



**European Parliament Greens/EFA Group  
& Heinrich Böll Stiftung**

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## **World Nuclear Industry Status Report - 2019**

### **Commentary**

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**Research motto:**  
**Prefer to speak true words receiving blame,  
above deceiving advice in soliciting praise.**



# Overview

- 1. Praise WNISR-2019**
- 2. Energy reversal: end of the steam power era**
- 3. IPCC's rotten low-carbon mantra “RE, nuclear, CCS”**



## **Laudato si' : Praise be to you WNISR founder & contributors**

**A commentary is always difficult, because the study is**

- Either junk, & commenter must be polite (ask an Englishman)**
- Or too marvelous for words (ask nobody)**

**Tonight I am mr. nobody as the WNISR is marvelous.**

**Diana Ürge-Vorsatz's Forward already cuts the grass of praise:**

- "Authoritative report"**
- "International reputation beyond doubt"**
- "Single most important reference document"**
- "All concerned parties should read the WNISR to understand the real issues the nuclear industry is facing"**

**Concluding recommendation:**

**"READ THIS REPORT PRIOR TO MAKING DECISIONS"**



## Laudato si' : Praise be to you Let me focus on 3 attributes

### FACTUAL

- ❖ Based on numbers, documents, fully referenced
  - ↳ nuclear sector story telling, fake news, mirages, ...
- ❖ Accessible: clear language & excellent informative graphs
  - ↳ fig. 38, 39 investment volumes RE & NP are pro-nuclear biased ("nobody is perfect" (WNISR-2019, p.3))

### COMPREHENSIVE

- ❖ All countries: up-to-date information & quick-view pictures
- ❖ All plants: old, new, LTOs, decommissioning list, ...
- ❖ Temporal: begin to (forecasted) end of insane NP, all NP

### PERSEVERANCE

- ❖ Of first author Mycle, & other oldies Amory, Steve, Walt, ...
  - ❖ Annually, robust & fresh (as BP Stat. Review, not the budget)
  - ❖ Sustainability direction (as IRENA, also free access)
- I.e.: all energy is covered: nuclear, fossil, renewables

Do we need more International Energy Agencies?  
[expensive reports, mostly 5 years behind new trends]

# 1° Transition Strain of the energy reversal: Electricity as major energy vector

## Electric energy is a non-storable flow

- Not available in nature for human use (lightning is not useful)
- Needed conversion of other energy flows
- Supply flows (2019): ca. 80% steam / 20% natural currents

## Steam era (18<sup>th</sup> – 20<sup>th</sup> century)

- Geothermal steam at some locations (e.g., Iceland), low pressure, polluted, ...
- Steam from fossil (+ some bio) fuels, and atoms fission

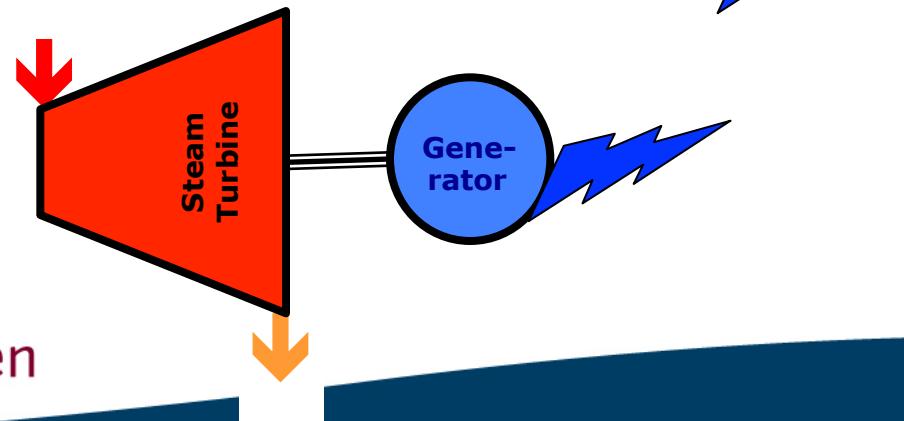
## CORE of steam power generation plant:

