# The Energy Efficiency Target Monitoring System

Danish Energy Management

Burgers Park Hotel, Pretoria

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# Overview of the Energy Efficiency Target Monitoring System (EETMS)

- System to allow Department of Energy to track progress towards meeting the energy efficiency targets in the NEES
- Based on a top-down 'decomposition' analysis
- For the industry & mining sector only, the top-down analysis is supplemented by a bottom-up analysis of the main energy intensive branches

# How EETMS works

- Decomposition analysis breaks down observed changes in energy consumption into component parts that are attributable to:
  - Changes in overall level of activity
  - Structural changes
  - Efficiency changes
- For the residential sector, changes in living standard were treated in an analogous way to structural changes
- At each level of analysis, data is required on activity and on energy consumption for each of the main sub-divisions of that level

# Economy-wide analysis

- Data situation at the beginning

| ECONOMY-WIDE ANALYSIS | | | | |
|---|---|---|---|---|
| Industry & mining sector | Commercial & public sector | Residential sector | Transport Sector | Agricultural sector |
| Energy consumption | Energy consumption | Energy consumption | Energy consumption | Energy consumption |
| Activity (GDP) | Activity (GDP) | Activity (number of households) | Activity (GDP) | Activity (GDP) |

✓ All necessary data for a simple economy-wide analysis was already available from DoE / StatsSA

⇒ But such a simple analysis only 'sees' structural changes between the main sectors

⇒ A true picture can only be obtained if structural changes within the main sectors are taken into account – need the results from sector-level analyses

# Residential sector analysis

- Use the “Living Standards Measure” (LSM) stratification tool to divide the population into 10 LSM bands
- Data situation at the beginning

| RESIDENTIAL SECTOR ANALYSIS | | | | |
|---|---|---|---|---|
| LSM 1 | LSM 2 | ..... | LSM 9 | LSM 10 |
| Energy consumption | Energy consumption | Energy consumption | Energy consumption | Energy consumption |
| Activity (number of households) | Activity (number of households) | Activity (number of households) | Activity (number of households) | Activity (number of households) |

- ✓ Data on number of households by LSM is available from SA Audience Research Foundation
- ✗ Data on energy consumption by LSM was not available:

# Commercial & public sector analysis

- Adoption of energy-intensive equipment (e.g. ICT and air-conditioning) is such an important driver of energy consumption that an analysis must include this
- Data situation at the beginning

| COMMERCIAL & PUBLIC SECTOR ANALYSIS | | | | |
|---|---|---|---|---|
| Wholesale trade | Retail trade | Hospitality | Government services | (6 further sub-sectors) |
| Energy consumption | Energy consumption | Energy consumption | Energy consumption | Energy consumption |
| Activity | Activity | Activity | Activity | Activity |
| Penetration rates of energy-intensive equipment | Penetration rates of energy-intensive equipment | Penetration rates of energy-intensive equipment | Penetration rates of energy-intensive equipment | Penetration rates of energy-intensive equipment |

- ≈ Sub-sector data was available on electricity consumption only (rather than total energy consumption)
- ≈ Sub-sector GDP data was available, but this is not an ideal way to measure activity levels, particularly for the government sector
- ✗ No data on penetration rates of energy intensive equipment

