



## *Articulation qualitatif-quantitatif dans l'élaboration des scénarios du Conseil mondial de l'énergie*



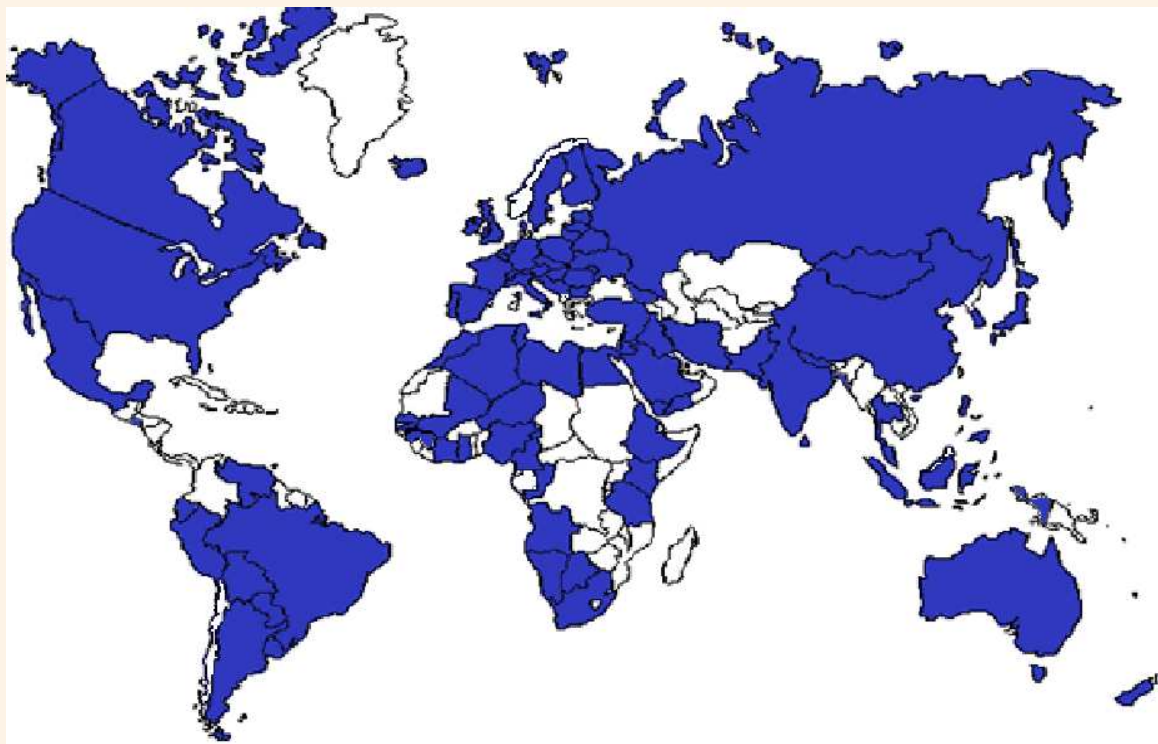
Conseil Français de l'Énergie  
WORLD ENERGY COUNCIL

*Jean-Eudes Moncomble*



Conseil Français de l'Énergie

## What is World Energy Council (WEC)



WEC has Member Committees in about 100 countries in the world, including most of the largest energy-producing and energy consuming countries (2/3 of developing countries).

The World Energy Council (WEC) is one of the foremost multi-energy organisation in the world today. Established in 1923, the organisation covers all types of energy, including coal, oil, natural gas, nuclear, hydro, and renewables, WEC is UN-accredited, non-governmental, non-commercial and non-aligned. WEC is a UK-registered charity, headquartered in London.

