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Mongolia: Updating the Energy Sector Development Plan

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Prepared by E. Gen Consultants Ltd. Bangladesh in association with MVV decon GmbH, Germany, and Mon-Energy Consult, Mongolia

For Ministry of Energy, Mongolia

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Asian Development Bank

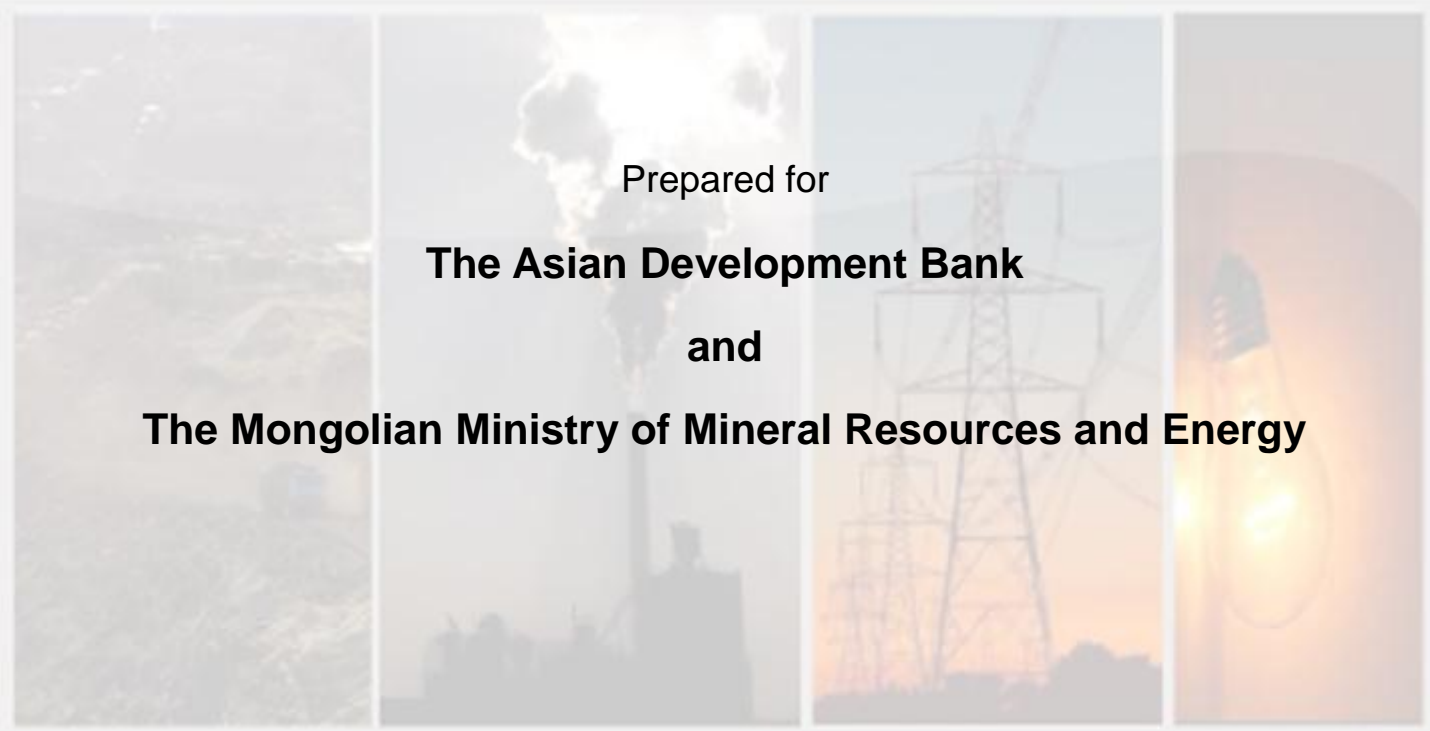
Updating Energy Sector Development Plan

Project Number: TA No. 7619-MON

FINAL REPORT

PART B: Volume - II of X

MACRO-ECONOMIC ANALYSES



Prepared for
The Asian Development Bank
and

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ABBREVIATIONS

ADB	–	Asian Development Bank
AUES	–	Altai-Uliastai Electricity System
CEE	–	Central Eastern Europe
CES	–	Central Energy System
CFB	–	Circulating Fluidized Bed
CHP	–	Combine Heat Power
COD	–	Commencement Operation Date
DES	–	Dalanzadgad Energy System
ERES	–	Eastern Region Energy System
ERA	–	Energy Regulatory Authority
FIRR	–	Financial Internal Rate of Return
FSU	–	Former Soviet Union
GDP	–	Gross Domestic Product
GoM	–	Government of Mongolia
MoE	–	Ministry of Energy
MoF	–	Ministry of Finance
NDC	–	National Dispatch Center
NDIC	–	National Development and Innovation Committee
NPV	–	Net Present Value
O&M	–	Operation and Maintenance
TOR	–	Terms of Reference
UB	–	Ulaanbaatar
WACC	–	Weighted Average Cost of Capital
WRES	–	Western Region Energy System

UNITS OF MEASURE

BTU	-	British thermal unit
GCal	-	Gigacalorie (one million kilocalories)
GJ	-	Gigajoule (one thousand megajoules)
kJ	-	Kilojoule
kWh	-	Kilowatt-hour
MWh	-	Megawatt-hour
MWel	-	Megawatt electric
MWth	-	Megawatt thermal
PJ	-	Petajoule
TSC (TPU)	-	Tons of standard coal
TJ	-	Terajoule