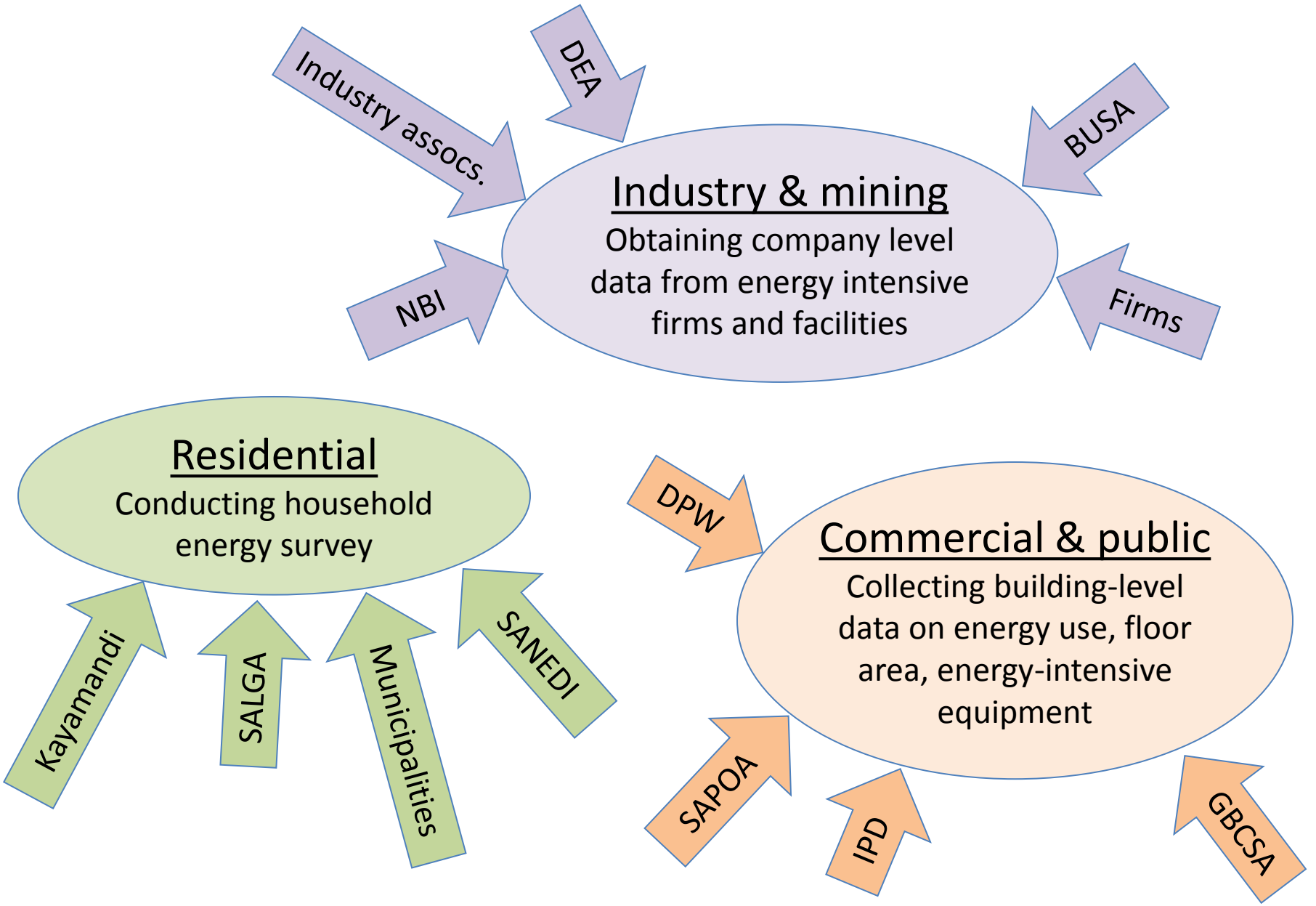
# Industry & mining sector analysis

- Data situation at the beginning

| INDUSTRY & MINING SECTOR ANALYSIS | | | | |
|---|---|---|---|---|
| Metals | Chemicals | Pulp & paper | Mining | (4 further sub-sectors) |
| Energy consumption | Energy consumption | Energy consumption | Energy consumption | Energy consumption |
| Activity (GDP) | Activity (GDP) | Activity (GDP) | Activity (GDP) | Activity (GDP) |
| Deeper analysis required to derive a more accurate picture | | | | |

- ✓ All necessary sub-sector level data for a simple sector-level analysis was already available from DoE / StatsSA
- ✗ But such an analysis does not 'see' many important structural and other changes taking place within the main sub-sectors
- ✗ For a true picture, the analysis must be taken deeper still – requires company-level data on energy consumption and output

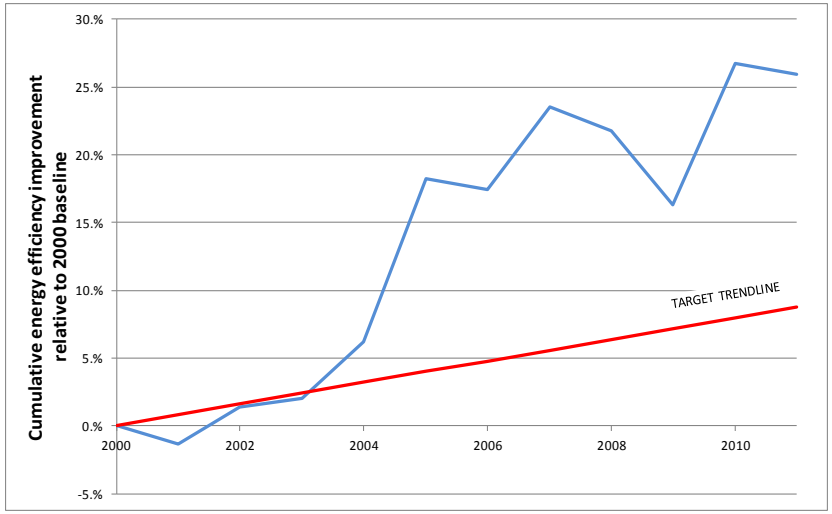
# Processes & partners for filling data gaps

