Report for the Norwegian Post and Telecommunications Authority (NPT)

NPT's fixed long-run incremental cost (LRIC) model

Documentation of the Co-location module

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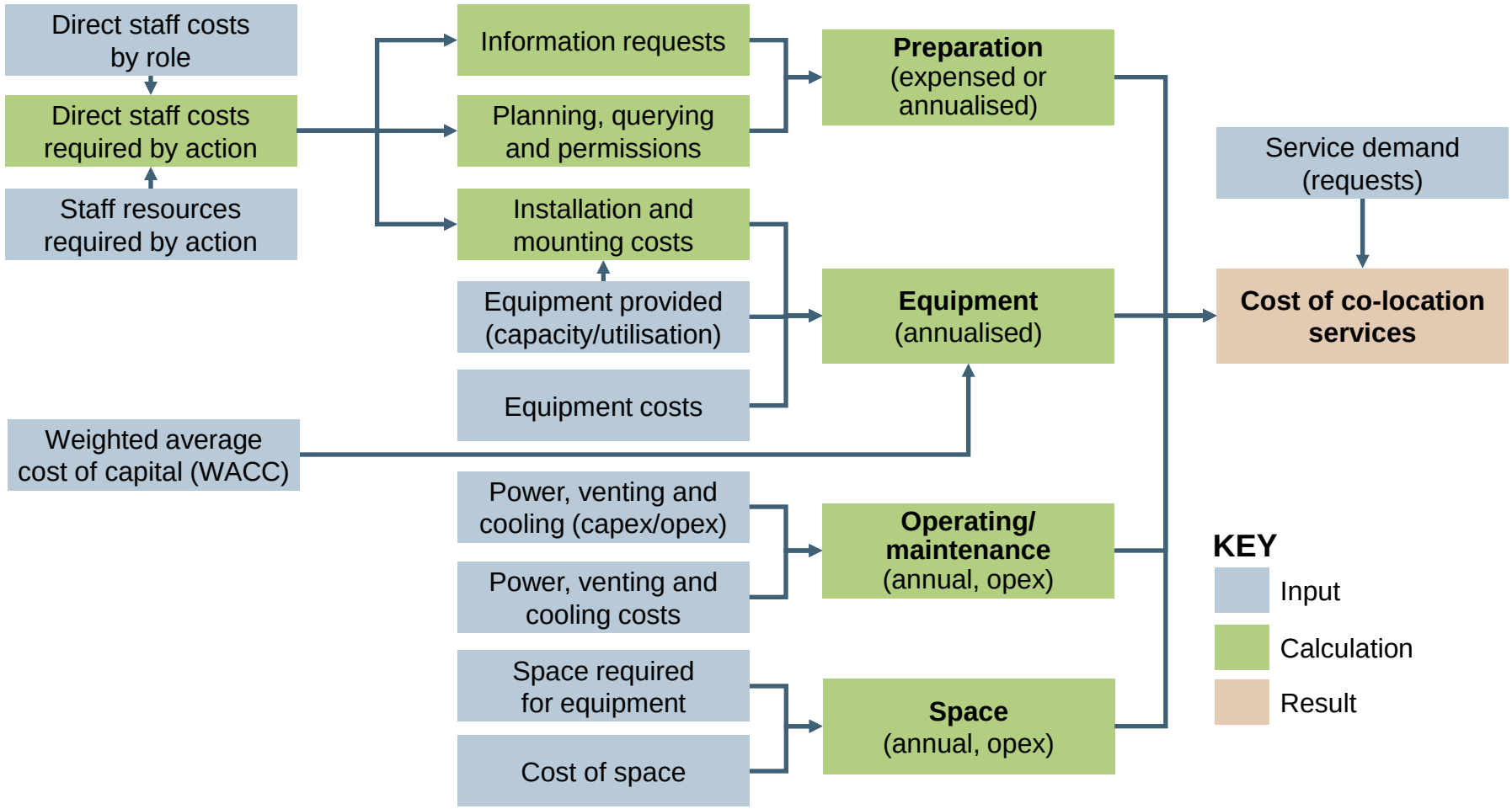
The Co-location module calculates the bottom-up costs of certain Telelosji services