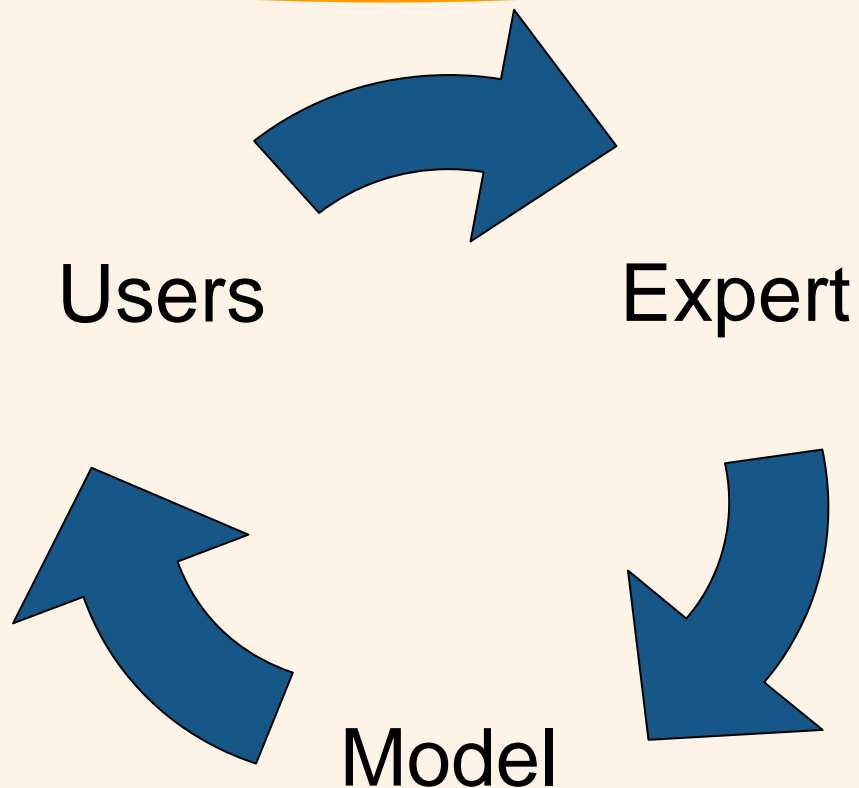
***To promote the sustainable supply and use of energy for the greatest benefit of all people***

# Turning the traditional modelling approach upside down



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WEC members & partners

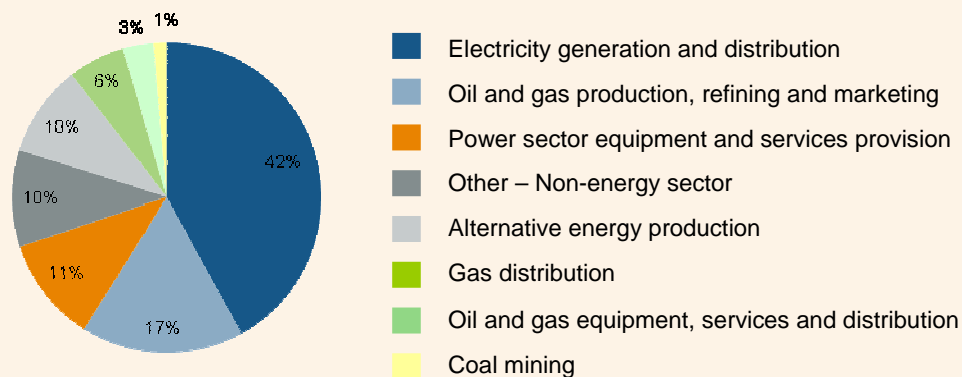


## The Study is Bottom-up

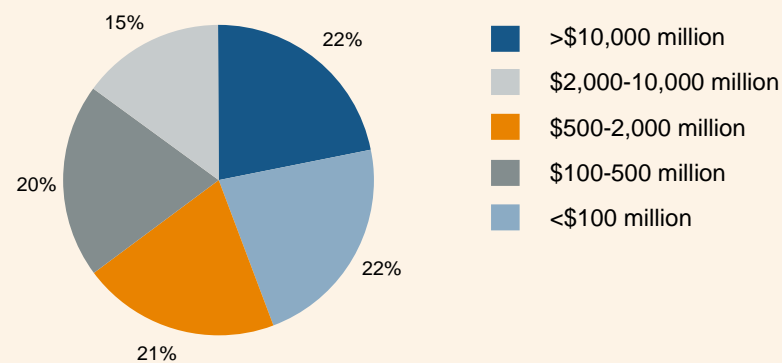
- Conversely, it is the decision makers that influence, plan, and manage regional and local energy systems on a daily basis.
- These scenarios capture and collate their priorities and opinions, from the bottom up, in each of the five regions of the World Energy Council.



