

Dear CRP Colleagues -- Happy New Year!

I had an action from the recent CRP meeting on Small Reactors Without Onsite Refueling to distribute (1) a description of the DANESS code used for dynamic scenario modeling; (2) a list of the data required to model a given reactor type and fuel cycle type and (3) proposals for specific scenarios involving small reactors without onsite refueling for consideration to be evaluated by our CRP.

This email addresses a broad overview of items (1) and (2) only. Item (3) will come later.

(1) The DANESS code is intended to examine nuclear futures at any level of aggregation.

- A utility
- A nation
- A region
- Multi-regions
- The world

The scenarios are run as follows:

- Nuclear energy growth rates are pre-specified as the driving function
- Priority choices for new deployments are pre-specified by the user, such as:

"add ALWR's 40% and HTGR's 60%"

or

"add LMFBR's to the limit of available TRU from reprocessing LWR SNF and LMFBR excess fissile; then fill in the remainder of required capacity with LWR's".

- Therefore, in most simulations run so far we do not model economic competition for market share, but DANESS does include a classical intra-nuclear market-penetration model (analogous to the model used in ENPEP/BALANCE) which may (optionally) be used by the user. Also DANESS optionally can track cost and revenue streams for reactors and fuel cycle facilities and their net present value with various degrees of aggregation (if data are provided for unit costs).

(2) The DANESS code uses pre-computed mass flow input/output data to represent reactors - (inline depletion calculation is currently not done).

Recent additions provide for specific representation of several dozen specific isotopes and their post irradiation time evolution of heat rates and toxicity indexes - used for more detailed studies of waste management strategies. (But these issues are not likely to be relevant for initial multi-region nuclear growth scenarios undertaken by this CRP).

The code handles a discrete representation of asset deployments. Deployment time delays for licensing and for construction/startup are required. Similarly fuel cycle time lags for such things as enrichment, fabrication, shipping, spent fuel cooling, fresh fuel shipping, reprocessing, refabrication, and shipping are required. (In growth scenarios, these dynamic time delays and the mass holdups in the fuel cycle pipeline have a profound impact on outcomes and they cannot be neglected.) (As an example the "support ratio" of fast burners vs LWR's in a Partitioning/Transmutation symbiotic energy park is very different in a growth scenario from a steady state scenario.)

(3) The Dynamic Analysis of Nuclear Energy System Strategies (DANESS) code is described at website:

www.daness.anl.gov

The website has some archived papers and presentations from 2004 and 2005 showing the type of scenarios the code can handle. For a QUICK OVERVIEW of the capability and a worked application the best choice is to:

Click on Applications, PAPERS

Then

Click on Big10 Workshop INTRO Viewgraphs "DANESS-Intro.pdf"

And

RESULTS Viewgraphs "DANESS-Results.pdf"

Note that VG#18 of the Intro viewgraphs shows the reactor attribute data that you would be required to supply to get your concept represented in a scenario. It's no more than mass flows and working inventories along with power rating.

For a more extensive description of DANESS, Click on OVERVIEW/MANUAL

An especially useful chapter of the REPORT is Chapter 16 where a step-by-step example is given for setting up a scenario using the GUI input interface and relying on the already existing reactor type and fuel cycle databases.

The most recent description of the code status was presented in the Global 05 meeting in October 2005, paper #550 - which is one of the archived PAPERS on the website.

(4) The code is openly available under paid licensing agreement; the website has contact information. A free, simplified demo version will soon be available on the website that you can play with to gain familiarity.

This information about DANESS is at an overview level. Persons interested in DANESS can find out much more detail by contacting the address listed on the website, and/or by waiting a few weeks for availability of the free simplified demo version for familiarization with DANESS's capabilities.

I will be addressing the third action item - suggesting some potential scenarios involving small reactors without onsite refueling -- in a month or two.

Best regards,

Dave Wade