NTS Demand Forecast

DSWG - 2 August 2006

Peter Zeng

Network Operations

National Grid

nationalgrid

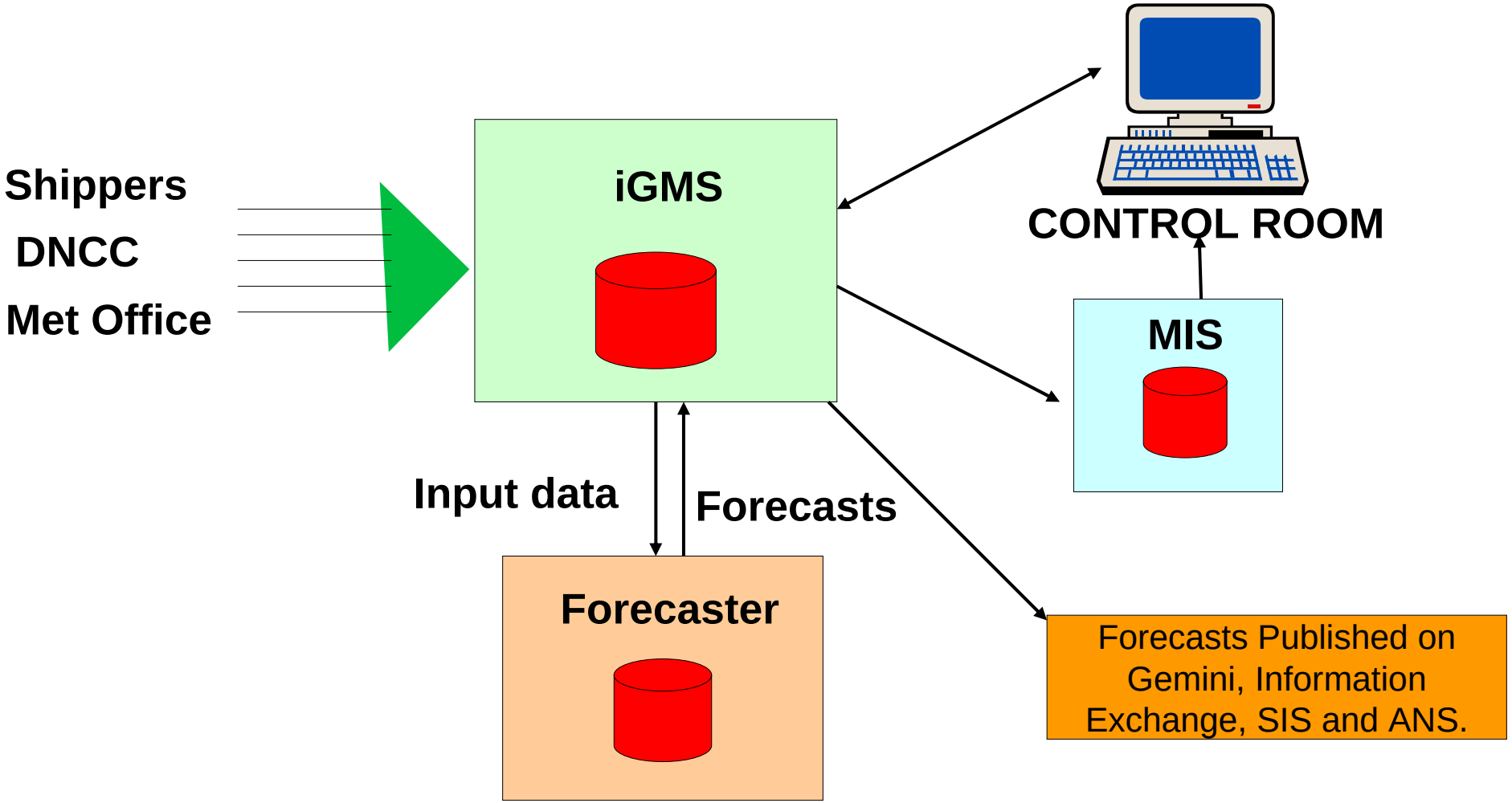
Agenda

- Introduction
- Demand Forecast - Overview
- Demand Forecast Models
- Forecast Performance
- Conclusions