- Analysys Mason has developed a number of models for NPT to investigate the costs of fixed services in Norway
  - this document describes the structure of the Co-location module
- Telenor currently offers co-location services (Telelosji) in Norway, allowing access seekers to use systems and space within Telenor's node locations
- The main components of these services are:
  - location, mounting and installation of equipment
  - provision of station wiring, power, ventilation and cooling
- A bottom-up calculation of co-location services provides a transparent basis for industry on which to consider their costs:
  - this was described in Section 5.4 of the final model specification, issued in February 2010*
- The Co-location module consists of a single self-contained Excel workbook, containing:
  - the current prices for services from Telenor's reference interconnect offer (RIO)
  - a bottom-up calculation of the costs of particular co-location services
- Telenor's RIO enables the relevant services to be defined
- **Co-location space in Telenor's sites (at least 3 units):**
  - set-up (per units of rack)
  - monthly rental (per units of rack)
- **Termination blocks (100 pairs):**
  - installation and rental per month
- **Site set-up charge:**
  - operator's first co-location only
- **Power supply:**
  - set-up
    - capacity installation per kilowatt (AC/DC)
  - monthly rental
    - capacity per kilowatt (AC/DC)
    - AC/DC back-up per kilowatt
  - power used per kilowatt-hour (AC/DC)
- **Exchange duct access, in terms of cables into the site:**
  - rental (per metre per month) including regional variations
- **Co-location contractual relationship costs:**
  - set-up and continuation of contract

*http://www.npt.no/ikbViewer/Content/115558/endelig_prinsippnotat_for_BU-modell.pdf

A framework for the Co-location module was set up in the model specification



Source: Final model specification, February 2010 (some minor additions)

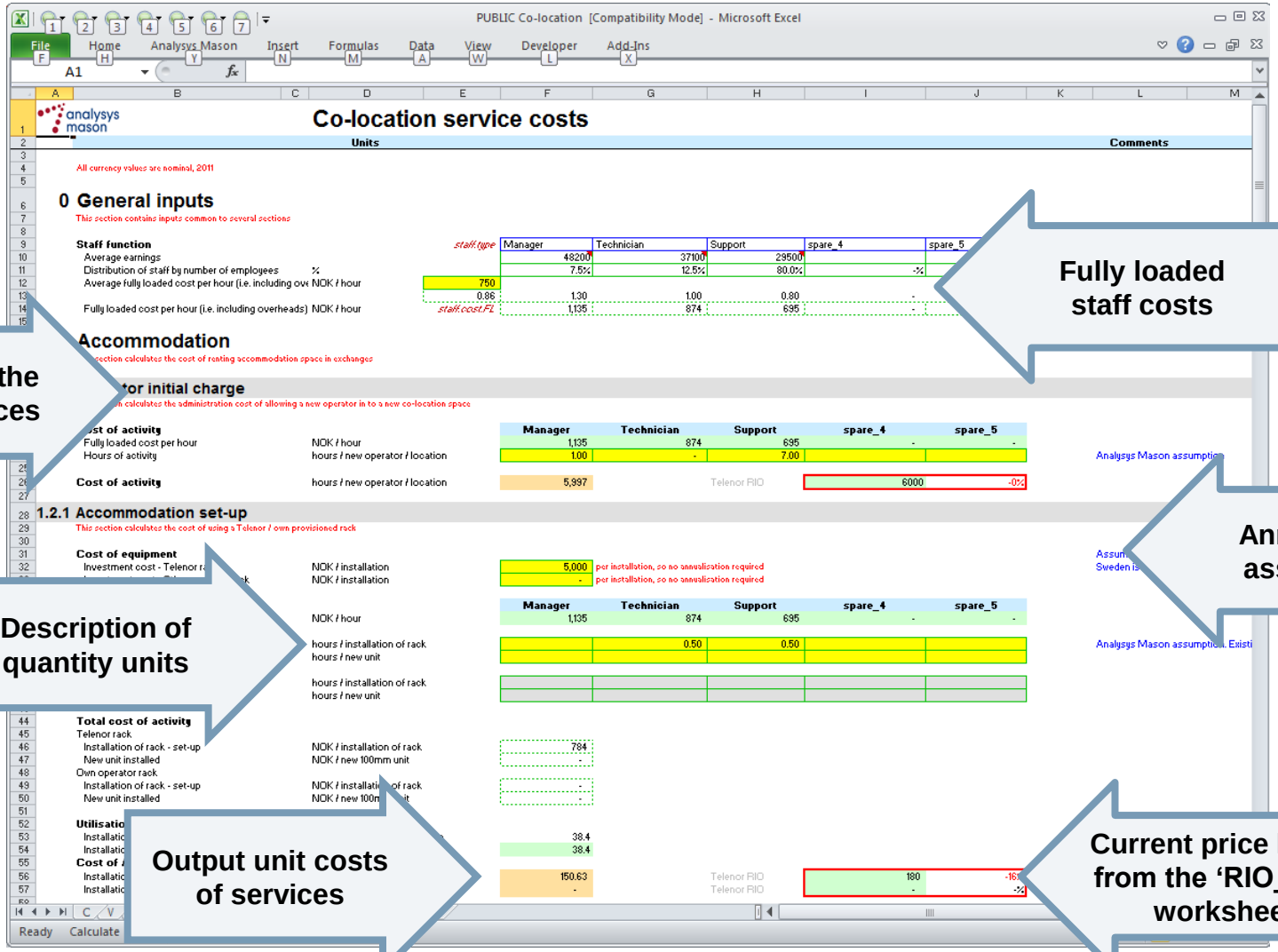
Cell formatting is consistent with that in the Core and Access models