SteamTurbine: kinetic energy in high-pressure steam in-flow

out-flow of exhausted steam to condenser

Causes turbine-axis = to rotate

Generator converts rotation in electricity

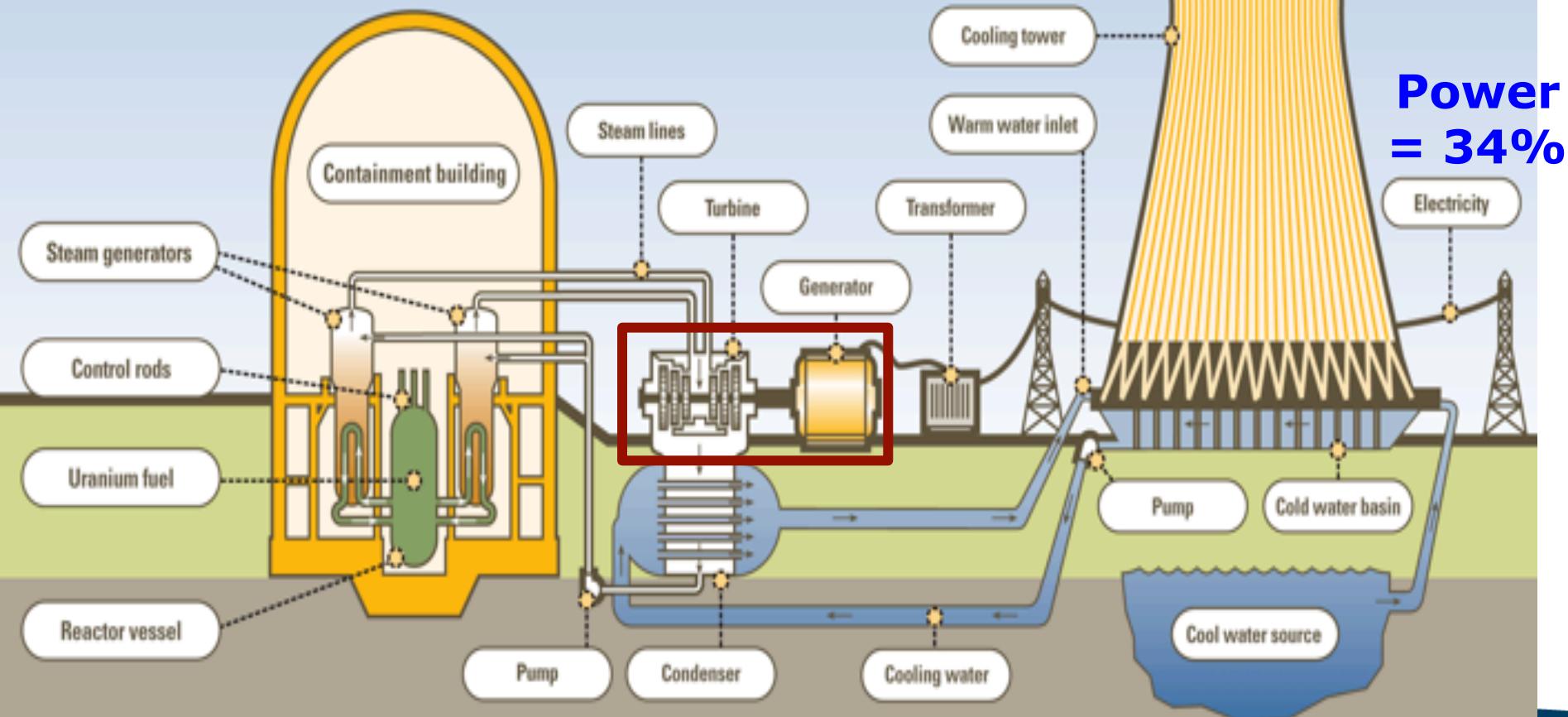


# Nuclear plant as 'should' (Walt Disney picture)



**Construction  
+ \$10 billion**

**Waste heat  
= 66%**



**Power  
= 34%**

# Steam electricity generation needs many costly and polluting flab activities to source steam and to sink waste and waste heat (non-exhaustive enumeration)



## From fuel to steam

### Coal

- Mines: delving machinery
- Washing, sorting, storing
- Transport: belts, trains, vessels, harbours
- Crushing, milling, powdering
- Combustors, ventilators
- Feed water pumps
- Boilers, economizers, ..
- Steam pipes, nozzles

### Natural Gas

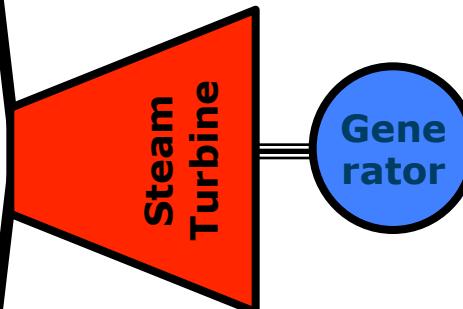
- Wells: winning, cleaning
- Compressing, liquefying, storing
- Transport: pipelines, LNG ships
- Gas turbine in combined cycle
- Air capture & compression
- Heat recovery steam generator

### Nuclear

- Uranium mines
- Yellow cake, enrichment
- Fuel tablets, canisters
- Containment, Reactors
- Feed water pumps
- Steam generators

