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presents

Complying with the Energy Requirements of the National Building Regulations
Through Rational Design & Energy Modelling

Jonathan Skeen
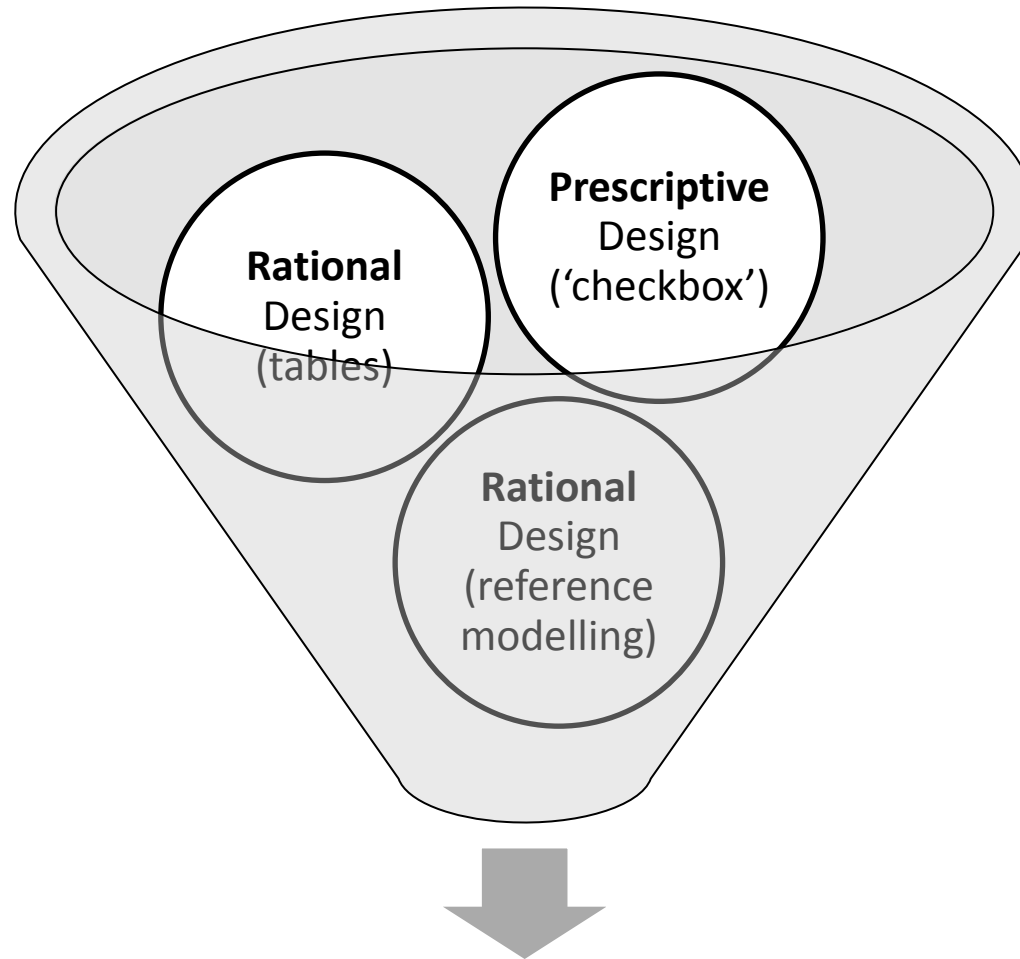**Consulting & Operations Manager**

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15th October 2013

- What is SANS 10400 XA, and what are the requirements?

- Achieving compliance: Rational vs. Prescriptive Design

- Applying rational design: An example

- Some pitfalls…

- Conclusions

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- Part of the National Building Regulations

- Part 'XA' covers '**Energy usage in buildings**'.

- Requires buildings to comply with a **basic standard** of **energy efficiency**

- Provides specifications for:

  - Hot water energy efficiency

  - Building envelope efficiency (walls, roofs, windows, floors)

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SANS 10400 XA Compliance!

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PRESCRIPTIVE DESIGN HAS SEVERAL REQUIREMENTS:

- Glazing area <= 15% of floor area (or glazing with higher R Value)

- Walls: R Value (insulation) of 1.9 – 2.2 W/m2.K (depending on location, or specific masonry wall types)

- Roofs: R Value (insulation) of 2.7 – 3.5 W/m2.K (dep. on location)

- Orientation: Living areas (lounges, bedrooms etc) in the North.

