Stéphanie Tillement – Between heterogeneity and cooperation: The (electronuclear) scenario as a 'boundary object' for decision-making.

- Part of work that started in 2014.
- Investigating the factory and analysis of scenarios
- Used focus grouped to perform the analysis
    - Politics
    - Research; Engineering and Industry
    - Academics
- Thinking of scenarios as 'boundary objects'
    - These can be weakly structured in common use, but strongly structured in local use.
- Encouraged different scenarios for different decision making processes
    - Normative vs Realistic
    - Complex vs simple
- How does this work compare if performed at other countries?

Lindsay Shuller-Nickles – Energize: An interaction evaluation tool for engaging the general public with energy decision making

- Creating an interactive game for different energy scenarios for the user to choose from.
- Serious Games?
    - An expression to describe a complex game, a la - SimCity
- Life Cycle Assessment of all energy sources
- Simplifications
    - Can't be 100 accurate
- Game design
    - Player is CEO of a company - generic company
    - Grid modeled off of the North American grid but it is a generic map.
    - Goal - increase company earnings / meet energy demand
    - Playing with the idea of letting the player attempt other goals
- Considered board game
    - Added events a la - Pandemic Legacy / Risk Legacy
    - Ensures the game is new each time
    - Doesn't want the game to become too formulaic
- Win States
    - No win state
    - Singular win state
    - Unique win state linked to a given goal (green tech)
- Concerns for Win states
    - Imposition bias
    - Level of transparency
    - Player engagement and satisfaction
- How much is too much?
    - Information overload
    - Can one tool be used by several audiences

Discussion 1 (Thurs @ 9:30)

Lots of discussion on how a power grid / fuel cycle game would work. Overall thoughts, it's a lot of work and will be very difficult to balance the technical fuel cycle parts with fun. Also, how do we model the societal representation in the game. How is society accurately modeled.

Guillaume Krivtchik – Scenarios with COSI6: Optimization, Uncertainty and Beyond
- What do we optimize?
  - Looking for a strategy
  - Input (too many parameters)
  - Output (well-known criteria)
- Uncertainty Propagation
  - Nuclear data uncertainties
    - Not easy to consider
    - Well define
  - Industry data uncertainties
    - Difficult to obtains
    - Impact might be very strong
  - Policy changes
- Looking to find new optimization processes.
  - More efficient algorithms
- Improve uncertainty propagation
- Robust scenarios
  - Create scenarios that do well even under the uncertainty propagation.

Adrien Bidaud – Consequences of a calculation error in Harvard's report on the economics of reprocessing vs direct disposal of spent nuclear fuel
- Uncertainties in nuclear economics can be quite large because the base calculation is flow x cost.
- The error comes from the method they use to calculate the mass flows. For a reactor with a blanket, the assumption is that the blanket produces as much power as the driver.
- This brings the validity of the Harvard report into question.
- Results should be updated
- Interdisciplinary studies are difficult
- Keep codes open / free to use

Discussion 2 (Thurs @ 10:30)
- Uncertainties
  - Under which conditions do these uncertainties really have a big impact.
    - Do physics uncertainties really accumulate in a way that affects policy?
- Do we have data on why it costs so much to build a nuclear plant in the US?
- Are the costs of facilities really that accurate or are we way off on the cost of a fast reactor?
- Again, where do uncertainties fit. That is important to answering a problem.
- What parameters you choice has a big impact on the actual cost calculations. This is important when calculating the cost of anything.

Jean-Baptiste Clavel – Uncertainties and sensitivities study methods applied to the dynamic fuel cycle

- Issues
  - Large number of parameters
    - Fuel cycle options
    - Facility options
  - Limited parameters to
    - UOX MOX
    - Cooling time
    - Others
  - Large number of outputs
    - Inventories - both at the end and during
- MORRIS method
  - How to evaluate the cross weight of input parameters
  - Deterministic approach
  - Screening method
    - Doesn't require a lot of calculation
  - Identify the non-influential inputs
- Application Case
  - MOX cases
  - Looked at PU content of input and output MOX fuel compositions
  - Determined which input values had the highest impact on these two values.
- MORRIS method can be used to select which parameters are impact to a specific reactor case.

