



IAIGEN MODEL DESCRIPTION

October 2004

- 1.1 This note describes the basic new features and operation of the ILEX generation model for Ireland.

New features

- 1.2 ILEX has recently extended its Irish generation model to explicitly model the Northern Irish market, and to improve its treatment of electricity interconnectors with Great Britain.

All-Island modelling

- 1.3 The previous version of the model, *EirGen* simulated the operation of the electricity market in the Republic of Ireland (ROI) only. Here, the North-South Interconnector with Northern Ireland (NI) was divided into a number of incrementally priced tranches, each effectively acting as a generic power plant bidding into the ROI market.
- 1.4 The *IAIGen* model simulates the operation of the Irish generation plant on an all island basis. Existing and projected demand and generation capacity in NI are now modelled explicitly, and flows across the border can be constrained.
- 1.5 In periods where the flows are constrained, this results in two separate market prices for the ROI and NI.

GB Interconnectors

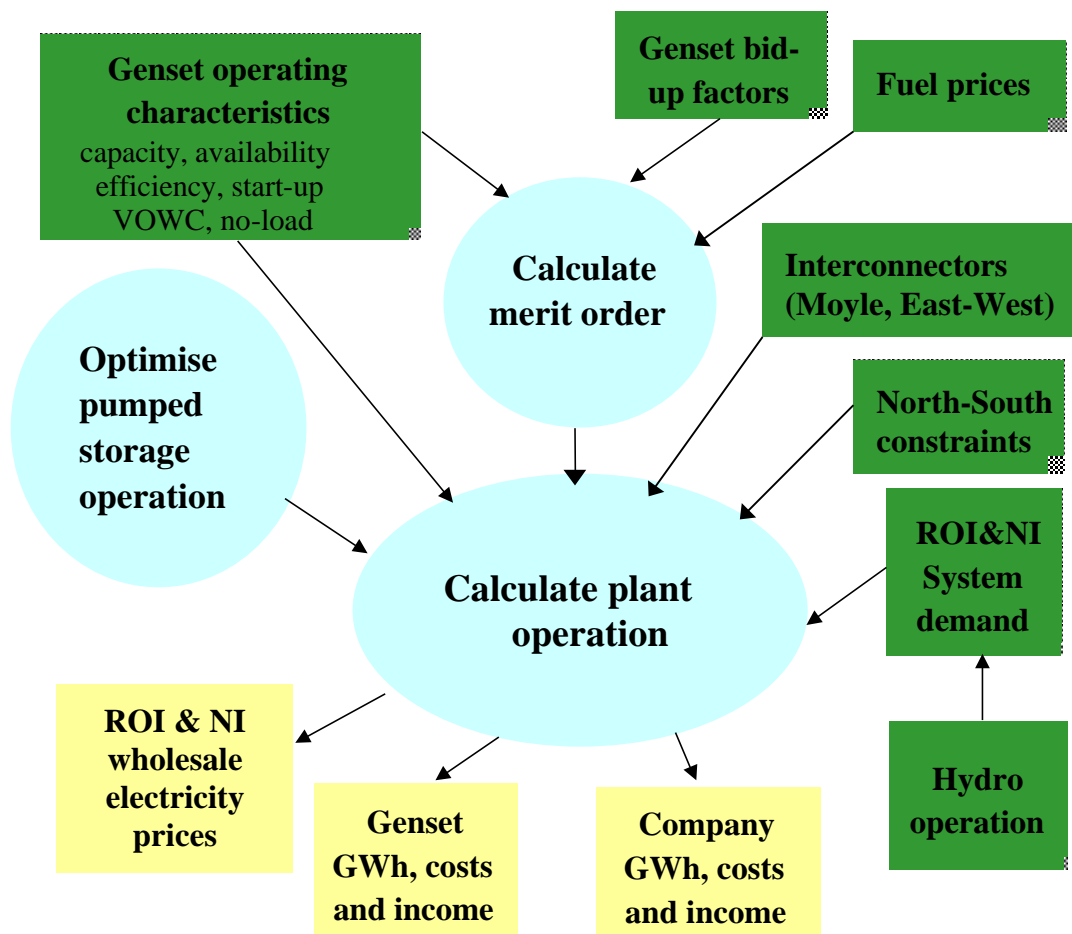
- 1.6 Due to the extension of the model to include NI (and hence the Moyle interconnector with Scotland), and recent government announcements concerning a planned East-West Interconnector between the ROI and Wales, we have also added the explicit modelling of electricity interconnectors with Great Britain (GB) to the features of *IAIGen*.
- 1.7 When bidding into the Irish market(s), interconnector prices will be determined by the corresponding prices in GB for the period under consideration. These half-hourly prices are outputs of our Great Britain generation model, *GBGen*, adjusted to take into account GB system charges and transmission losses. *GBGen* and *IAIGen* use the same underlying economic assumptions to ensure consistency.

- 1.8 Setting these prices in the context of the Irish power plant merit order will determine whether interconnectors are importing to or exporting from Ireland. Import and export capacities can be set at different levels, and capacity can be set aside to account for existing long-term contracts.

Operation of the model

- 1.9 *IAIGen* is a spreadsheet-based model, structured into three main types of worksheet:
- *database/input sheets* - the detailed input assumptions, covering plant characteristics, demand projections, fuel price projections, as well as a number of other market-specific assumptions;
 - *process sheets* – described below; and
 - *results/output sheets*.
- 1.10 This general structure is illustrated in Figure 1 below.

Figure 1 – General *IAIGen* structure



Process sheet operation

- 1.11 The model is structured to calculate which plant are called to run, and the resulting Irish System Marginal Price (SMP), for each half-hour of each sample day. Each year has 25 sample days (a business day and non-business day for each month of the year, plus a ‘peak’ day, which simulates the ten days of highest demand).