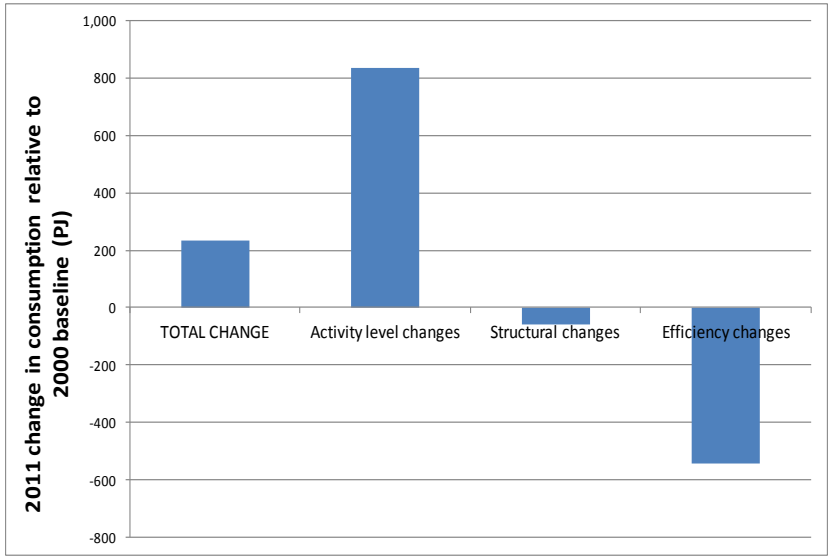


# Challenges already faced and still to come

- Industry & mining
  - Harmonising data requests with those of other agencies in particular DEA
- Residential
  - Regularising household energy survey at a level that is nationally representative
- Commercial & public
  - Almost complete lack of historical data
  - Very diverse sector hence:
    - Wide range of different indicators for activity level
    - Huge number of potential data providers makes data collection expensive

# Results: economy-wide analysis

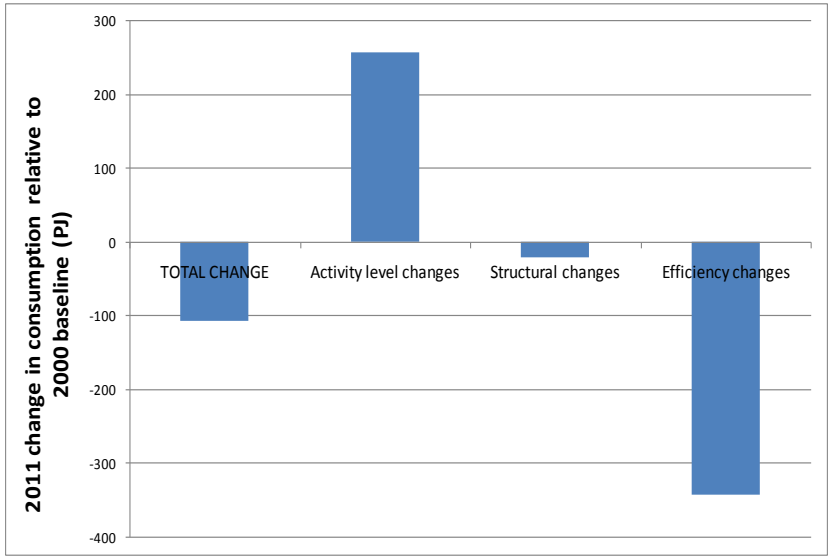



- Cumulative improvement in energy efficiency of 26% in 2011 relative to 2000 baseline