- Hot water: Minimum of 50% of heating energy from solar, geothermal, bioenergy, etc.

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**RATIONAL DESIGN:
ONLY ONE REQUIREMENT,
ACHIEVABLE IN TWO WAYS**

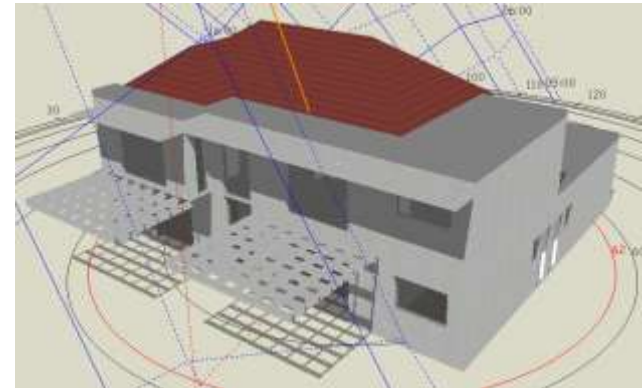*Achieving compliance: Rational vs. Prescriptive*

Comply with the tables:

Table 2 — Maximum energy demand per building classification for each climatic zone

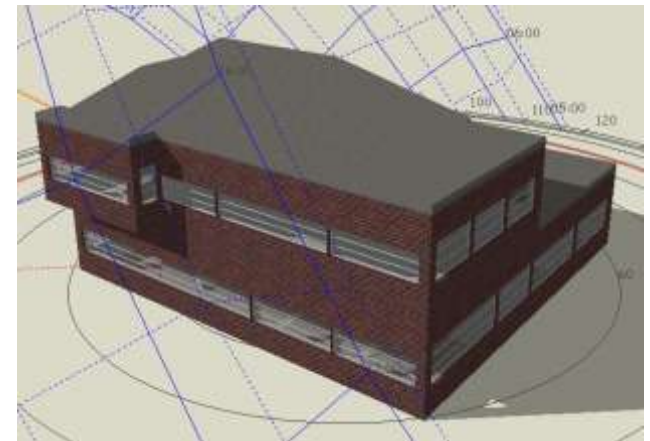| 1	2	3	4	5	6	7	8
Classification of occupancy of building	Description of building	Maximum energy demand[a] VA/m²					
		Climatic zone[b]					
		1	2	3	4	5	6
A1	Entertainment and public assembly	85	80	90	80	80	85
A2	Theatrical and indoor sport	85	80	90	80	80	85
A3	Places of instruction	80	75	85	75	75	80
A4	Worship	80	75	85	75	75	80
F1	Large shop	90	85	95	85	85	90
G1	Offices	80	75	85	75	75	80
H1	Hotel	90	85	95	85	85	90

[a] The maximum demand shall be based on the sum of 12 consecutive monthly maximum demand values per area divided by 12/m², which refers to the nett floor area.

[b] The climatic zones shall be as given in annex A.

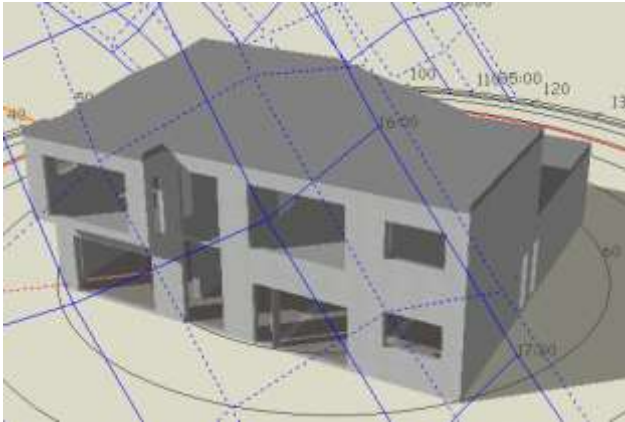*OR, exceed the performance of a SANS 10400 XA reference model:*

