

## **Appendix 1: References for energy technology RD&D investments in the BRIMCS countries and the United States**

This appendix provides the references for the data points on national government and other sources of energy RD&D expenditure in the BRIMCS countries and the United States. It consists of two sections. The first section provides an overview of all data points that have been collected for the United States and the BRIMCS countries. For comparison reasons, Table 1 provides data in million 2008 purchasing power parity (PPP) adjusted international dollars and the conversion factors for PPP are based on the World Development Indicators Online are provided in Table 2. Section 2 provides a description of the data sources that have been used to for each country and any calculations or assumptions contained within the data analysis. The references include overviews of national agencies, reports by international agencies, annual reports of state-owned enterprises (SOEs) and private industry, academic papers, consultancy reports and occasionally newspaper articles. Data is collected in local currencies and based on annual values. The corresponding references including any digital links to the reports are provided at the end of this appendix.

## A1.1. Overview of energy RD&D expenditure in the United States and the BRIMCS countries

Table 1. Overview of energy research, development and demonstration expenditure of the United States and the BRIMCS countries.

In mln 2008 PPP \$Int			2000	2001	2002	2003	2004	2005	2006	2007	2008
Fossil (incl. CCS)	US	government	308	633	713	633	610	420	577	583	659
		other	986	867	863	1067	1162				
	BR	government	170	129	79	76	64	68	89	101	79
		other	352	361	453	571	595	745	1192	1240	1167
	RU	government								23	20
		other	339		263	256	280	399	152	261	411
	IN	government	53	58	72	224	146	96	307	186	106
		other	0	0	1	3320	2389	1564	559	1378	694
	MX	government	230	183	203	218	97	78	62	140	
		other							0.1	0.1	0.2
	CN	government	1004	684	999	563	3499	3760	4586	5541	6755
		other	767	1101	1028	1873	40	55	46	105	289
	SA	government									
		other	125	96	117	117	116	63	65	165	164
Nuclear (incl. fusion)	US	government	354	365	466	461	480	529	583	678	770
		other		27	25		34				
	BR*	government	0	9	4	9	9	9	10	7	8
		other									
	RU	government									
		other									
	IN	government	207	289	298	296	295	738	866	987	965
		other									
	MX	government	54	45	40	22	33	35	33	32	
		other									
	CN	government	0	24	6	5	19	23	25	41	12
		other	0	17	4	3	14	16	18	27	7
	SA	government	146	126	105	451	217	209	211	263	133
		other	26	25	22	118	43	41	38	35	31
Renewable energy sources	US	government	346	410	415	326	292	306	272	579	699
		other									
	BR*	government	7	40	36	50	46	44	66	46	15
		other									
	RU	government								16	14
		other									
	IN	government	38	52	43	43	38	18	31	45	57
		other									
	MX	government									
		other									
	CN	government									
		other									
	SA	government									
		other	8	11	12	19	7	12	8	11	7
Energy Efficiency	US	government	624	671	549	567	535	486	467	442	525
		other									
	BR*	government	9	35	40	47	41	40	67	46	3
		other									
	RU	government								29	25
		other									
	IN	government									
		other									
	MX	government									
		other	213	0.1	662	566	219	263			
	CN	government			75	86	87	75	114	144	136
		other			4	3	17	15	12	6	26
	SA	government									
		other									

**Table 1. Overview of energy research, development and demonstration expenditure of the United States and the BRIMCS countries (continued).**