- This is to increase the transparency of the Co-location module, as well as to make it easier to understand and modify
- A number of standardised cell formats are used to distinguish inputs, assumptions, calculations and links
- The most important conventions are shown below

Cell type	Cell style	Notes
Input Parameter	100	An input to the model that it is expected the user will change (change at will)
Input Data	100	A piece of real data (only change if you have better data)
Input Estimate	100	An estimate used in the absence of real data (only change if you have a better estimate, or real data)
Input Calculation	100	An input to the model that has, none the less, been calculated from other inputs (e.g. interpolated input values)
Input Link	100	An input to this part of the model, which is linked to a source on this or another worksheet within this workbook
Input Link (different Workbook)	100	An input to this part of the model, which is linked to a source on a worksheet in a different workbook
Calculation	100	A calculation of the model
Total	**123**	A total (use if not part of a "Sub-total row" or a "Total row" in a table - see below)
Checksum	*0.00*	A side calculation intended solely to cross check a result (and which therefore should not be referenced anywhere else in the model)
Output	100	A key result from this part of the model (in particular one that will be used elsewhere in the model)
Named range	*Name*	An Excel Name applying to one or more adjacent cells (use Insert Name Create to actually create the Excel Names)
Note	Note	A note (NB smaller than standard font size)

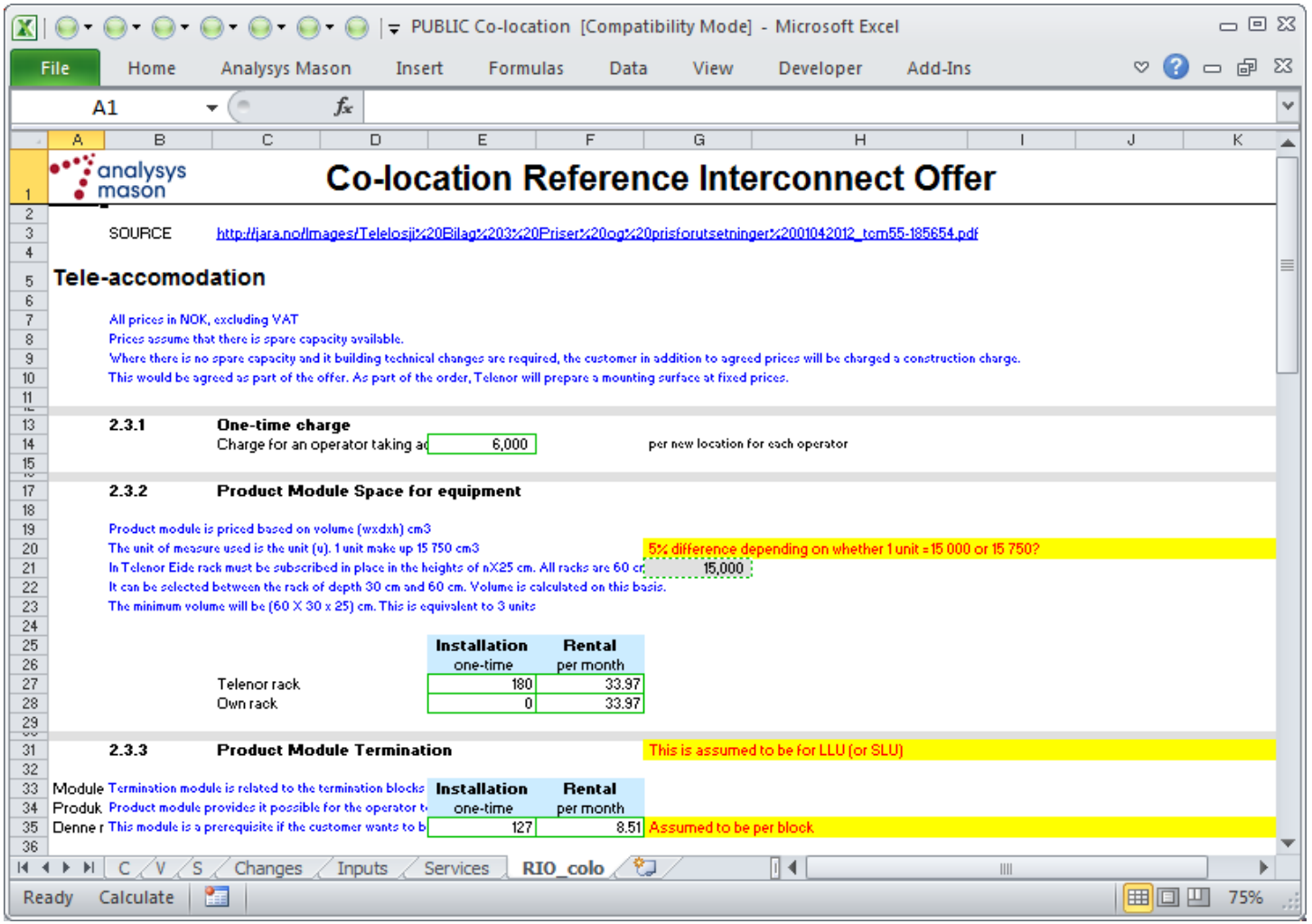
Source: Analysys Mason

Bottom-up costs are derived on the 'Services' worksheet using simple inputs and calculations …