Introduction

- Objectives
  - To fulfil the action DSWG placed on NG to present
    - “information on forecast development and calculation”
  - To give DSWG
    - an overview of NG demand forecasting process
    - an appreciation of key information used in the forecast
    - a description of models used
    - an overview of current demand forecast performance
- Reasons for demand forecasting
  - to fulfil UNC obligations including demand attribution process
  - to enable efficient and economic operation of NTS system
  - to facilitate efficient market operation by providing market participants with the most accurate demand forecast

NTS Demand Forecast Process



nationalgrid

Forecast of LDZ Demand

- It consists of
  - Temperature sensitive loads (NDM) produced by forecasting models
  - VLDMC (DM) OPNs provided by shippers

Weather stations
11 weather stations feed data to the 13 LDZs

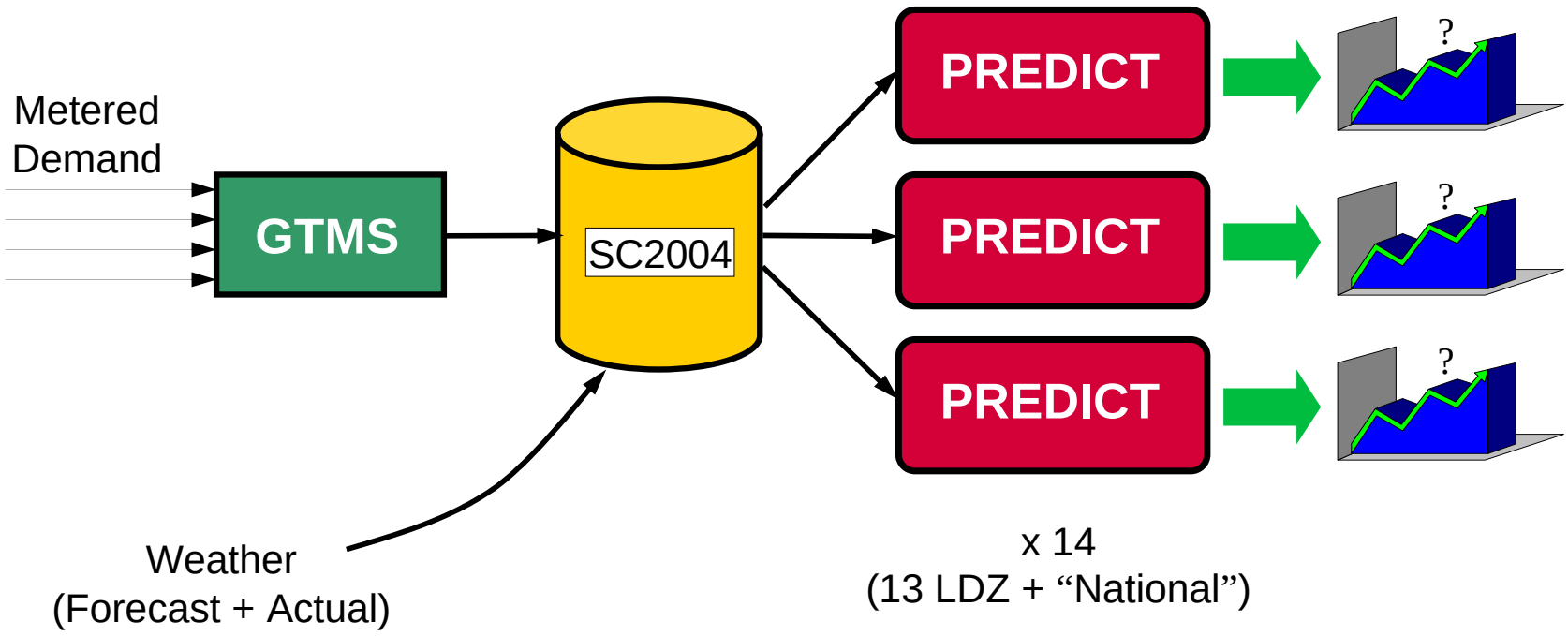
nationalgrid

Which weather factors affect gas demand?

