Quality reviews of energy data

Oslo Group Meeting

Wolfgang Bittermann
Directorate R

Abu Dhabi
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3 examples

STATISTICS AUSTRIA
The Information Manager

- Use of external expertise - collaboration with UBA (Environmental Agency)
- Model based data validation of Household Energy Consumption Survey
- Overall uncertainty of energy balances

Collaboration with UBA - the beginning

- **First contact between UBA and Statistics Austria in 1995 with the following given situation:**
  - Energy balances at these days were a rough instrument for energy planning
  - No comprehensive data validation
  - Low level of detail
  - Huge time lag (2 years) between reporting period and final data available
  - Statistics Austria took over the international energy reporting (EUROSTAT/IEA) the first time.

The main steps of collaboration

- Learning about the inventory needs
- Using the expertise of UBA staff
- Improving data quality
- Expanding the level of detail
- Implementation of ETS
- Improving timeliness

The status quo 1

- **Energy balances have improved**
  - Implementation additional data (mainly but not only ETS)
  - Additional expertise
  - Additional data checking
  - Taking into account additional user needs (details and accuracy)
  - Meeting of given deadlines

The status quo 2

- **Emission inventory has improved**
  - Improved understanding of the data collection process
  - Direct information about recalculations and their reasons
  - Deeper knowledge of the energy flows overall
  - Better consistency between national and regional inventories
  - Conformity with other national & international data sets
- **International reporting has improved**
  - Positive feedback from IEA that their emission calculations show the same trend for Austria like the national calculations

Energy balances format before 2000

Austria							
Energy Balances							
in Terajoule (10^{12} Joule)							
	1993	1994	1995	1996	1997	1998	1999
Indigenious primary production	387.542	372.857	382.486	379.200	380.434	385.391	405.126
Imports	782.214	786.654	828.971	896.234	900.924	940.231	924.596
Stock changes	-1.233	21.903	13.378	2.603	25.056	-5.714	10.250
Exports	75.117	91.399	91.388	100.306	113.204	128.878	141.690
Gross inland consumption	1.093.407	1.090.015	1.133.447	1.177.732	1.193.210	1.191.030	1.198.282
Transformation input	792.240	816.567	813.086	832.045	872.097	853.419	855.626
Transformation output	698.675	711.545	703.310	724.366	756.454	743.850	744.851
Energy sector use	77.735	79.004	82.232	82.043	80.358	84.608	80.066
Non energy use	64.697	63.294	61.059	64.746	69.674	67.944	67.917
Final energy use	857.410	842.695	880.380	923.263	927.535	928.910	939.523

Energy balances format today

- http://www.statistik.at/web_en/statistics/energy_environment/energy/energy_balances/index.html

An Austrian example: Household energy consumption survey

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- Calculation of annual energy use $E_{\sum}$ with the default values dependant on floor space and number of household members:
- $$E\sum = a*m^2 + b*n + cn$$

„a“: Default value for annual use for heating (GJ/m²) dependant on dwelling type and construction period

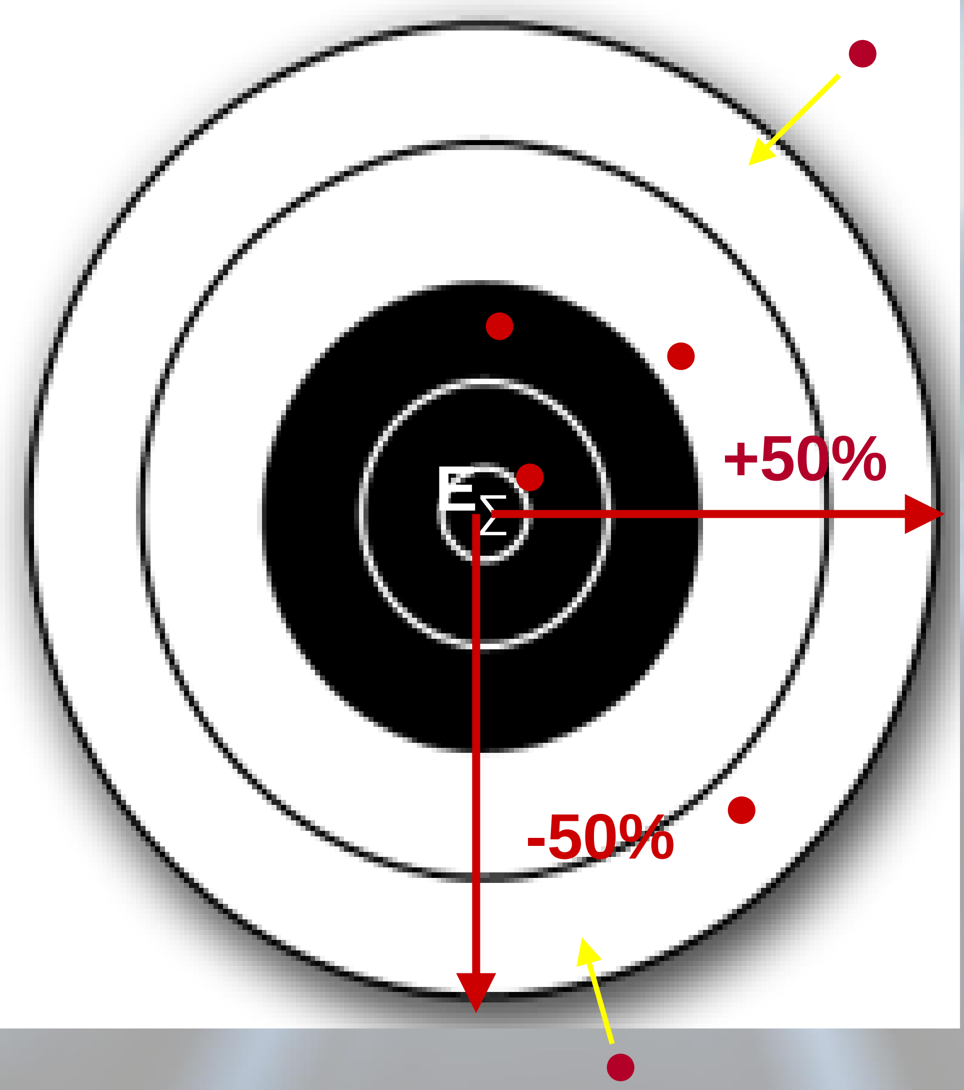
„b“: Default value for annual use for heating water (GJ/person)