In mln 2008 PPP \$Int			2000	2001	2002	2003	2004	2005	2006	2007	2008
Electricity, transmission, distribution & storage	US	government	30	32	89	202	252	286	314	286	319
		other									
	BR*	government	22	94	104	125	111	106	175	122	14
		other									
	RU	government						1	1	26	22
		other	34	64							
	IN	government	12	12	19	8	11	12	27	30	35
		other									
	MX	government	55	56	83	74	79	82	73	79	
		other									
	CN	government									
		other									
	SA	government									
		other	63	91	94	154	59	61	38	38	26
Energy technologies (unspecified)	US	government	924	1163	1150	1152	863	924	980	1120	1160
		other	285	535	784	728	1350				
	BR*	government		13	6	14	14	14	16	11	12
		other		224	203	178	165	199	218	209	184
	RU	government			28	25	20	16	14	52	45
		other	183		378		398		587		508
	IN	government									
		other									
	MX	government									
		other	26	24	21	23	18	19			
	CN	government	1631	1140	913	976	2609	2637	3257	3320	4900
		other	554	845	780	938	745	575	704	725	985
	SA	government			0.3		0.5	0.5	0.5	10	9
		other									
<b>Total</b>	US	government	2586	3274	3382	3341	3031	2951	3193	3688	4132
		other	1271	1430	1671	1794	2545				
		<b>total</b>	3857	4703	5053	5135	5577	2951	3193	3688	4132
	BR	government	208	319	270	321	286	281	424	333	131
		other	352	585	656	750	760	945	1410	1449	1351
		<b>total</b>	560	904	925	1071	1046	1226	1833	1782	1482
	RU	government			28	25	20	17	15	145	126
		other	555		642		677		739		918
		<b>total</b>	555		670	280	698	417	754	406	1045
	IN	government	311	410	431	570	491	865	1231	1248	1163
		other	0	0	1	3320	2389	1564	559	1378	694
		<b>total</b>	311	410	432	3891	2880	2428	1791	2626	1857
	MX	government	339	284	326	314	209	194	167	252	
		other	239	24	684	589	237	282	0.1	0.1	0.2
		<b>total</b>	579	308	1009	903	446	476	167	252	0.2
	CN	government	2634	1911	1992	1629	6214	6496	7983	9045	11803
		other	1321	1963	1816	2818	816	661	779	863	1307
		<b>total</b>	3955	3874	3809	4447	7030	7156	8762	9908	13110
	SA	government	146	126	106	451	217	210	211	273	142
		other	223	223	245	409	225	178	148	248	229
		<b>total</b>	369	349	350	860	443	387	359	521	371

\* Data on Brazil's Sectorial funds is available for the years 2000-2008, but its allocation of the respective research areas is only available in 2006. Similarly, ANEEL's R&D funding for EE investments is available for the period 2001-2008, but only its aggregated allocation is known. In 2006, the allocation of Sectorial funds consisted of 15% for nuclear, 6% for basic industry technology, 8% for human resources, 7% for cooperation, 19% for electricity, 8% for hydrogen and 8% for other. Similarly, ANEEL's allocation to the power system has been allocated to TDS, renewable generation to 'renewable energy' and all other projects to energy efficiency. In the report energy RD&D expenditure have been added to the following categories: 'basic technology' to energy efficiency, 'electricity' and 'hydrogen' to transmission, distribution and storage and 'human resources', 'cooperation' and 'other' to unspecified energy technologies. We have assumed that allocations are constant over the 2000-2008 period, and have added the allocations to the respective categories annually.

**Table 2. Conversion of local currencies to PPP-adjusted annual international 2008 dollar (The World Bank Group 2009).**

Purchase power parities	2000	2001	2002	2003	2004	2005	2006	2007	2008
US ( mln 2008 international \$/ mln \$US)	1.22	1.19	1.17	1.15	1.12	1.08	1.05	1.02	1.00
Brazil (mln 2008 international \$/ mln BRL)	1.27	1.16	1.05	0.92	0.86	0.80	0.75	0.72	0.68
Russia (mln 2008 international \$/ mln RUB)	0.19	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.06
India (mln 2008 international \$/ crore (10 mln INR))	0.90	0.87	0.84	0.81	0.77	0.74	0.70	0.67	0.62
Mexico (mln 2008 international \$/ mln \$MXN)	0.20	0.19	0.18	0.17	0.15	0.15	0.14	0.14	0.13
China (mln 2008 international \$/ mln \$RMB)	0.37	0.36	0.36	0.35	0.33	0.31	0.30	0.28	0.26
South Africa (mln 2008 international \$/ mln \$ZAR)	0.39	0.36	0.33	0.31	0.29	0.28	0.26	0.24	0.22

## A2.2. Overview of data sources for energy RD&D investments

This section contains seven tables, which each provide the data sources for a particular country and the calculations and/or assumptions that have been made. The data sources are subdivided per energy technology category.