Source: Co-location module

… with the RIO prices shown alongside the outputs; this data is stored on the 'RIO_colo' worksheet



Source: Co-location module

Key inputs on the ‘Services’ worksheet (1/2)

General inputs

Cells	*Contents*
F10:J10	• Monthly wage by staff type
F11:J11	• Distribution of employees amongst staff types
E12	• Average cost per hour, including overheads

Other inputs

Cells	*Contents*
F24:J24	• Hours required for administration of allowing a new operator in to a new co-location space
F250:J250	• Hours required for mounting instruction

Inputs for accommodation-related services

Cells	*Contents*
F32:F33	• Investment cost of a rack (Telenor / other operators)
F38:J39	• Labour required for installation
F63	• Exchange opex per site
F67:J67	• Hours required for administration of renting accommodation in an exchange
F70	• Units in use
F75:F77, F81:F84	• Definition of rack dimensions and overhead space allowance
F87	• Utilisation factor of rack
F90:F92	• Size definition of 100mm unit for rack
F97	• Mark-up for overheads to cost per rack
F105:F107	• Cost inputs for terminal block on the MDF*
F111:F112	• Blocks per MDF and area per MDF
F118:J119	• Management and admin related to block rental for Telenor rack

MDF = Main distribution frame

Key inputs on the ‘Services’ worksheet (2/2)

Inputs for power-related services

Cells	*Contents*
F135:F137	• Unit capex per kW of power/aircon systems
G135:G137	• Lifetime of power/aircon systems
H135:H137	• Proportion of initial capex captured in the initial charge for power/aircon systems
I135:I137	• Opex as % of capex for power/aircon
J135:J137	• Cost trends for power/aircon
F183	• Cost of electricity per kW
F185	• Uplift to power to account for dissipation
F198:F199	• Unit capex per kW of back-up power systems
G198:G199	• Lifetime of back-up power systems
H198:H199	• Opex as % of capex for back-up power
J198:J199	• Cost trends of back-up power systems

Inputs for duct access-related services

Cells	*Contents*
F215:J215	• Hours required for installation per connection
F223:H223	• Unit cost, lifetime and trend for digging trench
F224:H224	• Unit cost, lifetime and trend for ducting
F226:F228	• Uplifts for trench cost to Oslo, Cities/Towns and Rural
F231:H231	• Unit cost, lifetime and trend for cable installation
F232:H232	• Unit cost, lifetime and trend for subduct
F233:H233	• Unit cost, lifetime and trend for cabling joint barrel
G226:G229	• Average length of access purchased per barrel
F238:G238	• Utilisation of route for new/existing connections

The Co-location module is an entirely standalone calculation to the Core and Access models

- The Co-location module has no links to other Excel workbooks: it can therefore be considered on its own
- Certain inputs should nonetheless be consistent with those in the Core and Access models, in particular:
  - WACC and working capital allowance on the 'Inputs' worksheet
  - Lifetimes, unit costs and cost trends for assets, on the 'Services' worksheet
- In order to re-calculate costs after changing inputs, press F9 or Ctrl+Alt+F9 (there are no macros present)
- Annualised costs are calculated as tilted annuities, using the following formula :

$$\text{Tilted Annuity} = \frac{\text{WACC} - \text{CostTrend}}{1 - \left(\frac{1+\text{CostTrend}}{1+\text{WACC}}\right)^{\text{Lifetime}}} \times \text{capex}$$

  - a slightly different treatment is required when recovering power equipment capex (Section 2.2 of the Co-location module), where future asset replacement capex must also be considered
    - if the ongoing charge is based on the full capex (e.g. via an annuity calculation), then this is not a problem
    - if part of the capex is paid in the set-up fees (i.e. not just one-off costs, but potentially assets which need to be replaced), then an additional amount needs to be recovered in the monthly fees to pay for future replacement
    - this has also been implemented as a tilted annuity, but multiplied by the value $\left(\frac{1+\text{CostTrend}}{1+\text{WACC}}\right)^{\text{Lifetime}}$
    - as a result, the payment leads to the same net present value (NPV) over the asset lifetime as the required cost to be recovered at the future replacement date

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