„c“: Default value for annual use for cooking/depending on number of persons

„n“: number of persons

- Comparison of the notified annual energy use and calculated annual energy use E∑
- Adjustment of notified annual energy use if necessary

THE BUTT FOR DATA ADJUSTMENT



➢Defined target

Bull's eye [-50%; +50%]

➢All notified annual quantities within target are accepted

➢Notified annual quantities outside the butt are adjusted iteratively until they meet the butt's margin

Standard documentation
Meta information

(Definitions, comments, methods, quality)

on Random Sample Survey

Energy Consumption of Households

This documentation applies to the reference period:

2003 bis 2011

Status: **23.02.2012**

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STATISTICS AUSTRIA
Federal Institute Statistics Austria
A-1110 Vienna, Guglgasse 13
Phone: +43-1-71128-0
www.statistik.at

Directorate Spatial Statistics
Organizational unit Energy

Contact person:	Contact person:	Contact person:
Dipl. Geogr. Eva Korus	Walter Frech	Dr. Wolfgang Bittermann
Phone: +43-1-71128-8217	Phone: +43-1-71128-7254	Phone: +43-1-71128-7315
e-mail: eva.korus@statistik.gv.at	e-mail: walter.frech@statistik.gv.at	e-mail: wolfgang.bittermann@statistik.gv.at

The Uncertainty Assessment of EB

- Focuses on the Gross Inland Consumption
- Provides a worst case scenario
- Covers 5 error types which are included hierarchically into the final equation following the sequence of their listening:
  - Statistical differences
  - Measurement errors
  - (Small) Reporting errors
  - Statistical error (95% confidential level)
  - Uncertainty of conversion factors

Statistical Differences

- It is only taken into account if supply and consumption side are of equal data quality. If one side is known as more complete – normally the supply side - no statistical difference is taken into account
- It is always negative, because the philosophy behind Austrian energy balances does not allow a statistical difference, and the higher value is interpreted as the more complete one.
- In 2006 statistical differences were observed in
  - Coal -931 TJ or -0.55%
  - Oil -1,064 TJ or -0.17%
  - Gas -188 TJ or -0.06%

Measurement Errors

- Include weighing errors and errors of flow meters
- For 2006 of ± 1% for scales and ± 0.5% for flow meters are assumed respectively
- The maximum errors in 2006 are
  - **Coal + 1,703 TJ / - 1,694 TJ**
  - **Oil + 6,085 TJ / - 6,075 TJ**
  - **Gas + 1,577 TJ / - 1,576 TJ**

Small Reporting Errors 1

- To a minor degree only because big ones can be found and eliminated by time series analyses
- Their potential range is checked by a Monte Carlo Analysis basing on the assumption that 5% of the reported values are deranged up to 10%
- As reference survey the material and energy consumption survey is used, because this survey covers a highe share of used quantities and includes a high number of respondents
- The reporting error is applied to primary fuels that are calculated from the supply side primarily

Small Reporting Errors 2

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- For 2006 the maximum GIC interval due to potential reporting errors is +2.7% and -3,1% and is for
- Coal + 5.386 TJ / - 4.463 TJ,
  Oil + 19.246 TJ / - 16.007 TJ and
  Gas + 9.926 TJ / - 8.348 TJ
- With 95% confidence level the interval is +0.4% and -0.3% and is for
- Coal + 1.801 TJ / - 1.816 TJ,
  Oil + 6.437 TJ / - 6.512 TJ und
  Gas + 3.320 TJ / - 3.396 TJ