**Table 3. Data sources for energy RD&D expenditure by the United States.**

Techno-logy	Funding source	References	Notes
Fossil energy	govern-ment	<i>(Gallagher and Anadon 2009)</i>	DOE expenditure (real mln dollars) - fossil incl. ccs (row 36 in original document)
	others	<i>(NSF 2008)</i>	Data available until 2004. OECD data on industry R&D in electricity, gas and water supply is not included.
Nuclear energy	govern-ment	<i>(Gallagher and Anadon 2009)</i>	DOE expenditure (real mln dollars) - includes fission (row 129 in original) and fusion (row 133 in original document)
	others	<i>(NSF 2008)</i>	Data available until 2004. OECD data on industry R&D in electricity, gas and water supply is not included.
Rene-wable energy	govern-ment	<i>(Gallagher and Anadon 2009)</i>	DOE expenditure (real mln dollars) - renewables (total all items) row 91 in original document.
	others	N/A	
Energy efficie-ncy	govern-ment	<i>(Gallagher and Anadon 2009)</i>	DOE expenditure (real mln dollars) - efficiency (total all items) (row 51 in original)
	others	N/A	
Trans-mission, distri-bution & storage	govern-ment	<i>(Gallagher and Anadon 2009)</i>	DOE expenditure (real mln dollars) - includes electric transmission and distribution (row 100 in original) and hydrogen (row 70 in original)
	others	N/A	
Generic energy techno-logies	govern-ment	<i>(Gallagher and Anadon 2010)</i>	DOE expenditure (real mln dollars) - includes Basic Energy Science (BES), but does not include Environmental and Biological R&D
	others	<i>(NSF 2008)</i>	Data available until 2004. OECD data on industry R&D in electricity, gas and water supply or motor vehicles or transport equipment is not included.

**Table 4. Data sources for energy RD&D expenditure by Brazil.**

Data sources for Brazil's energy RD&D expenditure			
Technology	Funding source	References	Notes
Fossil energy	government	<i>(Tolmasquim 2007; MCT 2009)</i>	CT-Petro, which is funded by oil royalties. Areas of R&D: exploration, production, supply, gas/energy, management & centers
	others	<i>(Petrobras 1999; 2000; 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008)</i>	Petrobras annual reports 2000-2008; Areas of R&D expenditure are 1) exploration and production, 2) supply, 3) gas & energy, 4) distribution and 5) corporate.
Nuclear energy	government	<i>(Tolmasquim 2007; Ministerio da Ciencia e Tecnologia 2009; Obadia 2010)</i>	MCT- assumed to be 15% of CT-Energy sectorial fund and constant over time, although the 15% corresponds to the percentage of the fund devoted to nuclear energy in 2006.
	others	N/A	
Renewable energy	government	<i>(Tolmasquim 2007; Pompermayer 2008; Soares, Melo Junior et al. 2008; Ministerio da Ciencia e Tecnologia 2009)</i>	MCT 2009 - CT-Energy, the percentage for renewables (29%) and hydro (8%) and ANEEL R&D investments in renewable generation (Soares & Pompermayer 2008). Both allocations are assumed to be constant over whole period .
	others	N/A	
Energy efficiency	government	<i>(Tolmasquim 2007; Pompermayer 2008; Soares, Melo Junior et al. 2008; Ministerio da Ciencia e Tecnologia 2009; Obadia 2010)</i>	MCT 2009 - the percentage of CT-Energy that goes to basic industry technology and ANEEL R&D investments into energy efficiency, thermoelectric generation, environment and others (Soares & Pompermayer 2008). Both allocations are assumed to be constant over whole period .
	others	N/A	
Transmission, distribution & storage	government	<i>(Tolmasquim 2007; Pompermayer 2008; Soares, Melo Junior et al. 2008; MCT 2009)</i>	CT-Energy expenditure on electricity (19%) and on hydrogen (8%) and ANEEL R&D investments in power system security, planning, control, reliability and measurement and catchment management (Soares & Pompermayer 2008). Both allocations are assumed to be constant over whole period .
	others	N/A	
Generic energy	government	<i>(Tolmasquim 2007; MCT 2009)</i>	CT-Energy expenditure on human resources (8%), cooperation (7%) and other (8%); allocation in 2006

