Assessing the future workforce supply for the UK Nuclear sector

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A System Dynamics based model is being used to inform a 20-year strategic analysis of the UK Nuclear sector workforce, which consists of over 80,000 highly skilled workers

- The model was commissioned by the UK Nuclear Skills Strategy Group, which consists of key employers and government representatives, for both the civil and defence nuclear sectors.
- The model projects the future supply of skills in the UK nuclear sector, and takes into account the many entry points into the workforce system, and the alternative approaches available to develop the workforce.
- The model is currently being used to explore ways in which the supply can be developed to meet the projected increases in workforce demand.

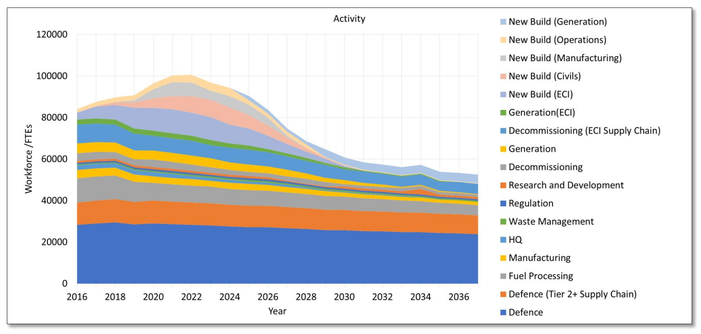
1 Background

The UK's nuclear workforce (civil, defence and supply chain) comprises around 80,000 FTE, but is expected to require expansion to a peak in the region of 100,000 as a result of a programme to build a fleet of new generating stations.

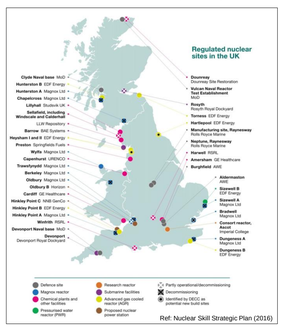
Context

A diverse range of skills are required

Workforce demand is expected to change significantly over time



Demand varies by region



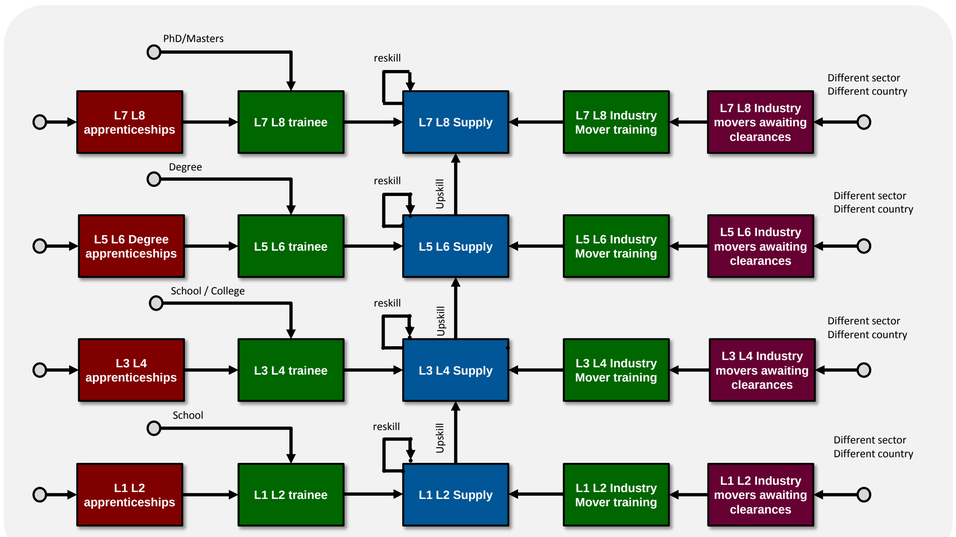
Model requirement

- The model was required by the Nuclear Strategy Skills Group (NSSG) to describe the supply of skills to the nuclear industry, in a way that complements an already developed demand side picture.
- The model will allow scenarios to be designed that in turn inform policy decisions on the level and timing of training and recruitment to meet the UK nuclear programme.
- The model is required to represent a common source of university graduates and apprenticeships feeding up to 20 different high level resource codes (HLRC).
- The model is required to project the workforce supply over a 20 year time horizon.

2. The model

The model was developed based on best practices in SD model development, which included model documentation and independent validation and verification.