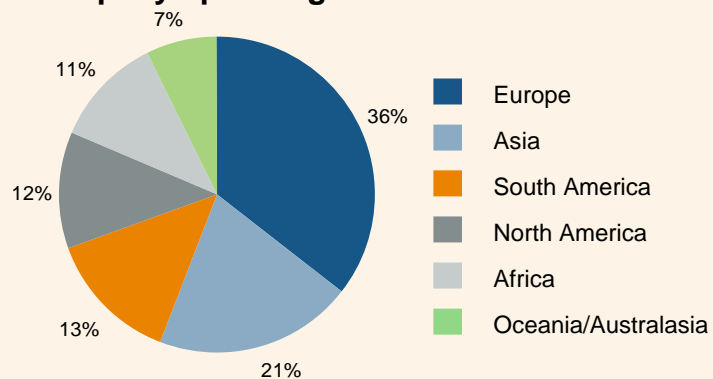
### Business type



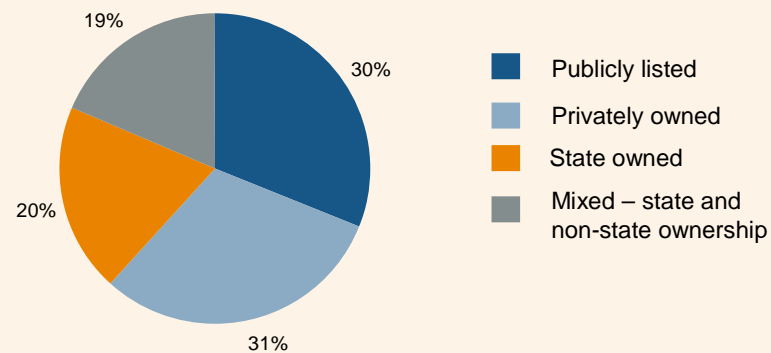
### Company revenue



### Company operating location



### Ownership structure



# Implementation



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- More than 20 workshops conducted from July 2005 to April 2007 in various regions of the world.
- Views of how to meet the need for energy that is accessible, available, and acceptable by 2020, 2035 and 2050, from over 400 principals from industry, government, academia, NGOs and trade groups.
- Experts from the five global regions, Africa, Asia, Europe, Latin America and North America, and from all facets of energy planning: energy production, finance, academia, civil society, and government.

# HOW BIG IS AFRICA?

Approximate Area in Square Miles

Africa	11,668,545
China	3,681,089
Europe	3,979,405
USA	3,678,235
Total	11,338,729



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Mollweide Equal Area Projection

