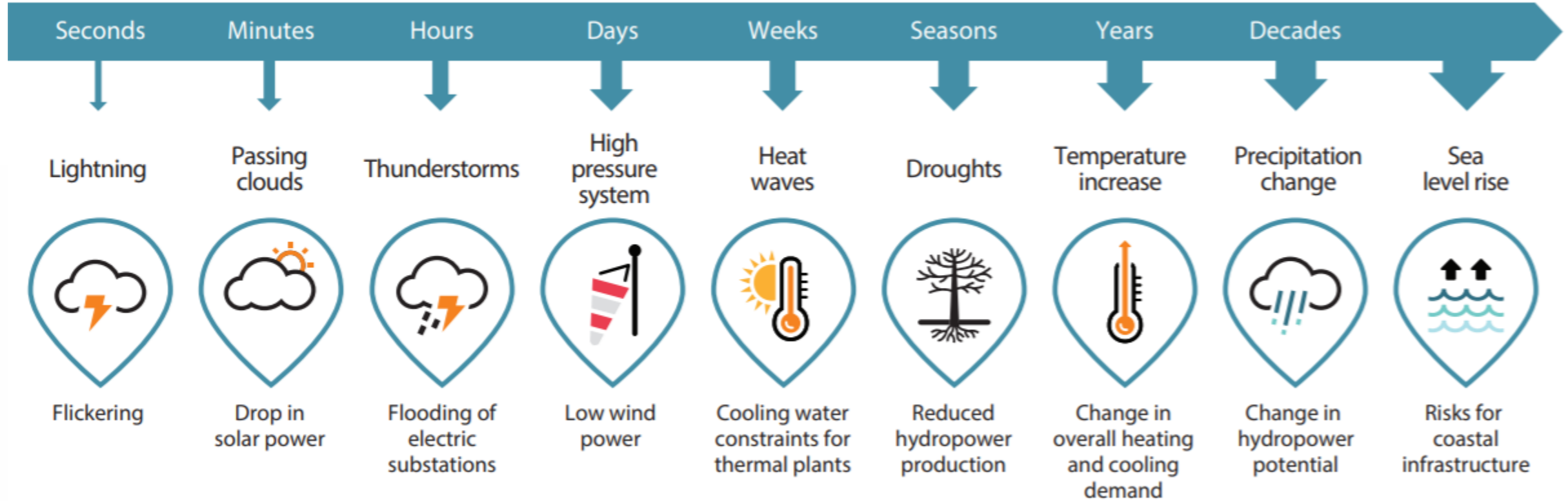
A CHANGE OF SEASONS?

SPATIOTEMPORAL IMPACTS OF CLIMATE CHANGE ON RENEWABLE ENERGY

Sebastian Sterl | 14 December 2019

IRENA AVRIL workshop, Bonn, Germany

WEATHER/CLIMATE IMPACTS ON ENERGY SYSTEM



ASKING THE RIGHT QUESTIONS

“What will be the impact of climate change on renewable energy resources?”



“What is likely to change about [X] due to climate change?”

“How will renewable resources be affected by [X]?”

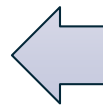
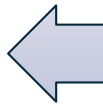
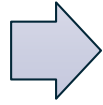
ASKING THE RIGHT QUESTIONS

QUESTION

Global
emission
pathways



Local
power
generation



STEPS

Global
climate change



Statistical
downscaling

Dynamical
downscaling

Regional
climate change



Local
climate impacts



MODELS

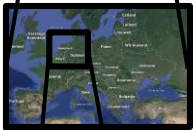
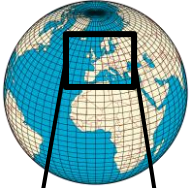
GCMs (Global Climate Models)
~100x100 km resolution



RCMs (Regional Climate
Models) down to ~km res.



Impact Models (IMs, e.g.
for river discharge) forced
by climate information



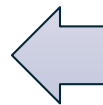
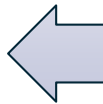
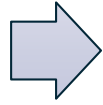
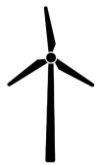
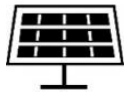
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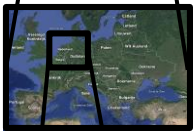
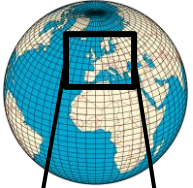
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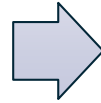


ASKING THE RIGHT QUESTIONS

“The impact of climate change”
according to which combination of

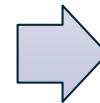
RCPs

RCP2.6
RCP4.5
...