  (NEES target would be 8.8%)
- Pronounced dip in 2007-09 probably a result of the global financial crisis
- Overall 235 PJ <u>increase</u> in final energy consumption between 2000-11, made up of:
  - ⇒ 837PJ <u>increase</u> due to increased activity levels
  - ⇒ 57PJ <u>decrease</u> due to structural change
  - ⇒ 544PJ <u>decrease</u> due to efficiency improvements

# Results: industry & mining sector analysis

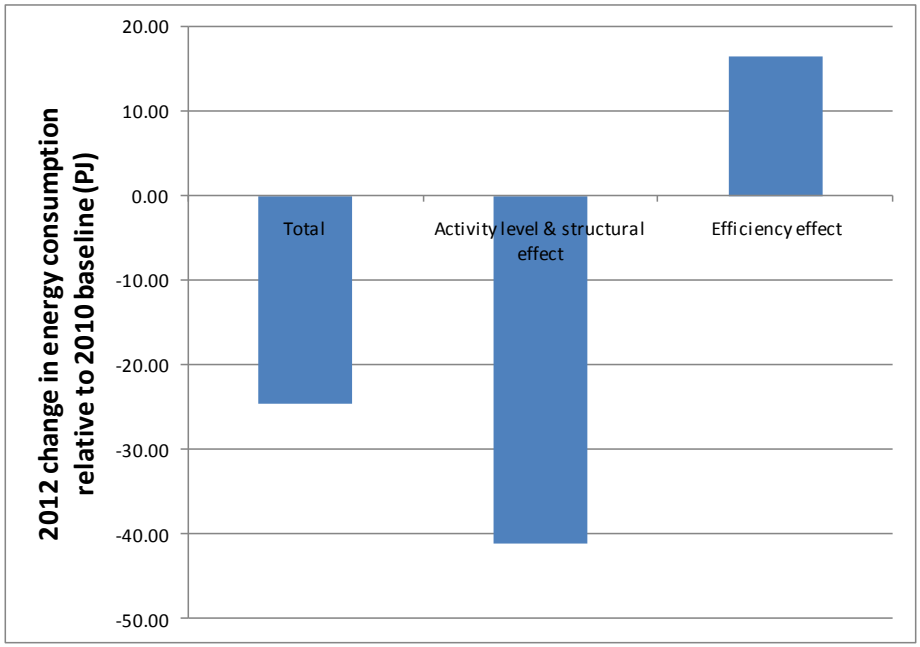




- Cumulative improvement in energy efficiency of 34% in 2011 relative to 2000 baseline

  (NEES target would be 11%)
- Dip in 2004 due partly to artefact in data and partly to planned outages of blast furnaces
- Overall 106PJ <u>decrease</u> in final energy consumption between 2000-11, made up of:
  - ⇒ 257PJ <u>increase</u> due to increased activity levels
  - ⇒ 20PJ <u>decrease</u> due to structural change
  - ⇒ 343PJ <u>decrease</u> due to efficiency improvements

# Results: industry & mining sector analysis

- Data on energy consumption and physical output was obtained from 66 firms and facilities in the most energy-intensive industry branches for 2010-12 only
- This was used to conduct a bottom-up analysis using a process similar to that used in deriving the EU's "Odex" indicators



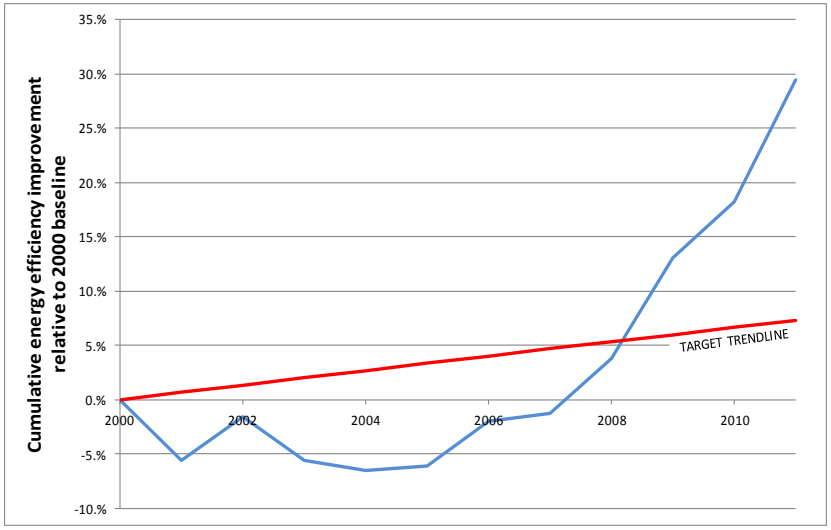

- Overall 24.6PJ <u>decrease</u> in energy consumption between 2010-12 was made up of:
  - ⇒ 41.1PJ decrease due to a combination of changes in activity level and structural changes
  - ⇒ 16.5PJ increase due to declining efficiency