Statistical Errors (95% confidence level)

- It is only taken into account with fuels calculated from the consumption side and surveyed with sample surveys only
- At the moment this is the case for final consumption and transformation input (for district heating) of biofuels
- In 2006 the confidence belt is for
  - Fuel wood **± 2.475 TJ** (4,0%),
  - Pellets **± 2.591 TJ** (16,4%),
  - Woodchips **± 1.619 TJ** (18,1%),
  - Bark **± 1.215 TJ** (18,1%)
  - TI **± 558 TJ** (4,5%)

Variation in Conversion Factors

- It is taken into account for fuels with inhomogeneous material shares (municipal waste) or varying water content (wood based biofuels) of which the calorific value was not metered but calculated with default values
- For 2006 the following variations (kJ/kg) are assumed
  - Municipial wastes 9.6 ± 0.4 (4%) → ± 443 TJ
  - Fuel wood 14.4 ± 1.4 (10%) →+ 6,434 TJ / - 5,939 TJ
  - Wood chips 12.8 ± 1.3 (10%) →+ 1,057 TJ / - 733 TJ
  - Bark 7.5 ± 0.8 (10%) → + 793 TJ / - 550 TJ

The Worst Case interval of GIC

$$\sum_{i=1}^{n}(x_i - s_i)*(1-a_i)*(1-b_-)*(1-c_i)*(1-d_i)$$

$$\leq \quad \sum_{i=1}^{n} x_i \quad \leq$$

$$\sum_{i=1}^{n}(x_i * (1+a_i)*(1+b_+)*(1+c_i)*(1+d_i)$$

i =all fuels of the EB,
x_i = CIG of the fuel i in TJ,
s_i = statistical difference of the fuel i in TJ,
a_i =Measurement error of the fuel i in %,
$b_{+/-}$ = Reportig error in %,
c_i = Statistial Error of the fuel i in %,
d_i = Variation of the calorific value of the fuel i in %

Cumulated uncertainty of GIC 2006 Worst Case

	Coal		Oil		Gas		Renewables		Overall Fuels	
	minus	plus	minus	plus	minus	plus	minus	plus	minus	plus
GIC in TJ	170,293		608,522		315,391		323,384		1,442,251	
Stat. Difference in TJ	-931	0	-1,064	0	-188	0	0	0	-2,183	0
Measurement Error in TJ	-1,694	1,703	-6,075	6,085	-1,576	1,577	0	0	-9,344	9,365
Reporting Error in TJ	-4,463	5,386	-16,007	19,246	-8,348	9,926	0	0	-28,818	34,557
Stat. Error in TJ	0	0	0	0	0	0	-8,459	8,459	-8,459	8,459
Variance of CV in TJ	0	0	0	0	0	0	-7,665	8,727	-7,665	8,727
Sum	-7,087	7,089	-23,146	25,331	-10,112	11,503	-16,124	17,186	-56,468	61,108
GIC-extreme value in TJ	163,206	177,382	585,376	633,853	305,279	326,894	307,260	340,570	1,385,783	1,503,359
Tolerance	*-4.2%*	*4.2%*	*-3.8%*	*4.2%*	*-3.2%*	*3.6%*	*-5.0%*	*5.3%*	*-3.9%*	*4.2%*

Cumulated uncertainty of GIC 2006 on 95% confidence level

	Coal		Oil		Gas		Renewables		Overall Fuels	
	minus	plus	minus	plus	minus	plus	minus	plus	minus	plus
GIC in TJ	170,293		608,522		315,391		323,384		1,442,251	
Stat. Difference in TJ	-931	0	-1,064	0	-188	0	0	0	-2,183	0
Measurement Error in TJ	-1,694	1,703	-6,075	6,085	-1,576	1,577	0	0	-9,344	9,365
Reporting Error in TJ	-1,816	1,801	-6,512	6,437	-3,396	3,320	0	0	-11,723	11,558
Stat. Error in TJ	0	0	0	0	0	0	-8,459	8,459	-8,459	8,459
Variance of CV in TJ	0	0	0	0	0	0	-7,665	8,727	-7,665	8,727
Sum	-4,440	3,504	-13,651	12,522	-5,160	4,897	-16,124	17,186	-39,374	38,108
GIC-extreme value in TJ	165,853	173,797	594,871	621,044	310,231	320,288	307,260	340,570	1,402,877	1,480,359
Tolerance	*-2.6%*	*2.1%*	*-2.2%*	*2.1%*	*-1.6%*	*1.6%*	*-5.0%*	*5.3%*	*-2.7%*	*2.6%*

Please address queries to:
Wolfgang Bittermann

Contact information:
Guglgasse 13, 1110 Vienna
phone: +43 (1) 71128-7315
fax: +43 (1) 71128-8155
wolfgang.bittermann@statistik.gv.at

Thank you for your attention