- temperature
- wind speed
- rain
- snow
- cloud cover

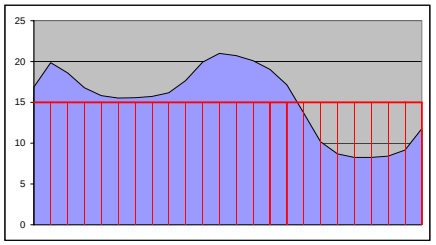
nationalgrid

Process diagram for producing LDZ Demand forecasts

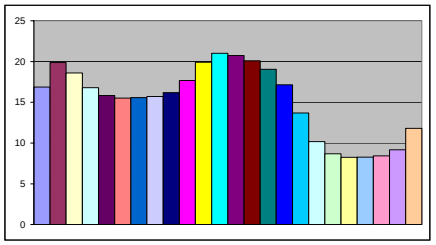


nationalgrid

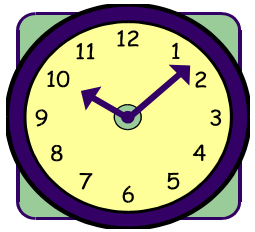
What is forecast and when?



End of day volume, mcm
(Area under the curve)



ALN and profile models also forecast a volume for each hour

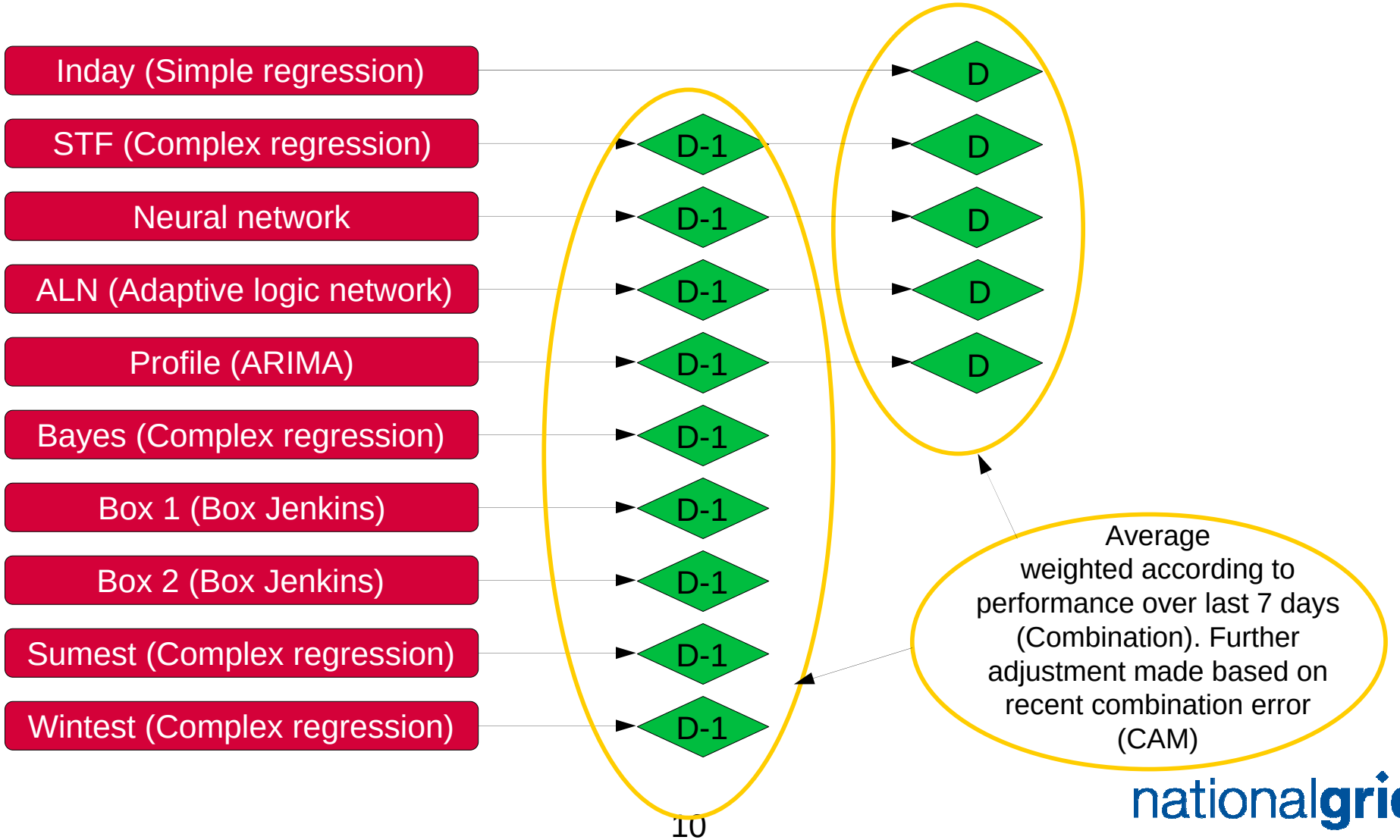


Within day and day ahead forecasts are run 5 times per day.

2 to 7 day ahead ‘Likelihood to Interrupt’ (LTI) run once per day.

nationalgrid

How?
- suite of models using different techniques



nationalgrid

What does a model look like?

PROFILE – WITHIN DAY MODEL

PROFILE model uses the Box Jenkins technique to forecast within day gas demand. There are two different models in the program. Model 1 is usually used for the 10am forecast and model 2 for the