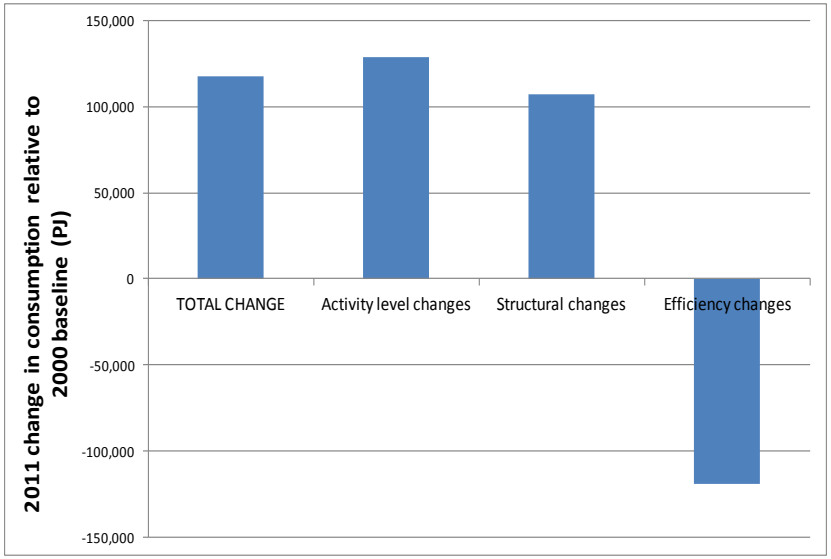
# Top-down versus bottom-up analysis

- For the single year period 2010-11, results are available for both the top-down and bottom-up analyses of the industry & mining sector:
  - Top-down shows a 7.6% improvement in efficiency
  - Bottom-up shows a 2.6% improvement in efficiency
- Main reasons for this difference include:
  - Increasing price of metals
  - Reduction in clinker content of cement products

  ...both of which will have the effect of making energy intensity (measured in terms of economic output) fall faster than specific energy consumption (measured in terms of physical output)