technologies			assumed to be constant
	others	<i>(ELETROBRAS 2000; 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2009)</i>	Eletrobras annual reports on R&D expenditure; projects are in the areas of 1) distribution management, 2) sea wave energy, 3) superconductivity technology, 4) development of electric vehicles, 5) bio-digesters and solar plates. It is assumed that the total expenditure on R&D between 2001 and 2004 (equaling 772.5 mln Reias) is distributed equally over these years

**Table 5. Data sources for energy RD&D expenditure by Russia.**

Data sources for Russia's energy RD&D expenditure			
Technology	Funding source	References	Notes
Fossil energy	government	<i>(Reutov 2007)</i>	200 mln roubles p.a. on CCS and co-generation and 150 mln roubles p.a. on oil & gas recovery, extraction of non-traditional resources (deep wells, bitumen sands, arctic shelf), processing of gas and LNG.
	others	<i>(LUKOIL 2000; 2001; Gazprom 2002; 2003; 2004; 2005; 2006; LUKOIL 2006; Gazprom 2007; LUKOIL 2007; Gazprom 2008; LUKOIL 2008; Gazprom 2009)</i>	Gazprom annual reports (2002-2008, except 2005), Gazprom financial report (2005) and Lukoil reports in 2000, 2006, 2007 and 2008. Reported in bln roubles (net of vat).
Nuclear energy	government	<i>N/A</i>	Large programme on new generation nuclear technology (110 bln roubles) between 2010 and 2020, however this is not included in this overview.
	others	<i>N/A</i>	
Renewable energy	government	<i>(Reutov 2007)</i>	250 mln roubles p.a. for biofuels and biomass
	others	<i>N/A</i>	
Energy efficiency	government	<i>(Reutov 2007)</i>	450 mln roubles p.a. on systems managing in regions and efficient lighting
	others	<i>N/A</i>	
Transmission,	government	<i>(Reutov 2007)</i>	hydrogen program between 2005-2006 and 400 mln roubles p.a on h2 production, storage, fuel cells &

distri- bution & storage			hydrogen energy technologies
	others	<i>(RAO UES 2001)</i>	Only data available for 2000 and 2001.
Generic energy techno- logies	govern- ment	<i>(Klimenko 2008)</i>	Total federal R&D budget between 2002-2006 was 1008 mln roubles and the budget between 2007-2012 is 3.5 bln roubles. Designated R&D funds for energy technologies are deducted from the total budget.
	others	<i>(Gokhberg 2010)</i>	Total gross domestic expenditure on energy R&D (includes government, enterprises, funding abroad and 'other'.) The data shown shows the total gross domestic expenditure on energy R&D minus the data on energy RD&D expenditure that could be attributed to either governments or any of the other energy technology categories.

