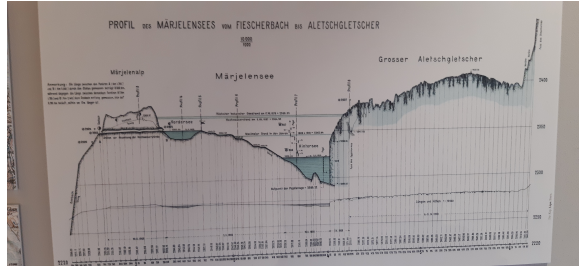# My perspective on climate risk and power systems

Historical session, next generation challenges workshop

Jan Wohland | Climate Policy Group | jwohland@ethz.ch

How not to do it – outflow regulation Märjelensee

Picture taken at World Nature Forum, Naters, Switzerland.

- repeated flooding from the lake in 19th century

How not to do it – outflow regulation Märjelensee

Picture taken at World Nature Forum, Naters, Switzerland.

- repeated flooding from the lake in 19th century
- ⇒ 600m outflow regulation tunnel constructed 1889 - 1894
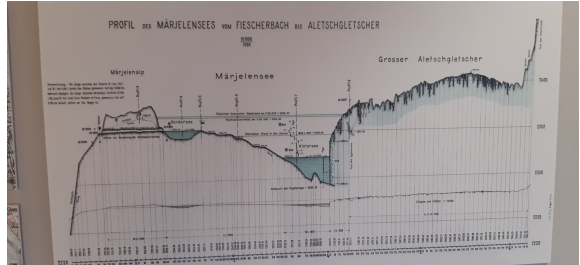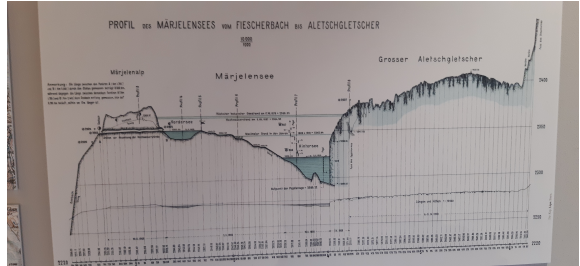
How not to do it – outflow regulation Märjelensee

Picture taken at World Nature Forum, Naters, Switzerland.

- repeated flooding from the lake in 19th century
- ⇒ 600m outflow regulation tunnel constructed 1889 - 1894
- But didn't check the IPCC report. Lake level only reached tunnel entrance once (1896)!

A three step research agenda

A three step research agenda

Weather
House

Renewable feed-in

Electricity demand
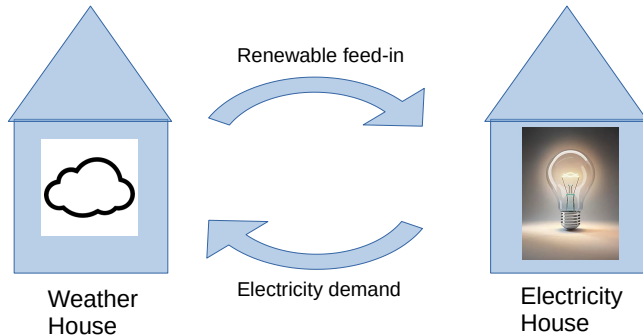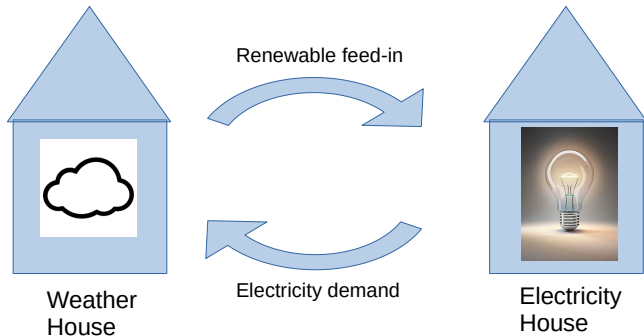
Electricity
House