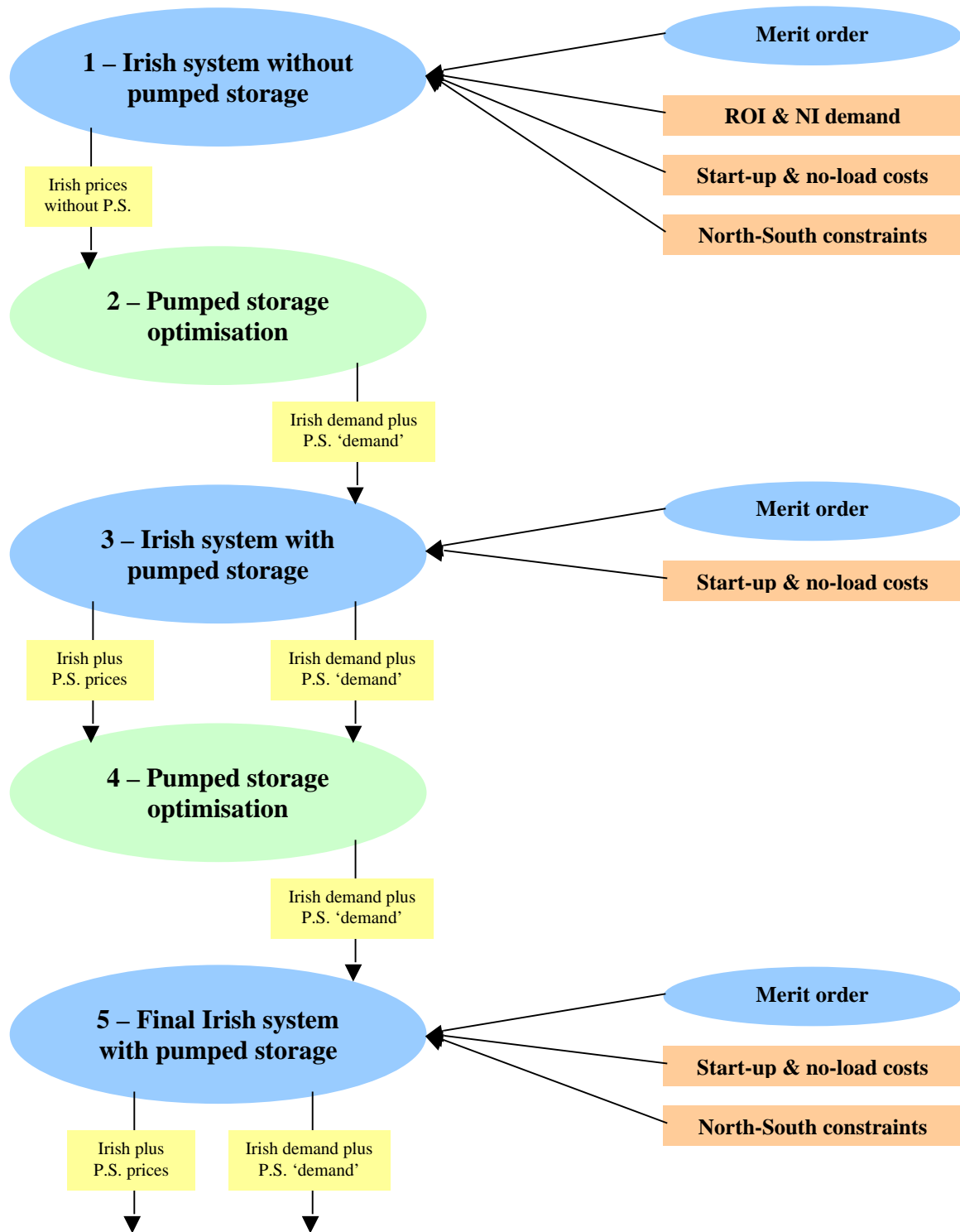
Irish merit order

- 1.12 The first stage in this operation is to calculate a merit order for the sample day. This merit order is only for interconnectors and thermal plant - i.e. it excludes the hydro plant and pumped storage plant.
- 1.13 The ‘bid prices’ used to create the merit order are based on the fuel costs of the plant at full load efficiency, plus any variable other works costs, excluding start-up and no-load costs. Interconnector costs are based on the outputs of the ILEX *GBGen* model, adjusted for GB system charges and interconnector losses. For gensets which can be fired on more than one fuel, the model will choose the least-cost fuel, subject to environmental constraints.
- 1.14 The GW capacity of the plant for the sample day is based on the net capacity of the plant, factored by the relevant seasonal availability factor for that plant.

Calculation of half-hourly price and operating regimes

- 1.15 Once the merit order has been calculated for the sample day in question, it is then compared with the half-hourly Irish demand to calculate the price and operating regime for each half-hour.
- 1.16 This process is complicated by the presence of a constraint in the form of the North-South interconnector. Although a plant may find itself in merit given the current total demand in the Republic of Ireland and Northern Ireland, it may not be able to operate if local demand and the maximum possible export volume over the interconnector are already met. In such a case, individual plant may be constrained off in the all-island merit order, and final output prices in the two zones will diverge.
- 1.17 Another complication is the presence of the pumped storage plant (Turlough Hill) in the ROI, which can ‘decide’ to generate or pump in any half-hour based on the price differentials within the day. In addition, its operation will impact on prices in Ireland, which will in turn impact on the decision as to whether to operate.
- 1.18 In order to simulate the pumped storage interactions accurately, the model uses a five stage iterative process to arrive at the final half-hourly price and operating regime for the sample day. This five-stage process is illustrated in Figure 2 below.

Figure 2 – IAIGen pumped-storage iterations





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