This…

…uses less energy than this…

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MAKING A HOUSE COMPLIANT: PRESCRIPTIVE ROUTE

1) First, shrink the windows, or add double glazing
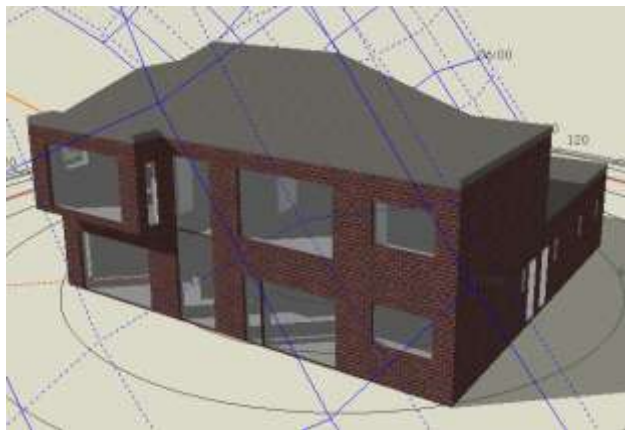
> *The client wants views, so we'll use double glazing.*
> **Approx. extra cost: <u>R70,000.00</u>**

2) Next, install an alternate heating system.

> *Double glazing squeezed the budget, so lets install a solar thermal geyser, rather than a more $$$ heat pump.*
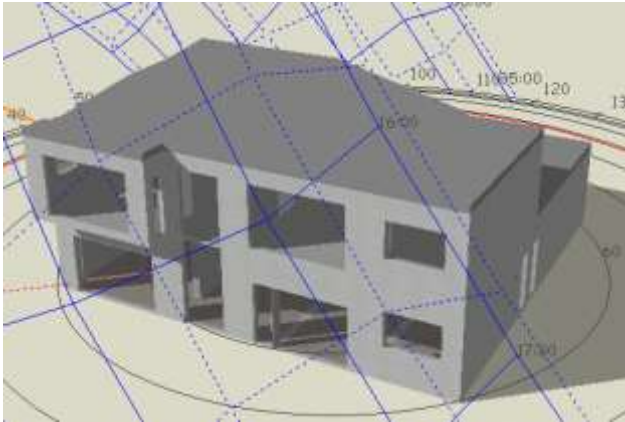> **Approx.extra cost: R17k – R4k = <u>R13,000.00</u>**

3) Put in walls, roofs, floors with correct R values

> **Approx. extra cost: Assume in line with base works cost.**

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MAKING A HOUSE COMPLIANT: RATIONAL ROUTE

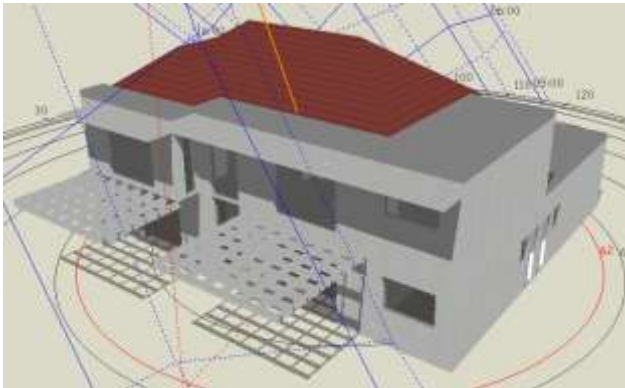1) What to do with the windows?

> *Double glazing is expensive, so lets try to make do with extra window shading.*
> **Approx. extra cost: R50,000.00**

2) What to do with the water systems?

> *Let's use some of the savings from double glazing and buy a heat pump, for better annual energy savings.*
> **Approx. extra cost: R20k - R4k = R16,000.00**