**Table 6. Data sources for energy RD&D expenditure by India.**

<b>Data sources for India's energy RD&amp;D expenditure</b>			
<b>Techno- logy</b>	<b>Funding source</b>	<b>References</b>	<b>Notes</b>
Fossil energy	govern- ment	<i>(Ministry of Petroleum &amp; Natural Gas 2000; 2001; Union Budget 2001a; Ministry of Petroleum &amp; Natural Gas 2002; Union Budget 2002b; Hindustan Petroleum Corporation 2003; Ministry of Coal 2003; Ministry of Petroleum &amp; Natural Gas 2003; Union Budget 2003b; Hindustan Petroleum Corporation 2004; Ministry of Coal 2004; Ministry of Petroleum &amp; Natural Gas 2004; Oil India Ltd 2004; ONGC 2004; Union Budget 2004b; Hindustan Petroleum Corporation 2005; Ministry of Coal 2005; Ministry of Petroleum &amp; Natural Gas 2005; Oil India Ltd 2005; ONGC 2005; Union Budget 2005b; GAIL 2006;</i>	Annual reports of MPNG, MOC and MOES and annual reports of 100% state-owned enterprises: This includes the budget of grant-in-aids and R&D projects of the OI&D of the Ministry of Petroleum & Natural Gas (including R&D activities of the Petroleum Conservation Research Association) as well as R&D budgets of 100% government owned petroleum companies in India. Also includes the budget for the research institute of Ministry of Coal. Also, includes research on Gas Hydrates through the Ministry of Earth Sciences in 2007 and 2008.

		<p><i>Hindustan Petroleum Corporation 2006; Ministry of Coal 2006; Ministry of Petroleum &amp; Natural Gas 2006; Oil India Ltd 2006; ONGC 2006; Union Budget 2006b; GAIL 2007; Hindustan Petroleum Corporation 2007; Ministry of Coal 2007; Ministry of Petroleum &amp; Natural Gas 2007; Oil India Ltd 2007; ONGC 2007; Union Budget 2007b; GAIL 2008; Hindustan Petroleum Corporation 2008; Ministry of Coal 2008; Ministry of Petroleum &amp; Natural Gas 2008; Oil India Ltd 2008; ONGC 2008; Union Budget 2008b; Hindustan Petroleum Corporation 2009; Ministry of Coal 2009; Oil India Ltd 2009; ONGC 2009; Union Budget 2009b; Ministry of Coal 2010)</i></p>	
	others	<p><i>(Ministry of Petroleum &amp; Natural Gas 2000; 2001; Union Budget 2001a; Ministry of Petroleum &amp; Natural Gas 2002; Union Budget 2002b; Hindustan Petroleum Corporation 2003; Ministry of Coal 2003; Ministry of Petroleum &amp; Natural Gas 2003; Union Budget 2003b; Hindustan Petroleum Corporation 2004; Ministry of Coal 2004; Ministry of Petroleum &amp; Natural Gas 2004; Oil India Ltd 2004; ONGC 2004; Union Budget 2004b; Hindustan Petroleum Corporation 2005; Ministry of Coal 2005; Ministry of Petroleum &amp;</i></p>	<p>Based on data derived from the annual reports of MPNG and MOC and annual reports of state-owned enterprises. This category includes R&amp;D expenditure of partially state-owned enterprises , the loans for R&amp;D activities to partially state-owned enterprises through the Oil Industry Development Board (OIDB).</p>