Conceptual model



For simplicity, flows like attritions from the stocks are not shown

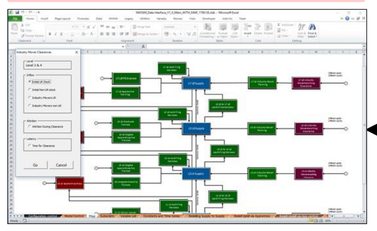
- Created in workshops using Stock and Flow notation, defining the supply stages and the model boundary.
- Each of the rectangles represents a number of people at various stages of training or within the workforce itself. In addition, each rectangle also represents multiple resource codes.
- Four different role levels are considered, representing a combination of qualification, knowledge and experience, and referenced to the UK Regulated Qualification Framework
- This conceptual basis for the UK nuclear workforce supply system formed the basis of the detailed quantitative model development.

Quantitative model

Nuclear Workforce Supply Side Model

Excel Data Interface → *Subscript elements and input data* → Vensim SD Model

User friendly SFD based data navigator



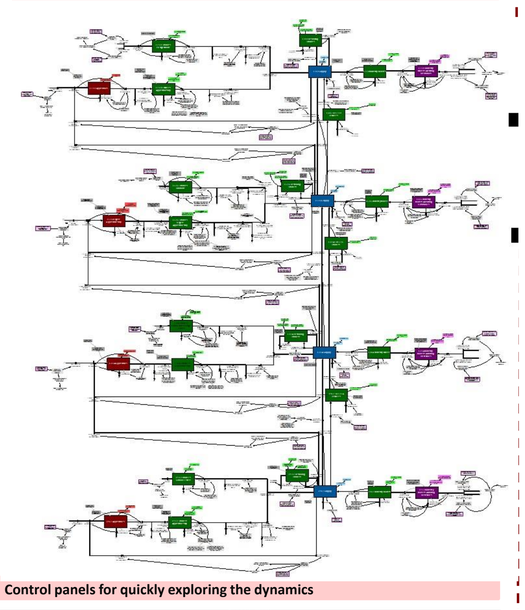
Time series inputs

152 data items

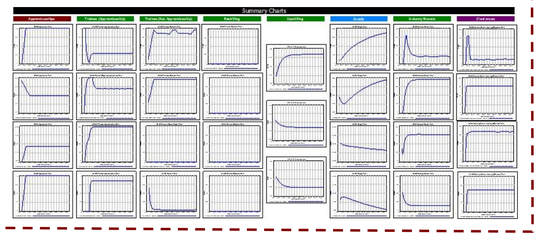
> 20,000 time series

- All input data was stored in the Excel Data Interface. This included all initial stock values, training enrolments and system delays.
- The model is subscripted to represent 20 High level resource codes, 72 types of apprenticeship, 9 different degree apprenticeships, 15 types of graduate and 8 different regions.
- The subscripts can be reconfigured in the Excel interface.
- The model includes structures to check model validity, such as mass balances.
- The model rapidly simulates 20 years at 1 month time steps.

Model stock and flow diagram replicated the conceptual model



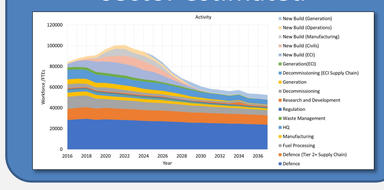
Control panels for quickly exploring the dynamics



3. Applying the model

The model is being used to explore policy options to meet future workforce demand.

Projected demand based on sector estimated



Do we meet demand?

Potential policies for each resource code

- Upskilling
- Reskilling
- Apprenticeships
- Graduates
- Intake from other sectors

Using the model

- Input flows and transition matrices are adjusted to achieve a supply profile that matches demand as closely as possible.
- In general, more than one combination of apprenticeship and industry mover stocks will be available, although timing considerations often constrain the range of options.

Example analysis

- The example analysis illustrates that a combined strategy which makes use of both apprenticeships and recruitment from other sectors enables a good fit between demand and supply.

4. What's next?

Conclusions

- Developing a model in collaboration with stakeholders helped all parties understand the complex nature of the nuclear workforce system.
- The visual representation of the model structure made it easier to share and explain to people.
- The formalised approach to model development and associated documentation built confidence in the model.
- Validation of the model was made easier as the model links were explicit within the stock and flow diagrams.
- It was easier than in an Excel model to interrogate the results for individual variables, which helped in understanding model behaviour.
- The analytical tools within the Vensim environment made it easier to explore the dynamics associate with all the model variables.

Next Steps

- Improved interface for defining potential policies.
- Sub-sector representation (for example an explicit defence sub-sector of the overall UK nuclear sector).
- Using Monte Carlo capabilities to make an assessment of the uncertainty associated with the projections.