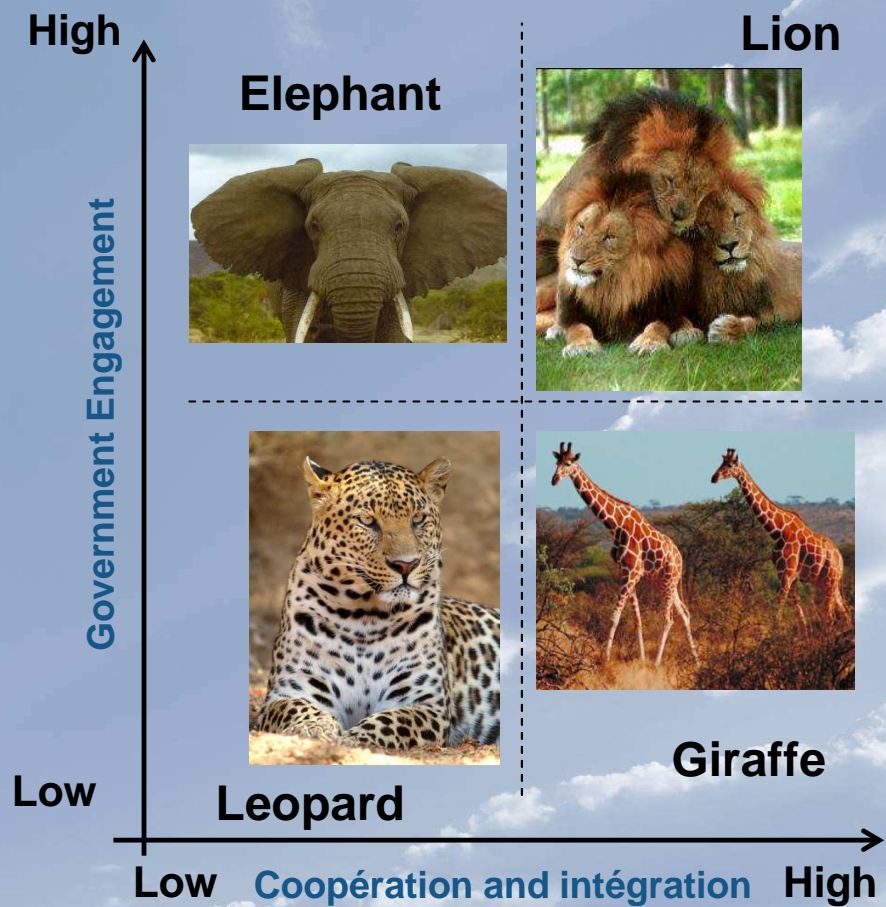


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# Storylines





# Implementation - Metrics

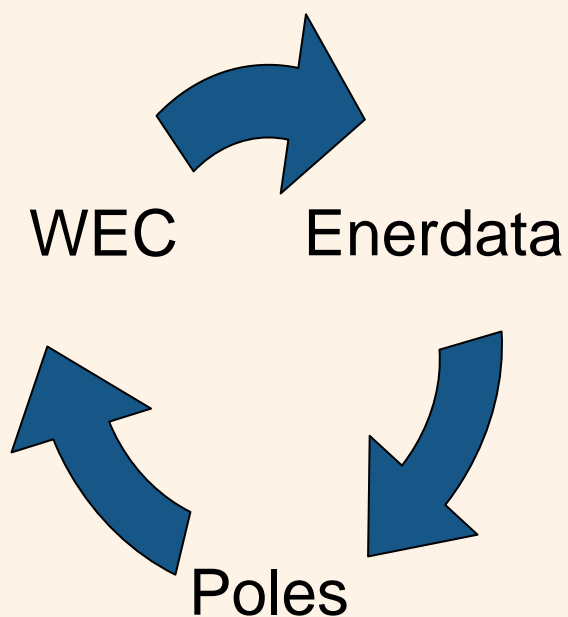
## Scenario III: High Government Engagement – High Global Co-Operation

TABLE 1 a – Scenario 3		UNMITIGATED			
Scenario Number / Name (3) HG –HC		Region: <b>Africa</b>			
	Year 2005	- 2005	- 2020	- 2035	- 2050
GDP Growth	4.9 %	↗	↗	↗	↗
Demographic Growth	2.2 %	→	→	↘	↘
Energy Intensity	0.3 Toe/ \$ 1000 GDP PPP	→	↗	→	↘
Prim. Energy Mix		→	↗	↗	↘
GHG Emissions	2.5%	↗	↘	↘	→
Supply/ Demand Tension	Oil	↗	↗	↗	↗
	Gas	↗	↘	↗	↘
	Coal	↗	↘	↗	↘
	Nuclear	→	→	↗	↘
	Renewable	↗	↗	↗	→
	Non- Commercial	↗	↗	↗	↗
Tot. Prim Energy Required	2.2%	↗	↗	↗	↗





# Model simulation



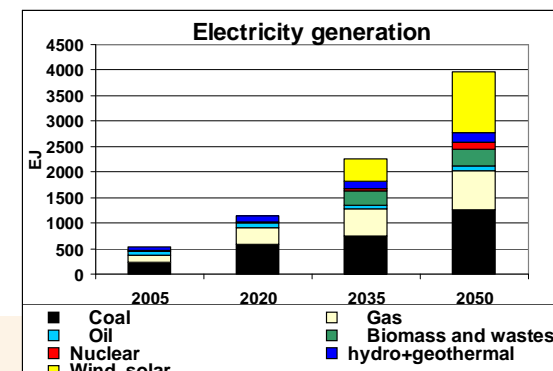
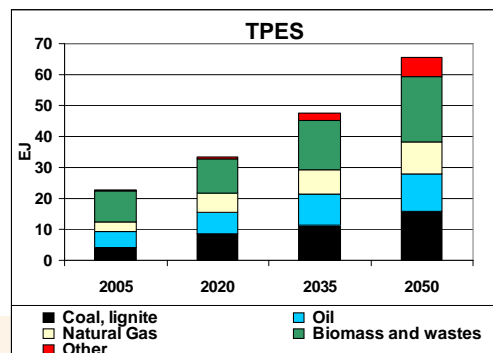
# Storylines