## Source flabs

Alternating power generation by  
Steam Turbine - Generator



## Waste handling & Installations

### Coal

- Flue gas cleaning
  - Dust precipitators, filters
  - Sulphur scrubbers
  - Carbon Capture & Storage
- Stacks
- Ash, dust, gypsum management

### Natural gas

- Flue gas cleaning
  - Catalytic NOx reduction
  - Carbon Capture & Storage

### Nuclear

- Nuclear facilities decommissioning
- Nuclear fuel waste cooled storage, reprocessing, eternal storage
- Decontaminating radiated sites, including accidental areas

## Sink flabs

- Discarding waste heat:
  - condensers, pumps,
  - cooling towers,
  - rivers, lakes, sea

■ ■

# Illustration sink flab atomic power Fukushima Daiichi destroyed (photo)

**Clean area and cooling water stocks  
+ \$500 billion?**



## 2° Transition strain of the energy reversal: Harvest Ambient Power NO source flabs + NO sink flabs





# Global climate policy discourse & nuclear power

See: WNISR-2019 chapters 'CC & NP' (pp. 228-256)  
and 'NP vs. RE deployment' (pp210-227)

Nuclear power relation to CC is framed by

- Acceptance of the triptych mantra 'RE, nuclear, CCS'
- Attention to 'carbon, cost, and time'

Lacking is: incompatibility RE - NP in power systems

- Mr. nobody ends with a sad, factual experience

IPCC AR5 (2014) & IPCC SR1.5°C (2018)

- Author nuclear sections: H.-Holger Rogner (IIASA, IAEA) as contributing author ch.7 Energy Systems in 2014
- Excluding critical publications, by silencing or misrepresenting  
↳ IPCC's mission is assessing ALL peer-reviewed literature, i.e. not an IPCC gate but an IPCC canyon (where is the press??)

Berlin, April 2014: AR5 WG3 SPM draft: 'NP expansion limited by barriers of public concern about safety' = nuclear problem is not its risks, but adverse public opinion

I opposed in full plenary; Rogner took over the meeting's chair!



## IPCC & nuclear: 'nobody is perfect'

**The perverse mantra 'RE, nuclear, CCS'**

- Following IEA (energy industry friendly)
- Life-essential for nuclear interests to go on
- IAEA is also an 'intergovernmental UN body'

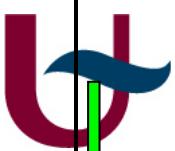
**The Integrated Assessment Models (IAM) are coarse, flawed**

- Electricity is a transient phenomenon
- Electricity generation modeling needs hourly chronology
- IAMs juxtapose yearly volumes

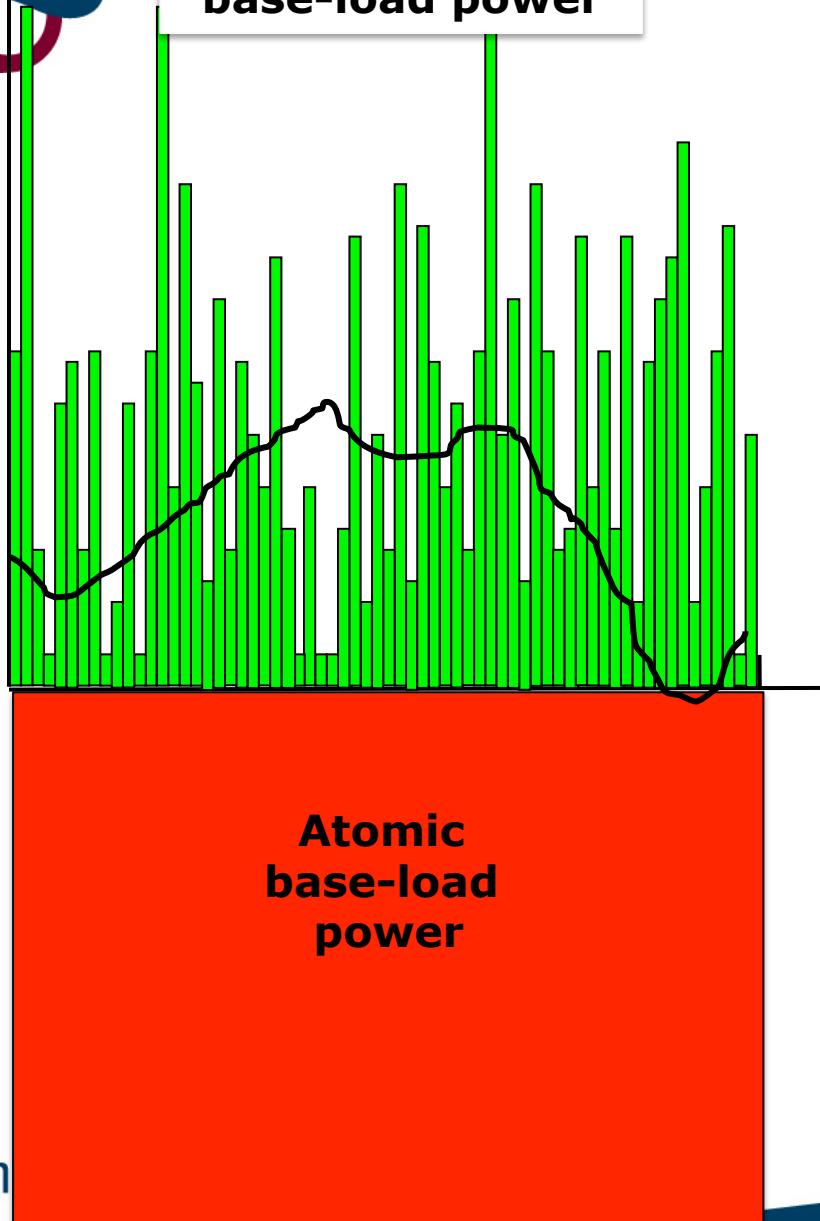
**Hence: incompatibility flow RE / nuclear power concealed**