# Results: residential sector analysis

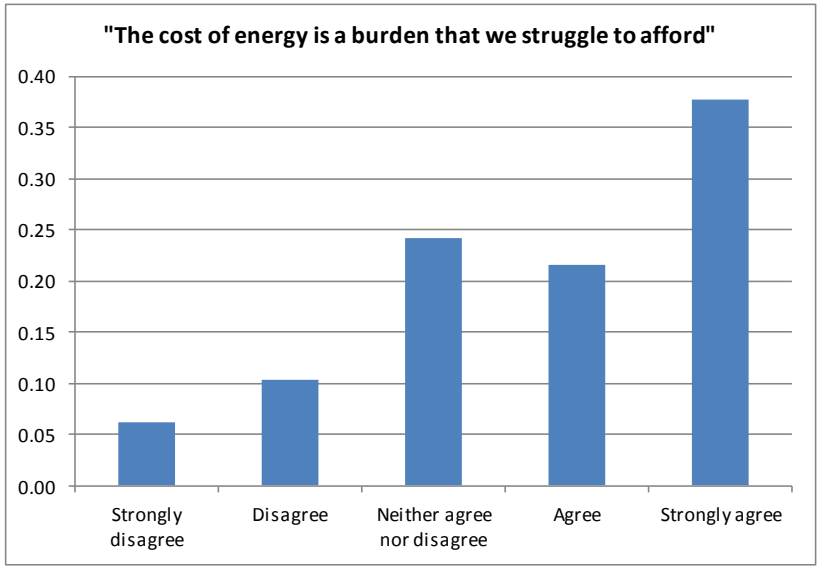


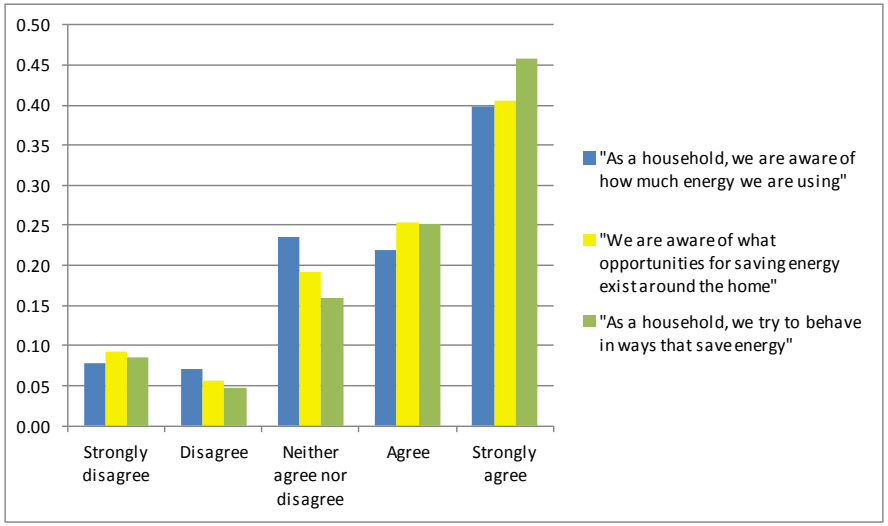




- Cumulative improvement in energy efficiency of 29.5% in 2011 relative to 2000 baseline

  (NEES target would be 7.3%)
- Sudden surge of improvement from 2007 onwards probably due to large increases in electricity tariffs
- Overall 117PJ <u>increase</u> in final energy consumption between 2000-11, made up of:
  - ⇒ 129PJ <u>increase</u> due to increased activity levels
  - ⇒ 107PJ in<u>crease</u> due to improving living standards
  - ⇒ 119PJ <u>decrease</u> due to efficiency improvements

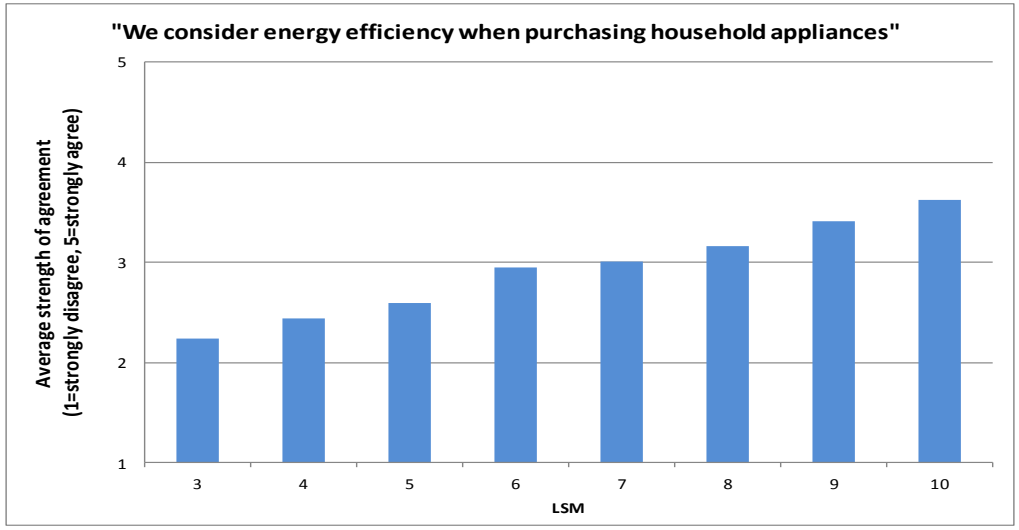
# Residential sector ‘driving force’ analysis