		<p><i>Natural Gas 2005; Oil India Ltd 2005; ONGC 2005; Union Budget 2005b; GAIL 2006; Hindustan Petroleum Corporation 2006; Ministry of Coal 2006; Ministry of Petroleum &amp; Natural Gas 2006; Oil India Ltd 2006; ONGC 2006; Union Budget 2006b; GAIL 2007; Hindustan Petroleum Corporation 2007; Ministry of Coal 2007; Ministry of Petroleum &amp; Natural Gas 2007; Oil India Ltd 2007; ONGC 2007; Union Budget 2007b; GAIL 2008; Hindustan Petroleum Corporation 2008; Ministry of Coal 2008; Ministry of Petroleum &amp; Natural Gas 2008; Oil India Ltd 2008; ONGC 2008; Union Budget 2008b; Hindustan Petroleum Corporation 2009; Ministry of Coal 2009; Oil India Ltd 2009; ONGC 2009; Union Budget 2009b; Ministry of Coal 2010)</i></p>	
Nuclear energy	government	<p><i>(Union Budget 2001b; 2002a; 2003a; 2004a; 2005a; 2006a; 2007a; 2008a; 2009c)</i></p>	<p>Budgets of two research centres of the Department of Atomic Energy: the Bhabha Atomic Research Centre and Indira Gandhi Centre for Atomic Research.” The data shown includes their total R&amp;D budgets, although it is unsure how much of their budgets is used for non-energy related applications, such as military purposes.</p>
	others	N/A	
Renewable energy	government	<p><i>(Union Budget 2001c; 2002c; 2003c; 2004c; 2005c; 2006c; 2007c; 2009d)</i></p>	<p>Original data reported in crores of rupees. Data based on the Union Budgets. Research areas include: (1) solar energy programme, (2) biogas programme, (3) wind energy programme, (4) biomass programme, (5) other sources of energy, (6) small hydel programme, and (7) National Institute of Renewable Energy</p>
	others	N/A	

Energy efficiency	government	N/A	
	others	N/A	
Transmission, distribution & storage	government	<i>(Ministry of Power 2000; Union Budget 2001d; Ministry of Power 2002; Union Budget 2002d; Ministry of Power 2003; NTPC 2003; Union Budget 2003d; Ministry of Power 2004; NTPC 2004a; b; Union Budget 2004d; Ministry of Power 2005; Union Budget 2005d; NEEPCO 2006; NTPC 2006; Union Budget 2006d; Ministry of Power 2007; NEEPCO 2007; NTPC 2007; Union Budget 2007d; Ministry of Power 2008; NEEPCO 2008; NHPC 2008; NTPC 2008; Union Budget 2008c; Ministry of Power 2009; NTPC 2009; Union Budget 2009a; Ministry of Power 2010)</i>	Original data is reported in crores of rupees. The data shown is based on the budget of the Central Power Research Institute (CPRI) at Bangaluru, which is the main R&D institution of the Ministry of Power ( <a href="http://indiabudget.nic.in">indiabudget.nic.in</a> ) and the R&D expenditures of two 100% government-controlled power companies; NHPC and NTPC.
	others	N/A	
Generic energy technologies	government	N/A	
	others	N/A	

Table 7. Data sources for energy RD&D expenditure by Mexico.

Data sources for Mexico's energy RD&D expenditure			
Techno-logy	Funding source	References	Notes
Fossil energy	govern-ment	<i>(CONACYT 2008)</i>	Data were sourced from CONACYT 2008 (GFIDE) and include expenditures executed by the Mexican Petroleum Institute (IMP) and PEMEX
	others	<i>(Pemex 2002; 2003; 2004; 2005; 2006; 2007; 2008)</i>	PEMEX (2008,2007,2006) ~ Duty for the Fund for Scientific and Technological Research on Energy – This duty was applied at a rate of 0.15% to the value of the extracted production; value of net sales of exploration and production used as proxy for the value of the extracted production. In 2008, 65% went to sectorial funds from CONACYT and 35% was directed to IMP.
Nuclear energy	govern-ment	<i>(CONACYT 2008)</i>	Data were sourced from CONACYT 2008 (GFIDE) and include expenditures executed by the National Institute of Nuclear Research (ININ).
	others	N/A	
Rene-wable energy	govern-ment	N/A	
	others	N/A	
Energy efficie-ncy	govern-ment	N/A	
	others	<i>(CONACYT 2008)</i>	R&D expenditure of the motor vehicle and other transport industries. The data shows large variability between years.
Trans-mission, distri-bution & storage	govern-ment	<i>(CONACYT 2008)</i>	Data were sourced from CONACYT 2008 (GFIDE) and include expenditures executed by the Institute of Electric Research (IIE).
	others	N/A	
Generic energy techno-logies	govern-ment	N/A	
	others	<i>(CONACYT 2008)</i>	R&D expenditure of two industry sectors: 1) coal, oil derivates and nuclear energy and 2) electricity, gas and

			water supplies. The data shows large variability between years.
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**Table 8. Data sources for energy RD&D expenditure by China.**