1) Understand weather house

A three step research agenda

Renewable feed-in

Electricity demand

Weather
House
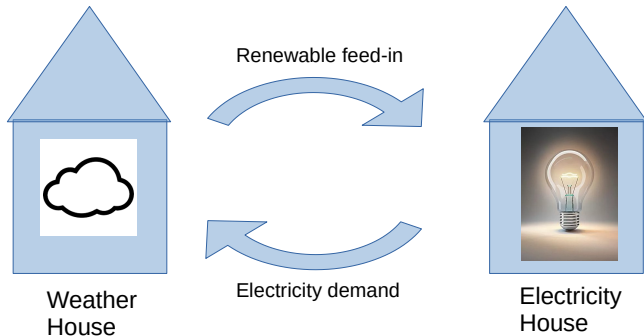
Electricity
House

1) Understand weather house **2)** Understand electricity house

A three step research agenda

Renewable feed-in

Weather House

Electricity demand
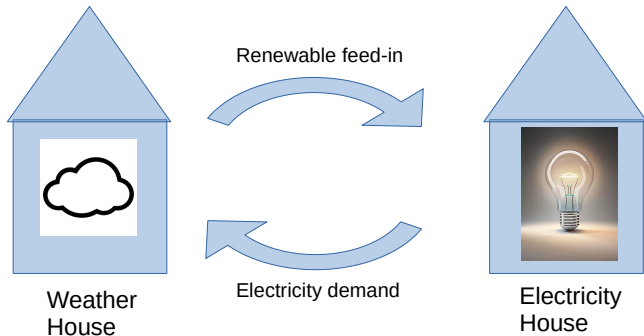
Electricity House

1) Understand weather house **2)** Understand electricity house **3)** Understand arrows

A ~~three~~ *N* step research agenda ($N \approx \infty$)
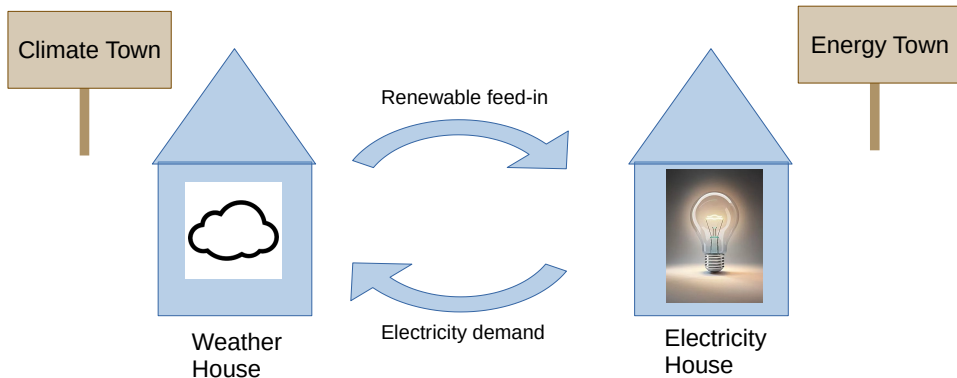
Leading workshop questions

1. What are the implications (...) of **climate risk/uncertainty** in power system modelling?
2. How should **climate risk/uncertainty** be estimated in power system modelling?

Leading workshop questions

1. What are the implications (...) of **climate risk/uncertainty** in power system modelling?

2. How should **climate risk/uncertainty** be estimated in power system modelling?

$$risk = \underbrace{probability \cdot severity}_{could\ both\ be\ uncertain}$$

Internal climate dynamics

(e.g., extremes, long-term variability)

Where could **climate risk** come from?

Internal climate dynamics

(e.g., extremes, long-term variability)

Forced Climate Change

(HB: Forbidden topic today)

Where could **climate risk** come from?

Internal climate dynamics

(e.g., extremes, long-term variability)

Forced Climate Change

(HB: Forbidden topic today)

Our limited understanding of Climate

(e.g., turbulence)

Where could **climate risk** come from?

Internal climate dynamics

(e.g., extremes, long-term variability)

Forced Climate Change
(HB: Forbidden topic today)

Our limited understanding of Climate
(e.g., turbulence)

Where could **climate risk** come from?

My even more limited understanding/ users are humans

(co-production of knowledge?)

Internal climate dynamics

(e.g., extremes, long-term variability)

Forced Climate Change
(HB: Forbidden topic today)

Our limited understanding of Climate
(e.g., turbulence)

Where could **climate risk** come from?

My even more limited understanding/ users are humans

(co-production of knowledge?)

Limited knowledge of the context

(e.g., what is correct scale?)

Internal climate dynamics

(e.g., extremes, long-term variability)

Forced Climate Change
(HB: Forbidden topic today)

Our limited understanding of Climate
(e.g., turbulence)

Where could **climate risk** come from?

Pitfalls when using data
(e.g., ensemble mean wind components in 20CR)

Limited knowledge of the context

(e.g., what is correct scale?)

My even more limited understanding/ users are humans

(co-production of knowledge?)

Internal climate dynamics

(e.g., extremes, long-term variability)

Forced Climate Change
(HB: Forbidden topic today)

Our limited understanding of Climate
(e.g., turbulence)

Unavailability of reliable and consistent data

(e.g., different timestepping)

Where could **climate risk** come from?