Baptiste Mouginot – Confidence improvement effort

- Fuel cycle model should be able to reproduce a real case
  - Compare against an existing fleet
  - Lack data for comparisons
- A model should also be able to study perspective fleets
  - Inter-code benchmarks are usually used to check model reliability
    - Issues interpreting results, getting consistent demons and users.
    - Model complications induce deviates from the specifications.
- Workflow
  - Define experiment
    - Facilities and links
  - Define problems
    - Number of facilities
  - Design experiment
    - Fixed parameters / input variables.
  - Runs
  - Sensitivity Study
    - Sampling on input data
- Between CLASS and CYCLUS we can see deviations between the behavior in the results.
  - Differences in the time steps, and differences in the way that facilities are managed.
- Goal of FCCI

- o Provide framework for comparing simulators by given open access to data and problems so that an even ground can be found for all simulators can compare against.
- o Need a format for data storage
- o Asking for new tools to participate
- o The cyclus model used was CyCLASS. So the same model just different simulators.

Discussion 3 (Thurs @ 11:45 AM)
- Could CyCLASS be replaced with Cycamore or Cyborg or Bright-lite
- For something like FCCI it is important to make sure that there is a minimum specification, and the goal of that is allow for most simulators to be very close in terms of the definition of the scenarios
- Sensitivity is also important, not just results.
- NEA OCD work on building up the database and simulations.
- I think there is a lot of support for an accessible database for fuel cycle benchmarks.
  - o This strikes on a more important topic for fuel cycles, which is essentially we have no real common benchmarks, and unit tests for a fuel cycle simulator.
- How do we generate recipes for recipe reactors for benchmarks like this?
- VISION lacked PWR and FR reactor recipes when doing the OECD study. So they were reliant on other simulators to get this data.
- Murmuring about keeping reactor physics parts of a simulation separate from the fuel cycle parts. These should be unit tested with different tests.
- There exists a database of outputs for used fuel in the U.S.
- SF Compo - UNFStandards : These are two have data on spent fuel in the US.

Abdoul-Aziz Zakari-Issoufou – A multivariate analysis of mixed oxide based nuclear scenarios
- How do we make Scenario Analyses more consistent?
- Global Observation Analysis
  - o MOX based cycle

Nicolas Thiolliere – Study of plutonium reprocessing in PWR with the CLASS tool
- Problem, France fleet is mostly MOX but reference scenarios are based on SFR closed cycles
- New facility construct is complex, EPR and CICEO
- Uncertainty around ASTRID - gen IV reactor
- SFR deployment delayed
- SFR deployment will not happen
- Starting for the current date, moving more fully from UOx to MOXEUS.
- To incinerate plutonium the thermal power of the fleet must be reduced.
- Sensitivity Analysis provides non intuitive solutions
- Plutonium stabilization is efficient with a constant power

Discussion 4 (Thurs @ 2:15)
- Canadian CANDU burning of PU through mixed PU/Th fuel.
  - o France did not consider this it seems like.

- You really only blend PU with Th if you are trying to eliminate PU, because you have a hard time generated U3 in that type of reactor.
- It's not really common for a phase out - but rather every country that has dropped nuclear just does it quickly. No phase out.
- Is phase out really an option, or if you decide no more nuclear you do it in a shut down.
- Do you care just about the waste or do you also care about the inventories in the operating reactors?
- What are the analysis and visualization concerns?
- 10k simulations
  - Collapse all the outputs into one file
  - 3 seconds to generate the graphs for Nicolas's talk
  - Uses ROOT as the output forms

Brent Dixon – Visualization of simulation results
- Being able to run something in reverse, interact with the system as it progresses
- Built in graphics for VISION
- Standard output template. This gives people a standard set of graphs to compare to each other.
- General overview of fuel cycle result visualization through VISION