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**Scenario III: High Government Engagement – High Global Co-Operation**

TABLE 1 a – Scenario 3		UNMITIGATED			
Scenario Number / Name (3) HG –HC		Region: Africa			
	Year 2005	- 2005	- 2020	- 2035	- 2050
GDP Growth	4.9 %	→	→	→	→
Demographic Growth	2.2 %	→	→	→	→
Energy Intensity	0.3 Toe/ \$ 1000 GDP PPP	→	→	→	→
Prim. Energy Mix		→	→	→	→
GHG Emissions	2.5%	→	→	→	→
Supply/ Demand Tension	Oil	→	→	→	→
	Gas	→	→	→	→
	Coal	→	→	→	→
	Nuclear	→	→	→	→
	Renewable	→	→	→	→
	Non- Commercial	→	→	→	→
Tot. Prim Energy Required	2.2%	→	→	→	→

	2005	2020	2035	2050	2005	2020	2035	2050
<b>Scenario S2 HG-LC</b>								
<b>Total primary energy supply (TPES) (EJ)</b>	<b>6</b>	<b>9</b>	<b>12</b>	<b>16</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Coal, lignite	0,2	0,4	0,9	1,6	3%	5%	7%	10%
Oil	2,6	3,1	3,6	3,8	47%	36%	30%	23%
Natural Gas	2,6	4,7	6,2	7,7	46%	55%	51%	47%
Biomass and wastes	0,1	0,2	1,0	2,0	3%	3%	8%	12%
of which traditional biomass	0,1	0,1	0,1	0,1	2%	2%	1%	1%
Other	0,1	0,1	0,5	1,3	1%	2%	4%	8%
of which Nuclear	0,0	0,0	0,1	0,3	0%	0%	1%	2%
Wind, solar	0,0	0,1	0,4	0,9	0%	1%	3%	5%
<b>Final energy consumption (EJ)</b>	<b>4</b>	<b>5</b>	<b>7</b>	<b>10</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Industry (inc. non-energy uses)	1,4	2,0	2,6	3,2	39%	38%	35%	33%
Transport	1,0	1,5	2,1	2,9	30%	28%	28%	30%
Household, service, agriculture	1,1	1,8	2,7	3,6	31%	34%	36%	38%
Electricity	0,6	1,2	2,2	3,7	16%	23%	30%	38%
Gas	0,7	1,1	1,4	1,5	19%	21%	19%	16%
Oil	2,0	2,7	3,0	3,0	58%	51%	41%	31%
Other	0,2	0,3	0,8	1,4	6%	5%	10%	15%



<b>International energy prices</b>				
	2005	2020	2035	2050
<b>Oil (\$/bl)*</b>	54	58	74	91
<b>Gas (\$/Mbtu)* European market</b>	5,4	6,9	8,9	11,3
<b>Coal (\$/t)* European market</b>	72	89	100	111

\* : all costs are given in constant 2005\$ PPP

<b>Oil &amp; gas production</b>				
	2005	2020	2035	2050
<b>World oil production (Mbl/d), of which :</b>	<b>80</b>	<b>94</b>	<b>101</b>	<b>96</b>
Conventional, of which :	78	86	82	68
Gulf countries	21	33	42	38
Non-conventional	2	9	19	28
<b>World gas production (Gm3), of which :</b>	<b>2849</b>	<b>4202</b>	<b>4760</b>	<b>5085</b>
Gulf countries	259	607	1005	1510
CIS	733	873	1088	1305