rest of the day. However, if the 9am temperature is greater than either the 1pm or 3pm temperature then model 1 is used for the 1pm and 4pm forecasts.

Model 1 (at hour k) (used for 10:00 forecast)

$$\nabla\nabla_7 D_t^{(h)} = w_0\nabla\nabla_7 T_t^{(3)} + w_1\nabla\nabla_7 T_t^{(6)} + w_2\nabla\nabla_7 T_t^{(9)} + w_3\nabla\nabla_7 D_t^{(k)} + (1-\theta_1 B)\,(1-\theta_7 B^7)\,a_t$$

Model 2 (at hour k) (used for forecasts at other times)

$$\nabla\nabla_7 D_t^{(h)} = w_0\nabla\nabla_7 T_t^{(h-1)} + w_1\nabla\nabla_7 D_t^{(6)} + w_2\textstyle\sum_1^k\nabla\nabla_7 D_t^{(j)} + (1-\theta_1 B)\,(1-\theta_7 B^7)a_t$$

where $T_t^{(h)}$ is the temperature at hour h on day t,

$D_t^{(h)}$ is the corresponding hourly demand on day t,

a_t is the error in the forecast demand for hour h on day t,

B is the backward shift operator i.e. $By_t = y_{t-1}$

w_0, w_1, w_2, w_3, θ_1, θ_7 are model parameters.