**Next graphs represent how the two contenders RE and NP**

- Are both inflexible (for different reasons)
  - Both claim the first place in the merit-order ranking
    - They ruin each other business case
- Hence: they are incompatible**

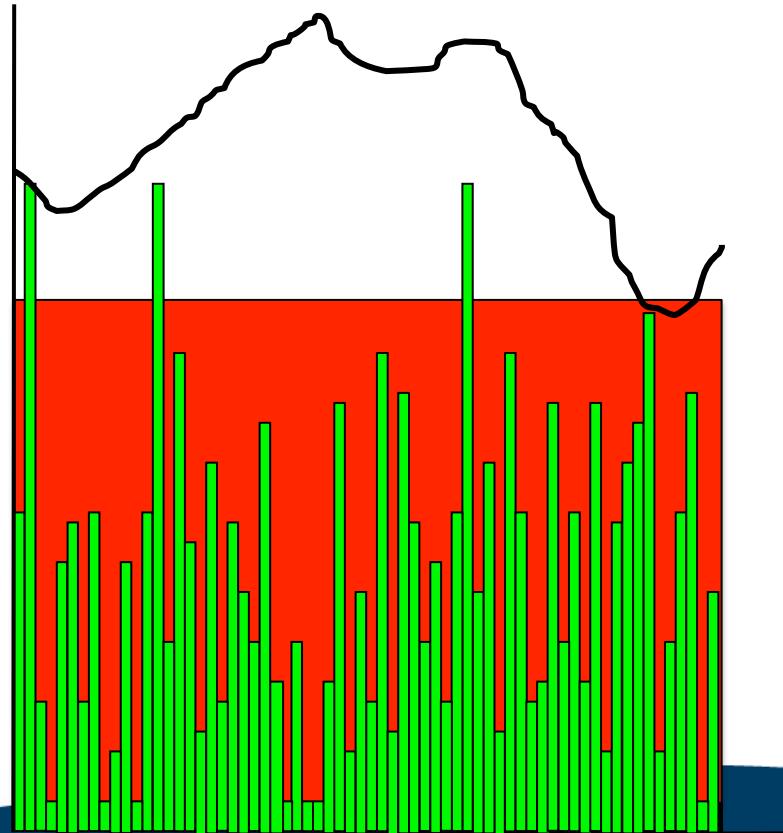


## Priority for Atomic base-load power



Priority for one ruins the business case of the other

## Priority for Flow renewable power



Un



## Thanks for listening & some homework

### **Reading about incompatibility RE-NP:**

Aviel Verbruggen (2008). Renewable and nuclear power: A common future? Energy Policy 36: 4036-47

Aviel Verbruggen and Yuliya Yurchenko (2017). Positioning Nuclear Power in the Low-Carbon Electricity Transition. Sustainability 9, 163 (14p.)

### **Reading about nuclear discourse:**

Aviel Verbruggen and Erik Laes (2015). Sustainability assessment of nuclear power: Discourse analysis of IAEA and IPCC frameworks. Environmental Science & Policy 51: 170-180

### **Remind:**

- 1. Steam power era is ending**
- 2. Reject the rotten triptych mantra 'RE, nuclear, CCS'**
- 3. Resist further spending on nuclear power projects & mirages**
- 4. Unveil flawed paradigms, hidden interests, dishonest science**