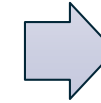
GCMs

CanESM2
CNRM-CM5
EC-EARTH
MIROC5
HadGEM2-ES
MPI-ESM-LR
NorESM1-M
GFDL-ESM2M
IPSL-CM5A-MR
...



RCMs

RACMO22T
HIRHAM5
CCLM4-8-17
RCA4
...



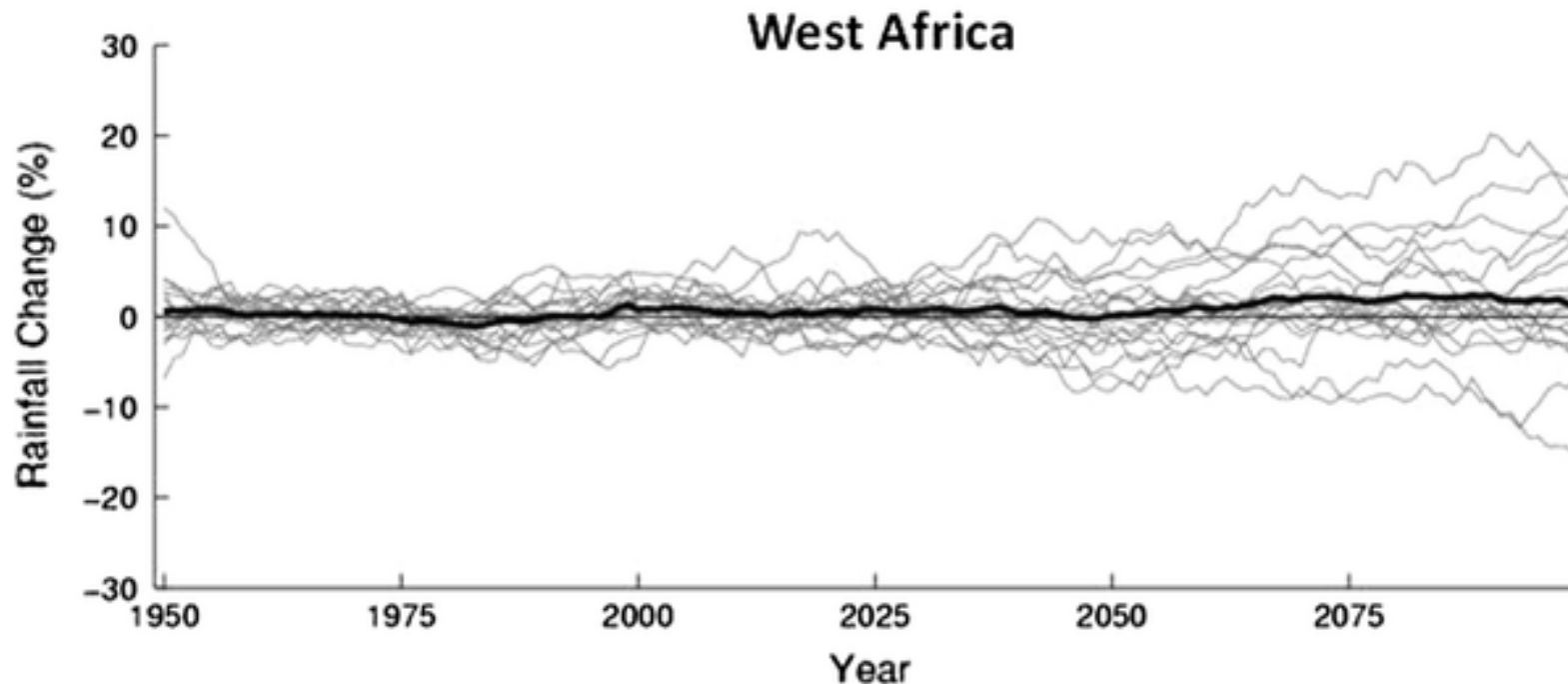
IMs

SWIM
SWAT+
...