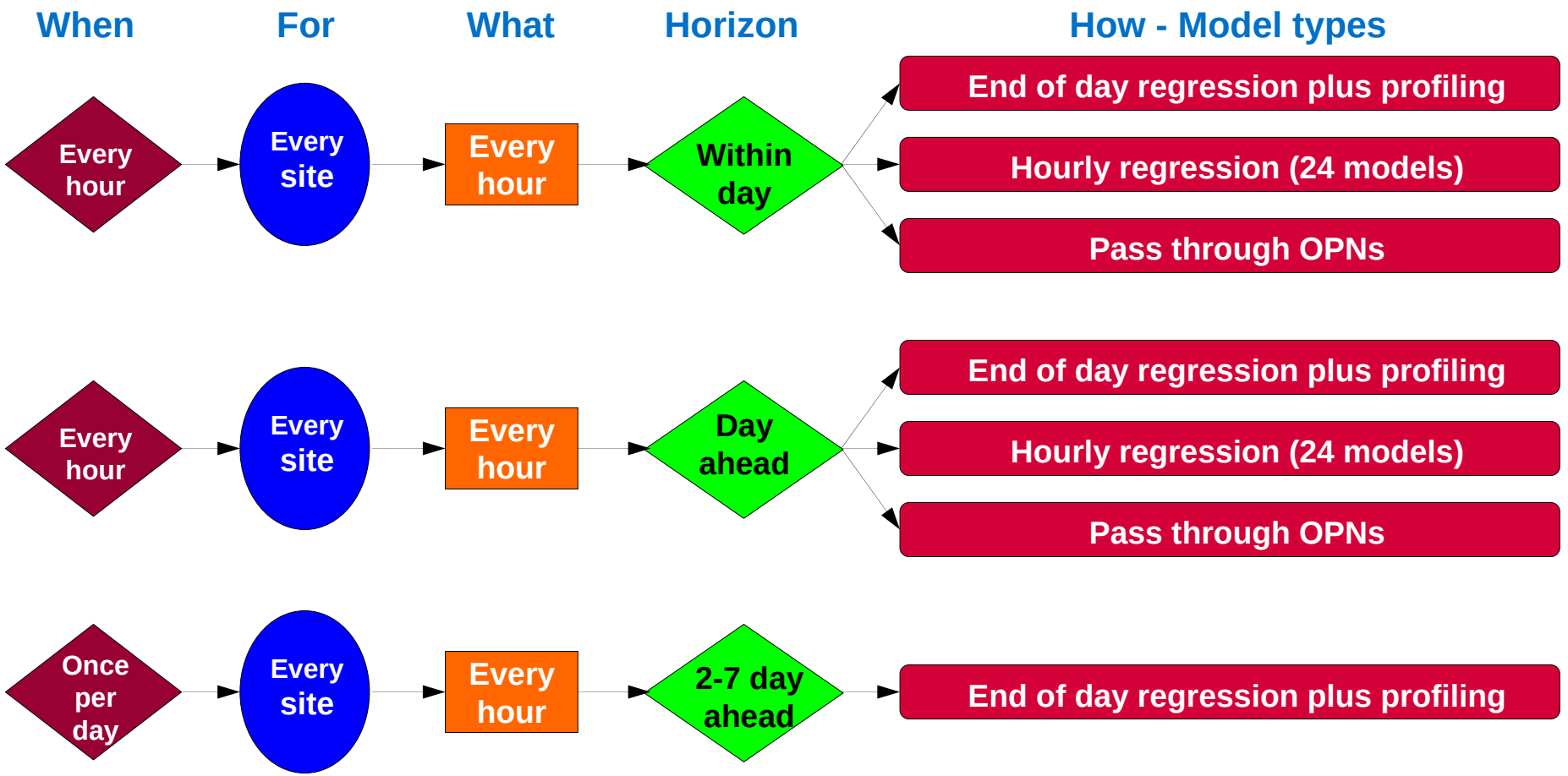
.