Pitfalls when using data
(e.g., ensemble mean wind components in 20CR)

Limited knowledge of the context

(e.g., what is correct scale?)

My even more limited understanding/ users are humans

(co-production of knowledge?)

Unavailability of relevant quantities

Internal climate dynamics

(e.g., extremes, long-term variability)

Forced Climate Change
(HB: Forbidden topic today)

Our limited understanding of Climate
(e.g., turbulence)

Unavailability of reliable and consistent data

(e.g., different timestepping)

Where could **climate risk** come from?

My even more limited understanding/ users are humans

(co-production of knowledge?)

Pitfalls when using data
(e.g., ensemble mean wind components in 20CR)

Limited knowledge of the context

(e.g., what is correct scale?)

How these risks might manifest and mitigation options

Risk origin	example impact	How to mitigate [MAYBE!]
Internal climate dynamics	Extreme energy shortfall	Use long timeseries
	Long-term resource variability	Use long consecutive timeseries

How these risks might manifest and mitigation options

Risk origin	example impact	How to mitigate [MAYBE!]
Internal climate dynamics	Extreme energy shortfall	Use long timeseries
	Long-term resource variability	Use long consecutive timeseries
Our limited understanding of climate	Models & reanalysis could be wrong	be aware of their imperfect nature, validate/sanity check with energy observation

How these risks might manifest and mitigation options

Risk origin	example impact	How to mitigate [MAYBE!]
Internal climate dynamics	Extreme energy shortfall	Use long timeseries
	Long-term resource variability	Use long consecutive timeseries
Our limited understanding of climate	Models & reanalysis could be wrong	be aware of their imperfect nature, validate/sanity check with energy observation
Users are humans	might make questionable decision outside their own field	bring disciplines together

How these risks might manifest and mitigation options

Risk origin	example impact	How to mitigate [MAYBE!]
Internal climate dynamics	Extreme energy shortfall Long-term resource variability	Use long timeseries Use long consecutive timeseries
Our limited understanding of climate	Models & reanalysis could be wrong	be aware of their imperfect nature, validate/sanity check with energy observation
Users are humans	might make questionable decision outside their own field	bring disciplines together
Limited context knowledge	real questions may be substituted with questions of limited relevance	Establish a forum to discuss approaches

How these risks might manifest and mitigation options

Risk origin	example impact	How to mitigate [MAYBE!]
Internal climate dynamics	Extreme energy shortfall Long-term resource variability	Use long timeseries Use long consecutive timeseries
Our limited understanding of climate	Models & reanalysis could be wrong	be aware of their imperfect nature, validate/sanity check with energy observation
Users are humans	might make questionable decision outside their own field	bring disciplines together
Limited context knowledge	real questions may be substituted with questions of limited relevance	Establish a forum to discuss approaches
Pitfalls when using data	Underestimate uncertainty when choosing only 1 dataset/member	use ensembles

How these risks might manifest and mitigation options

Risk origin	example impact	How to mitigate [MAYBE!]
Internal climate dynamics	Extreme energy shortfall Long-term resource variability	Use long timeseries Use long consecutive timeseries
Our limited understanding of climate	Models & reanalysis could be wrong	be aware of their imperfect nature, validate/sanity check with energy observation
Users are humans	might make questionable decision outside their own field	bring disciplines together
Limited context knowledge	real questions may be substituted with questions of limited relevance	Establish a forum to discuss approaches
Pitfalls when using data	Underestimate uncertainty when choosing only 1 dataset/member	use ensembles
Unavailability of reliable and consistent data	Cross-correlations between variables might be misleading	Verify reliability and consistency or do not use data

How these risks might manifest and mitigation options

Risk origin	example impact	How to mitigate [MAYBE!]
Internal climate dynamics	Extreme energy shortfall	Use long timeseries
	Long-term resource variability	Use long consecutive timeseries
Our limited understanding of climate	Models & reanalysis could be wrong	be aware of their imperfect nature, validate/sanity check with energy observation
Users are humans	might make questionable decision outside their own field	bring disciplines together
Limited context knowledge	real questions may be substituted with questions of limited relevance	Establish a forum to discuss approaches
Pitfalls when using data	Underestimate uncertainty when choosing only 1 dataset/member	use ensembles
Unavailability of reliable and consistent data	Cross-correlations between variables might be misleading	Verify reliability and consistency or do not use data

Let's try to be smarter than the swiss villagers 150 years ago!