EXAMPLE: PRECIPITATION ACROSS WEST AFRICA

- 50% of the ensemble projects a generally drier and 50% a generally wetter future
 - On average nothing changes (multi-model mean)?
 - Uncertainty is large. Can we still get a meaningful message?

WRONG



EXAMPLE: PRECIPITATION ACROSS WEST AFRICA

- **50% of the ensemble projects a generally drier and 50% a generally wetter future**
 - On average nothing changes (multi-model mean)?
 - Uncertainties too large for a meaningful message?
- **Hope for the best, plan for the worst!**
 - Analysis of individual models
 - Analysis of projected changes in extremes
 - Floods, recurrence intervals
 - Droughts, consecutive dry years...
 - Ex.: generally wetter future & unprecedented droughts – no contradiction

WRONG

ASKING THE RIGHT QUESTIONS

“What will be the impact of climate change on renewable energy resources?”

“What is likely to change about [X] due to climate change?”

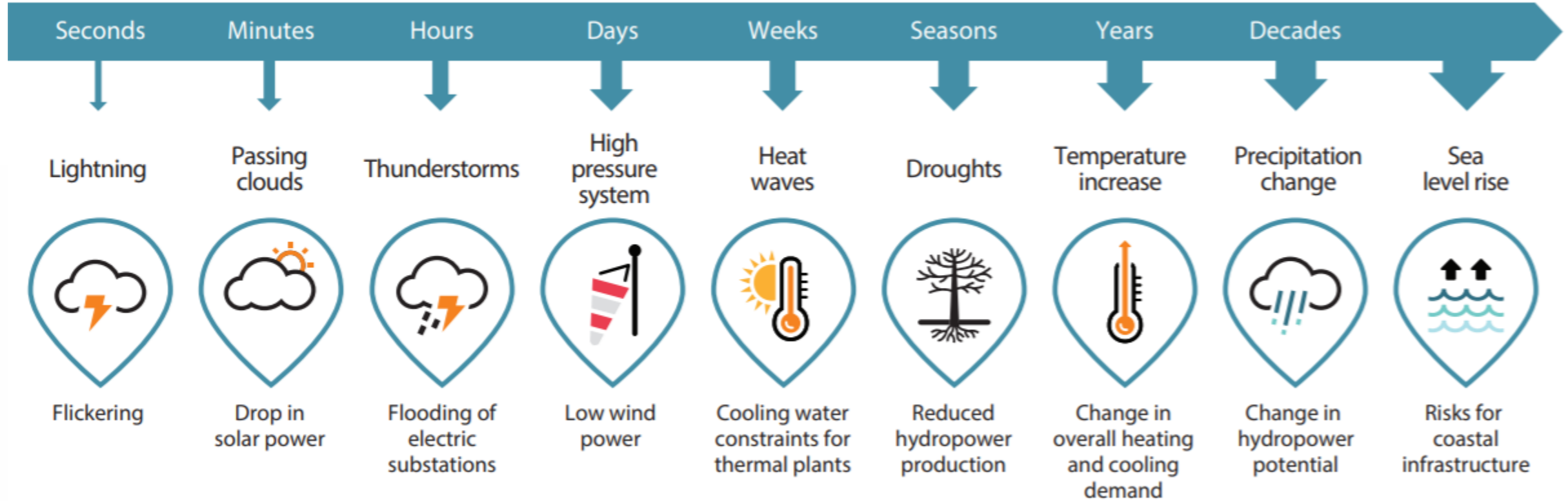


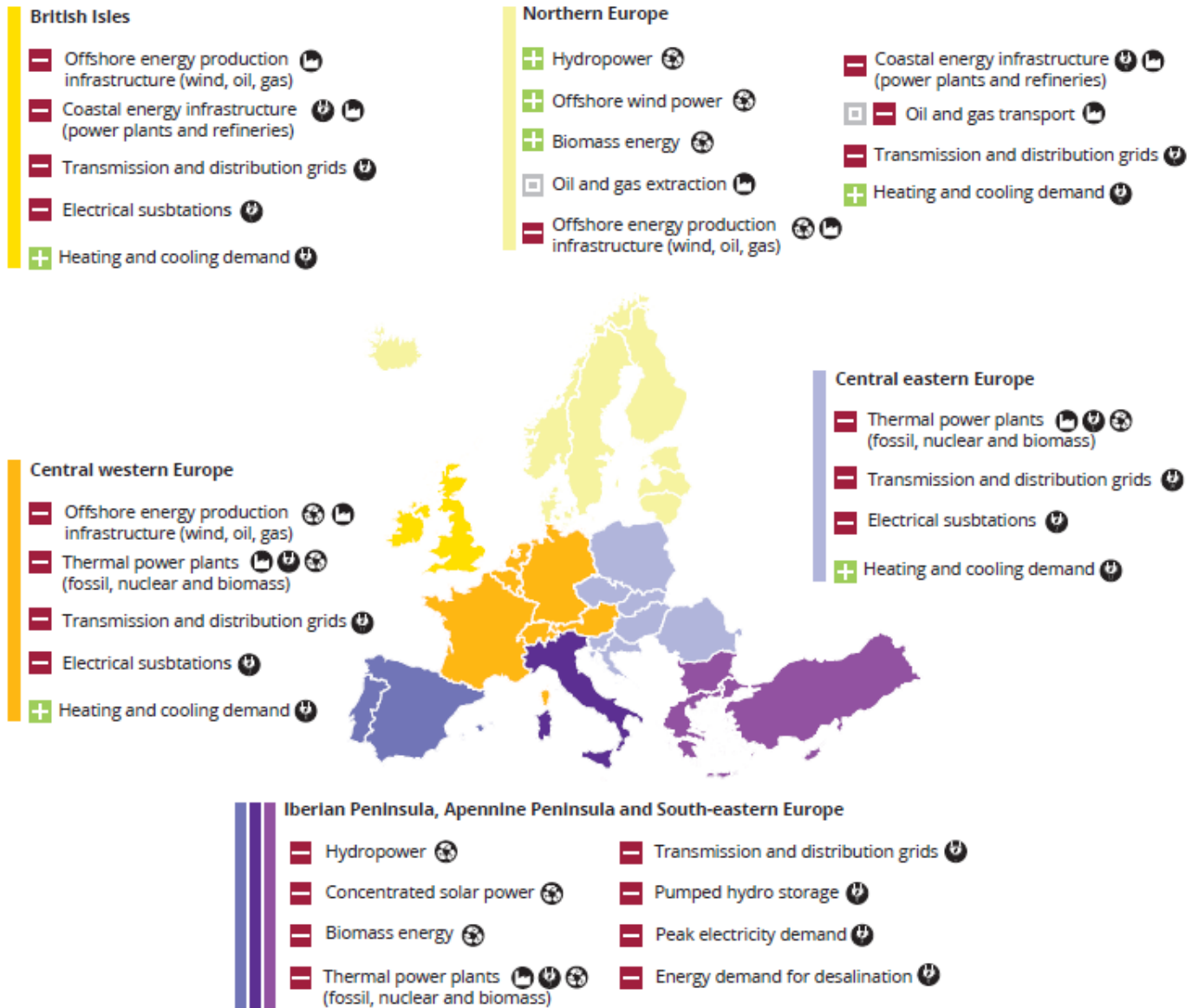
“What will be the overall impact on the energy system?”

“How will renewable resources be affected by [X]?”



WEATHER/CLIMATE IMPACTS ON ENERGY SYSTEM





+ Predominantly beneficial impacts
 - Predominantly adverse impacts
 □ Impacts not classifiable as beneficial or adverse due to complex economic and environmental effects

☀ Renewable energy sources
 ⚡ Fossil energy sources
 ⚙ Other energy sources and carriers (nuclear, electricity, heating and cooling)

Adaptation measures

- Hydropower expansion in response to glacier melt (Iceland)
- Adapting distribution grid design standards (Britain, Finland)
- Flood risk management for hydropower plants (France)
- Adapted power plant design to avoid flood damage (Britain)
- ...

Source: European Environment Agency, "Adaptation challenges and opportunities for the European energy system: Building a climate-resilient low-carbon energy system", EEA Report no 01/2019. Luxembourg, 2019

THANK YOU

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