nationalgrid

Forecasting NTS Direct Connected Loads

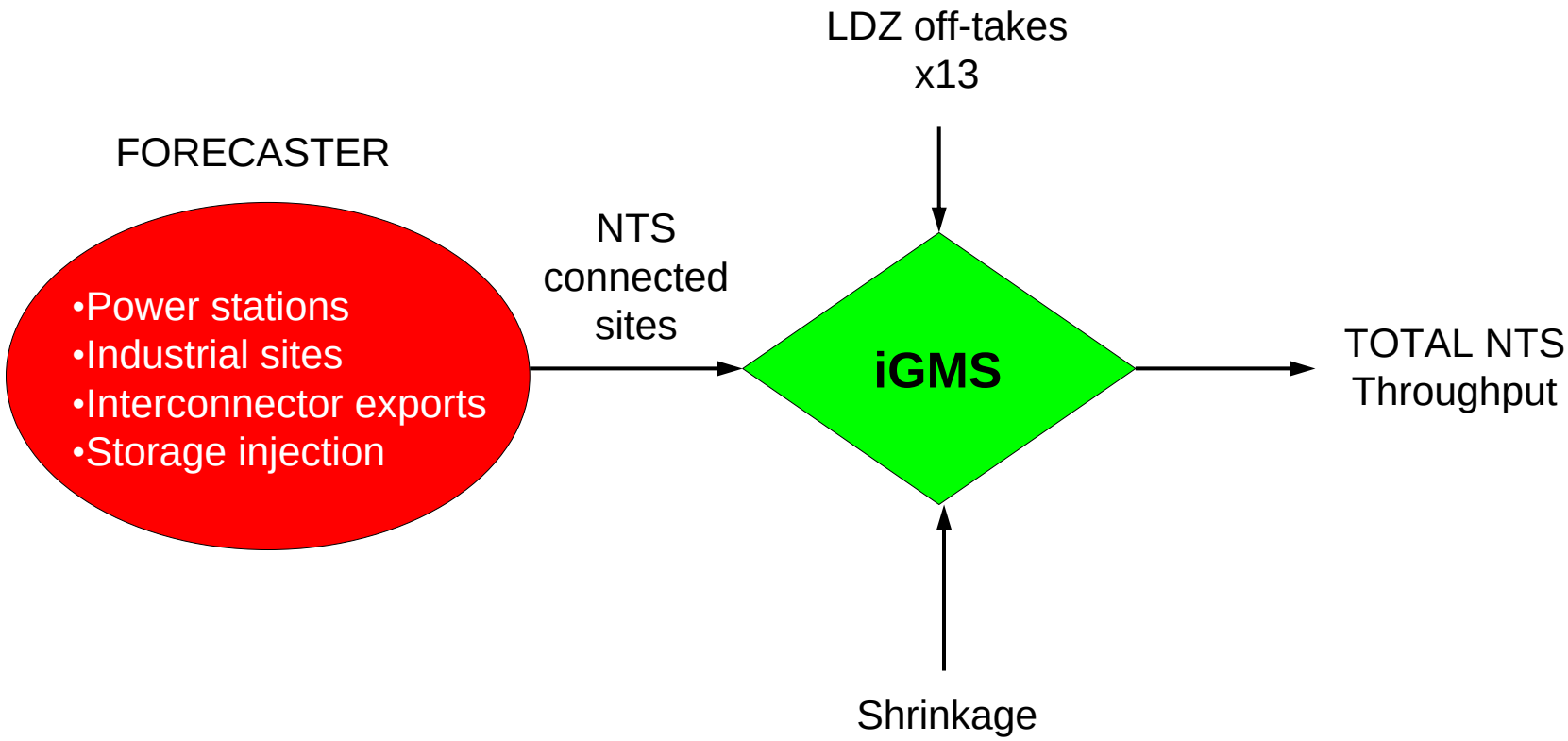
- Input Data
  - Shippers
    - OPNs/SFNs for NTS direct connected loads, first received at D-1 17:00.
  - Met Office
    - For D & D-1, forecast temperatures and wind speed
    - For D-2 to D-7, forecast max and min temperatures
- Forecast is produced for each individual site
- Models Used
  - Pass through OPNs where available
  - Profile model, forecast end of day volume which is then profiled to hourly offtake
  - regression model, forecast individual hourly offtake
  - Models are trained every week