### Scenario S2 HG-LC

	2005	2020	2035	2050	2005	2020	2035	2050
<b>Total primary energy supply (TPES) (EJ)</b>	<b>23</b>	<b>33</b>	<b>48</b>	<b>66</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Coal, lignite	4,0	8,5	11,3	15,8	17%	26%	24%	24%
Oil	5,2	7,1	9,9	12,1	23%	21%	21%	18%
Natural Gas	3,2	6,2	8,0	10,5	14%	18%	17%	16%
Biomass and wastes	10,0	11,0	15,8	20,9	44%	33%	33%	32%
of which traditional biomass	9,0	10,5	11,3	10,4	39%	31%	24%	16%
Other	0,4	0,7	2,6	6,3	2%	2%	5%	10%
of which Nuclear	0,1	0,2	0,6	1,4	0%	1%	1%	2%
Wind, solar	0,0	0,1	1,5	4,3	0%	0%	3%	7%
<b>Final energy consumption (EJ)</b>	<b>18</b>	<b>25</b>	<b>34</b>	<b>45</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Industry (inc. non-energy uses)	3,8	6,1	8,9	11,9	22%	25%	26%	26%
Transport	2,8	3,9	5,8	9,2	16%	16%	17%	20%
Household, service, agriculture	11,0	14,7	19,6	24,0	62%	60%	57%	53%
Electricity	1,6	3,3	6,4	11,5	9%	13%	19%	25%
Gas	0,9	1,3	1,8	2,1	5%	5%	5%	5%
Oil	4,4	6,8	9,6	11,0	25%	27%	28%	24%
Other	10,7	13,2	16,5	20,6	61%	54%	48%	46%

### Scenario S2 HG-LC

	2005	2020	2035	2050	2005-50
<b>Context</b>					
GDP growth (%/year)		3,7%	3,3%	2,8%	3,3%
Demographic growth (%/year)		2,2%	2,2%	1,5%	2,0%
<b>Energy efficiency and climate change policies</b>					
TPES growth (%/year)		2,6%	2,4%	2,1%	2,4%
Energy Intensity growth (%/year)		-1,1%	-0,9%	-0,6%	-0,9%
GHG emissions (Billions tons CO2)	0,93	1,65	2,22	2,66	
<b>Energy diversification and supply security</b>					
Diversity index (Shannon-Wiener)	1,51	1,51	1,67	1,70	
Independance ratio	181%	185%	139%	102%	
Self-sufficiency ratio	100%	100%	100%	97%	
<b>Supply / Demand tensions on fossils</b>					
Oil Independance ratio	360%	305%	168%	87%	
Gas Independance ratio	217%	301%	227%	112%	
Coal Independance ratio	129%	118%	116%	112%	

### Scenario S2 HG-LC

	2005	2020	2035	2050	2005	2020	2035	2050
<b>Total primary energy supply (TPES) (EJ)</b>	<b>17</b>	<b>25</b>	<b>35</b>	<b>49</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Coal, lignite	3,8	8,1	10,4	14,1	22%	33%	29%	29%
Oil	2,6	3,9	6,3	8,3	15%	16%	18%	17%
Natural Gas	0,6	1,4	1,9	2,8	4%	6%	5%	6%
Biomass and wastes	9,8	10,7	14,8	18,9	57%	43%	42%	38%
of which traditional biomass	8,9	10,3	11,1	10,3	51%	42%	31%	21%
Other	0,4	0,5	2,1	5,0	2%	2%	6%	10%
of which Nuclear	0,1	0,2	0,5	1,0	1%	1%	1%	2%
Wind, solar	0,0	0,0	1,2	3,4	0%	0%	3%	7%
<b>Final energy consumption (EJ)</b>	<b>14</b>	<b>19</b>	<b>27</b>	<b>35</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Industry (inc. non-energy uses)	2,5	4,0	6,3	8,8	18%	21%	23%	25%
Transport	1,7	2,4	3,7	6,4	12%	12%	14%	18%
Household, service, agriculture	9,9	12,9	16,9	20,4	70%	67%	63%	57%
Electricity	1,0	2,1	4,2	7,8	7%	11%	16%	22%
Gas	0,2	0,2	0,4	0,5	1%	1%	1%	2%
Oil	2,4	4,1	6,5	8,0	17%	21%	24%	23%
Other	10,5	13,0	15,8	19,1	75%	67%	59%	54%



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**And finally, communication**