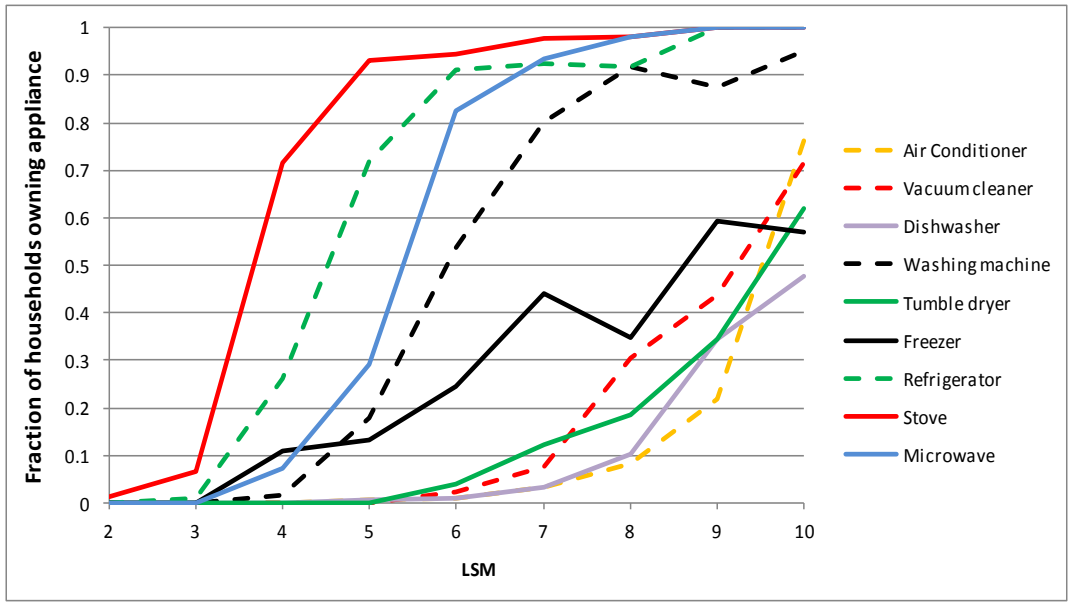




- “The cost of energy is a burden that we struggle to afford”
  - 16% of households disagree or strongly disagree
  - 60% of households agree or strongly agree
- Three statements relating to awareness of energy use and opportunities to save energy
  - 13-15% disagree or strongly disagree
  - 62-70% agree or strongly agree

# Residential sector 'driving force' analysis

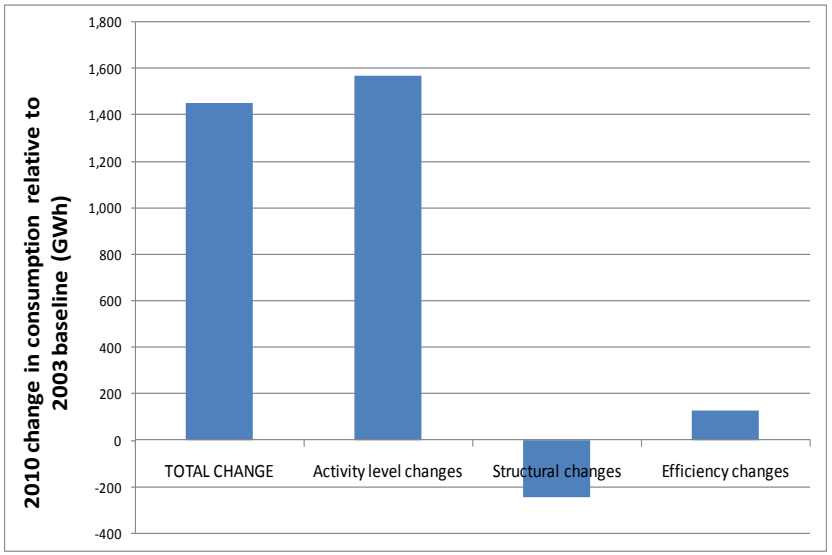



- Energy efficiency is not a significant criterion when purchasing appliances, particularly among LSMs 3-7




- But these are the very sections of the population that are acquiring appliances for the first time and driving up residential sector energy consumption

# Results: commercial & public sector analysis


- Cumulative fall in energy efficiency of 2.9% in 2010 relative to 2003 baseline

  (NEES target: 7% improvement)
- Analysis does not include penetration rates of energy-intensive equipment, so great care should be taken when interpreting these results
- Overall 1.45TWh increase in electricity consumption between 2003-10, made up of:
  - ⇒ 1.57TWh increase due to increased activity levels
  - ⇒ 0.24TWh decrease due to structural change
  - ⇒ 0.13TWh increase due to declining efficiency

# Conclusions

- New data flows from industrial / mining firms and from household surveys allow fairly robust results to be obtained for the industry & mining and residential sectors
- The commercial & public sector remains a particular challenge:
  - Lack of historical data, so analysis of past trends is very uncertain
  - Pressing need to put in place mechanisms to obtain regular data moving forward
- Based on present analysis, NEES targets in the industry & mining and residential sectors appear to be on track
- Next round of target setting must be informed by robust evidence – EETMS can potentially provide this