NTS Demand Forecasting
Model types



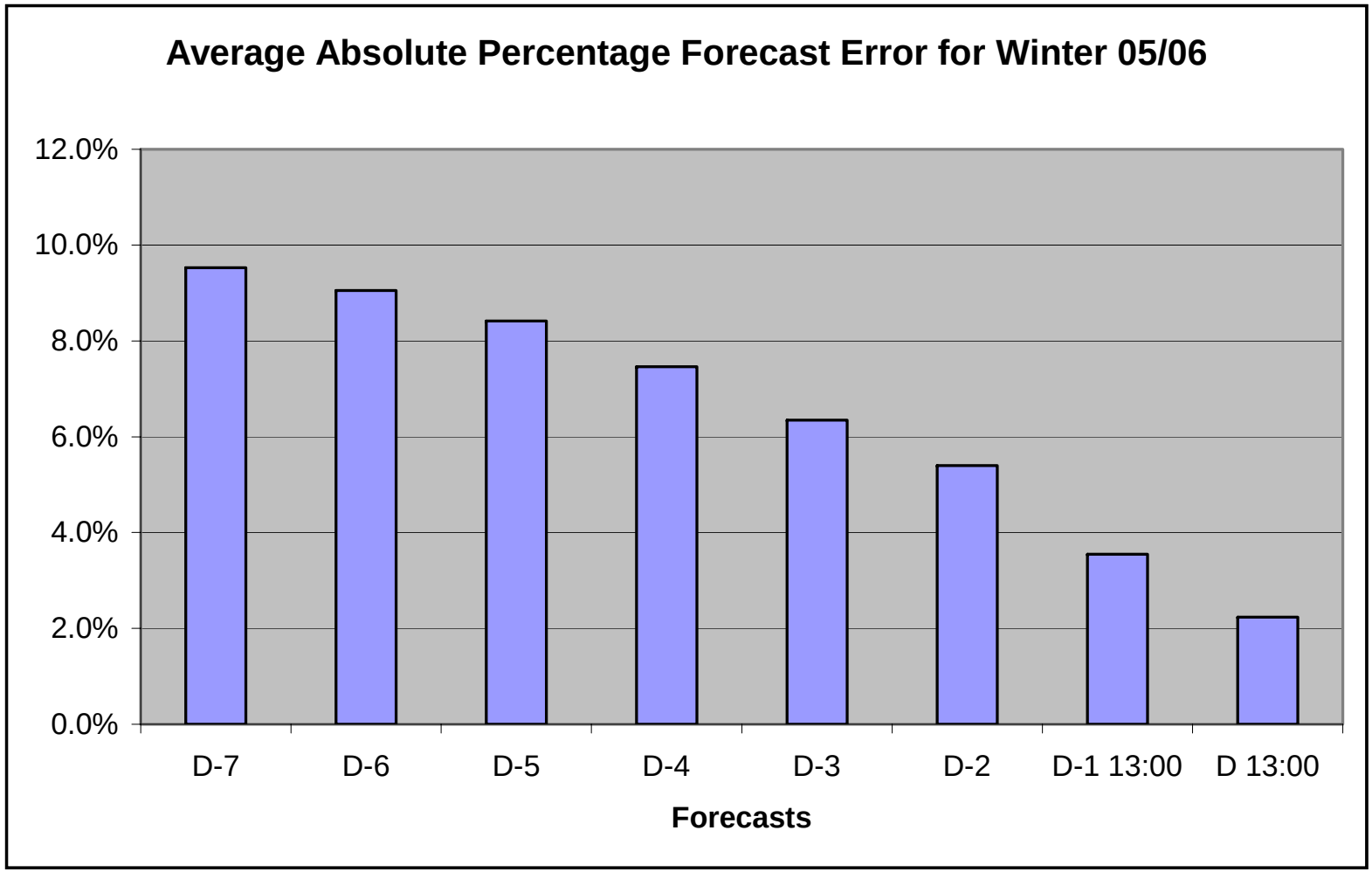
nationalgrid

NTS Demand forecasting schematic



nationalgrid

Winter 2005/06 Forecasting Performance



nationalgrid

Conclusions

- Demand Forecasting is inherently uncertain due to uncertainties in weather and prices
- Forecasting accuracy improves from 7 days ahead to within day as more accurate information becomes available
- NTS demand forecast, although robust at present, faces significant challenges to improve future forecasting accuracy, especially with the introduction of demand forecasting incentive this winter.