<b>Data sources for China's energy RD&amp;D expenditure</b>			
<b>Techno-logy</b>	<b>Funding source</b>	<b>References</b>	<b>Notes</b>
Fossil energy	govern-ment	<i>(State Statistical Bureau 2001; 2002; 2003; 2004; Gao 2005; State Statistical Bureau 2005; 2006; 2007; Xiao 2007; State Statistical Bureau 2008; Liu 2009; State Statistical Bureau 2009; Jiang 2010)</i>	China Statistical Yearbooks 2001-2009: includes government grants for intramural R&D expenditure in R&D institutions, government grants for S&T activities in non-state-owned enterprises and total funding for S&T activities in state-owned enterprises operating in the following industries: (1) coal mining and washing; (2) petroleum and natural gas extraction; (3) production and distribution of gas. Other data sources have been used to verify the data.
	others	<i>(State Statistical Bureau 2001; 2002; 2003; 2004; Gao 2005; State Statistical Bureau 2005; 2006; MOST 2007; State Statistical Bureau 2007; 2008; 2009; Jiang 2010)</i>	China Statistical Yearbooks 2001-2009: includes intramural R&D expenditure by R&D institutions other than government grants and funding for S&T activities in non-state-owned enterprises other than government grants in the following industries: (1) coal mining and washing; (2) petroleum and natural gas extraction; (3) and, production and distribution of gas. Other data sources have been used to verify the data.
Nuclear energy	govern-ment	<i>(State Statistical Bureau 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; Jiang 2010)</i>	China Statistical Yearbooks 2001-2009: includes government funding for S&T activities in institutions of higher education in the following category: nuclear technology. Other data sources have been used to verify the data.
	others	<i>(State Statistical Bureau 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; Jiang 2010)</i>	China Statistical Yearbooks 2001-2009: includes funding for S&T activities in institutions of higher education other than government grants in the following category: nuclear technology. Other data sources have been used to verify the data.
Rene-wable energy	govern-ment	N/A	
	others	N/A	
Energy	govern-	<i>(State Statistical Bureau</i>	First, Siegler (2009), Reuters (2009) and www.iphe.net: it

efficiency	ment	<i>2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; Reuters 2009; Siegler 2009; State Statistical Bureau 2009)</i>	includes data on two projects in the 863 program: (1) "batteries for electric vehicles" operating from 2001 to 2005, and (2) "Fuel Efficient and New Fuel Vehicle Project" from 2006-2010. It is assumed that the total budgets are evenly spread across the years. Second, China Statistical Yearbooks 2001-2009: includes government grants for intramural R&D expenditure in R&D institutions in the transport sector in the following categories: (1) road; (2) rail; (3) air; (4) water; (5) urban transport; (6) transport subsidiary; (7) pipeline, and (8) other forms of transport.
	others	<i>(State Statistical Bureau 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009)</i>	China Statistical Yearbooks 2001-2009: includes intramural R&D expenditure other than government grants in R&D institutions in the transport sector in the following categories: (1) road; (2) rail; (3) air; (4) water; (5) urban transport; (6) transport subsidiary; (7) pipeline, and (8) other forms of transport.
Transmission, distribution & storage	government	<i>(MOST 2007; Delman and Chen 2008; Jiang 2010)</i>	Delman and Chen (2008) have data points for 2003 and 2006 on government R&D investments in the grid. MOST (2007) has data on government R&D investments in power transmission and distribution industry. Both data points are not included in the overview, because they could not be verified.
	others	N/A	
Generic energy technologies	government	<i>(State Statistical Bureau 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; Su, Huang et al. 2009)</i>	China Statistical Yearbooks 2001-2009: includes government grants for intramural R&D expenditure in R&D institutions, government grants for S&T activities in non-state-owned enterprises, and total funding for S&T activities in state-owned enterprises in the following sectors: (1) processing of petroleum, coking and nucleus fuels, and (2) production and supply of electric power and heat power. It also includes government funding for S&T activities in institutions of higher education in the following areas: (1) energy technology, and (2) power and electrical engineering. Other data sources have been used to verify the data.
	others	<i>(State Statistical Bureau 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; Su, Huang et al. 2009)</i>	China Statistical Yearbooks 2001-2009: includes intramural R&D expenditure in R&D institutions other than government grants and, funding for S&T activities in non-state-owned enterprises other than government grants in the following sectors: (1) processing of petroleum, coking and nucleus fuels, and (2) production and supply of electric power and heat power. It also includes funding for S&T