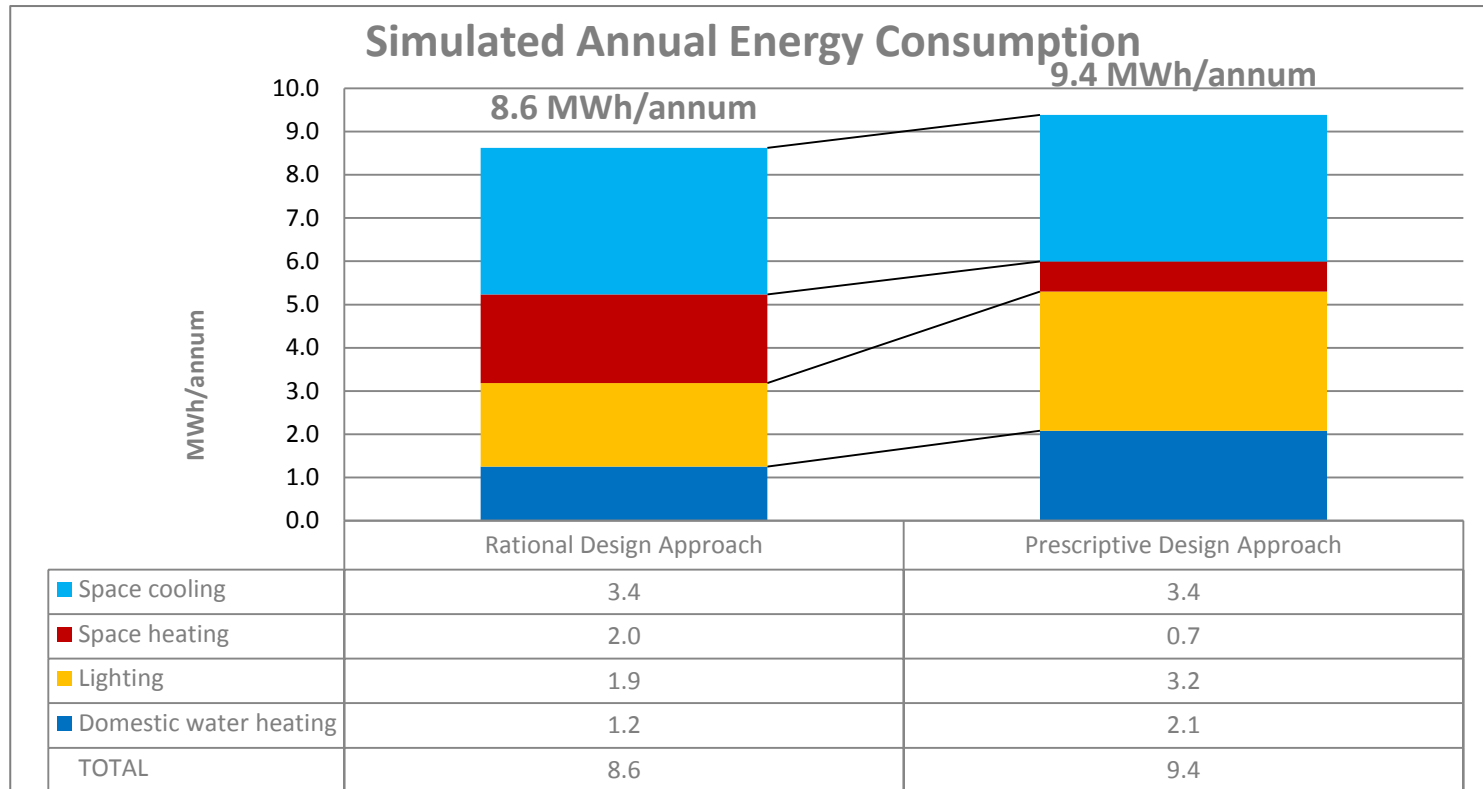3) Walls, roofs, floors with correct R values

> Lets assume we use similar constructions to the prescriptive building.
> **Approx. extra cost: Assume in line with base works cost.**

4) What else can we do? Lets try LEDs

> **Approx. extra cost: R5,700.00**

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COMPARITIVE RESULTS

Simulated Annual Energy Consumption

8.6 MWh/annum

9.4 MWh/annum

	Rational Design Approach	Prescriptive Design Approach
■ Space cooling	3.4	3.4
■ Space heating	2.0	0.7
■ Lighting	1.9	3.2
■ Domestic water heating	1.2	2.1
TOTAL	8.6	9.4

Additional shading	R50,000.00
Heat pump	R16,000.00
LEDs	R5,700.00
TOTAL	**R75,700.00**

Double glazing	R70,000.00
SWH	R13,000.00
TOTAL	**R83,000.00**

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- Comparisons vs. predictions (Table approach)

- Small changes can have big effects on results

- Are assessors taking a close look?

- Modelled versus real world results

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PRESCRIPTIVE DESIGN ROUTE

Checkbox compliance based on hand calculations.

✓ Easy, simple approach

✓ Well suited to certain applications

✗ Highly Restrictive

✗ Large Safety Margins

✗ Boxed Approach

✗ Value Add? Meaningful results?

RATIONAL DESIGN ROUTE

Holistic design analysis for SANS 10400 XA using energy modelling software

✓ Flexible

✓ Holistic and Optimised

✓ Simple & Quick

✓ Site Sensitive

✓ Adds Real Value

✗ Requires software

✗ Requires expertise

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