			activities in institutions of higher education other than government grants in the following areas: (1) energy technology, and (2) power and electrical engineering. Other data sources have been used to verify the data.
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**Table 9. Data sources for energy RD&D expenditure by South Africa.**

<b>Data sources for South Africa's energy RD&amp;D expenditure</b>			
<b>Techno-logy</b>	<b>Funding source</b>	<b>References</b>	<b>Notes</b>
Fossil energy	govern-ment	N/A	
	others	<i>(Sasol 2000; 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008)</i>	Sasol annual reports 2000-2008: Sasol, a major petroleum company in SA, spends between 250 and 750 mln ZAR p.a. on R&D, but the company's R&D decisions are not controlled by the federal government. Thus, Sasol's R&D expenditures is categorized under 'other' sources of funding.
Nuclear energy	govern-ment	<i>(National Treasury SA 2004; 2005; 2006b; a; 2007; PBMR 2007; National Treasury SA 2008; PBMR 2008; DPB 2010)</i>	Contributions to the PBMR project in different years. Public address by Barbara Hogan provides total government expenditure on PBMR between 2000 and 2009. Total expenditure is evenly distributed over those years, except for those years where the expenditure is known.
	others	<i>(Eskom 2001; 2002; 2003; 2005; 2006; 2007; PBMR 2007; Eskom 2008; PBMR 2008; DPB 2010)</i>	Eskom annual reports 2000-2008: allocation of R&D expenditure to 'sustainable development' and 'climate change projects'. Allocation between 2003-2006 is intrapolated. Public address by Barbara Hogan provides total non-government expenditure on PBMR between 2000 and 2009. Total expenditure is evenly distributed over those years, except for those years where the expenditure is known.
Rene-wable energy	govern-ment	N/A	
	others	<i>(Eskom 2001; 2002; 2003; 2005; 2006; 2007; 2008)</i>	Eskom annual reports 2000-2008: allocation of R&D expenditure to 'sustainable development' and 'climate change projects'. Allocation between 2003-2006 is intrapolated
Energy	govern	N/A	

efficiency	ment		
	others	N/A	
Transmission, distribution & storage	government	N/A	Eskom has a monopoly position within SA and spends between 150-300 mln. ZAR p.a. on R&D. However, the company's R&D decisions are not controlled by the government.
	others	<i>(Eskom 2001; 2002; 2003; 2005; 2006; 2007; 2008)</i>	Eskom's R&D expenditure allocations to 1) research management, 2) future generation systems, 3) power system reliability, 4) process improvement and 5) future market research.
Generic energy technologies	government	<i>(DST 2001; 2002; 2003; 2004; 2005; 2006; 2007b; a; 2008; 2009)</i>	DST (2000-2007): annual R&D contributions to 'energy resources' and 'energy supply', DST (2007-2008): annual R&D budget for SANERI.
	others	N/A	

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