WEIGHTS AND MEASURES

GW (giga watt)	–	1,000,000,000 calories
GJ (giga joules)	–	1,000,000,000 joules
GW (giga watt)	–	1,000,000,000 watts
kVA (kilovolt-ampere)	–	1,000 volt-amperes
kW (kilowatt)	–	1,000 watts
kWh (kilowatt-hour)	–	1,000 watts-hour
MW (megawatt)	–	1,000,000 watts
W (watt)	–	unit of active power

CONVERSION FACTORS

1 GCal	=	4.19 GJ
1 BTU	=	1.05506 kJ
1 Gcal	=	1.1615 MWh = 4.19 GJ = 1.75 steam tons/hour
1 GJ	=	0.278 MWh = 0.239 Gcal = 0.42 steam tons/hour
1 MW	=	0.86 Gcal = 3.6 GJ = 1.52 steam tons/hour
1 TSC	=	7 Gcal = 29.3 GJ = 8.15 MWh

NOTE

In this report, "\$" refers to US dollars.

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I. INTRODUCTION

A. General

1. Mongolia is faced with long-term development challenges and might benefit by considering the principles of 'new structural economics' which is an evolution of development thinking since the end of WWII. New structural economics suggests a framework to enable developing countries to achieve sustainable growth, eliminate poverty, and narrow the income gap with the developed countries. The framework is called a neoclassical approach to structures and change in the process of economic development.

2. New structural economics also stresses the idea that the industrial upgrading process in a developing country should be consistent with the change in the country's comparative advantage that reflects the accumulation of human and physical capital and the change in its factor endowment structure - this ensures the viability of firms in new industries. New structural economics concludes that the role of the state in industrial diversification and upgrading should be limited to the provision of information about the new industries, the coordination of related investments across different firms in the same industries, the compensation of information externalities for the pioneer firms, and the nurturing of new industries through incubation and encouragement of foreign direct investment (Lin 2009a; Lin and Chang 2009). The state also needs to effectively assume its leadership role in the improvement of hard and soft infrastructure in order to reduce transaction costs on individual firms,

3. Prior to 1990, the Republic of Mongolia was a socialist country associated with the Soviet Union. After the fall of the Soviet Union in 1990, Mongolia began a transition from a socialist to a market economy.

4. According to UNIDO¹, prior to 1990, the manufacturing sector was relatively large and organized, and generated substantial modern sector employment. However, during the course of a decade, the privatized state-owned companies collapsed, and the overall industrial output index fell from 100 to 27. The manufacturing sector became less diverse and technologically advanced, with the food, textile and garment sub-sectors becoming more important at the expense of the chemical, metal, transport and electrical industries. The manufacturing sector's former high labour productivity, the engine of growth for the whole economy, declined to the same level as the average for the whole economy. In effect, over the course of two decades the market economy eliminated the distortions affecting the competitiveness of Mongolia, revealing factor endowments offering a competitive advantage, notably in the labor- and resource-intensive areas of animal livestock and minerals extraction respectively.

5. Factor endowments for countries at the early stages of development are typically characterized by a relative scarcity in capital and relative abundance in labor or resources. Their production activities tend to be labor-intensive or resource-intensive (mostly in subsistence agriculture, animal husbandry, fishery and the mining sector) and usually rely on conventional, mature technologies, and produce "mature," well-established products. Except for mining and plantations, their production has limited economies of scale. Their firm sizes are usually relatively small, with market transactions often informal, limited to local markets with familiar people. The hard and soft infrastructure required for facilitating that type of production and market transactions are limited and relatively simple and rudimentary. In developing countries with abundant unskilled labor and resources but scarce human and physical capital, only the labor intensive and resource-intensive industries will have comparative advantages in open,

¹ MON/UNDP/UNIDO Project MON/02/003/A/08/37, Industrial and Trade Development Policy Review Project

competitive markets (Heckscher and Ohlin 1991; Lin 2003).

6. Mongolia has a base of human and physical capital involved in the livestock trade.

7. Mongolia also has abundant mineral resources and has the potential to develop resource-intensive industries. Mongolia possesses major reserves of 80 different minerals including copper, gold, coking coal, iron ore, fluorspar, molybdenum, and crude oil. The Oyu Tolgoi mine, in particular, is potentially the world's largest copper mine.

8. Population movement during the last decade, into the industrial centres, suggests that Mongolians are willing to participate in industrial production, perhaps to take advantage of steady and rising income and to avoid the hardship involved in living on the land. What remains to be seen is to what extent the development of human and physical capital will pay off in the long-term. UNIDO offers an opinion that development should be focussed in traditional areas closer to Mongolia's agrarian base, and in mineral extraction only, where human capital is already abundant. The success of Erdenet and Darkhan suggest an alternative development scenario based on industrial parks.

9. According to Justin Lifu Yin², as strategies for achieving sustainable growth in developing countries are re-examined in light of the 2008 financial crisis, it is critical to take into account structural change and its corollary, industrial upgrading. The optimal industrial structure of a given economy will be different at different stages of development. Each industrial structure requires corresponding infrastructure (both "hard" and "soft") to facilitate its operations and transactions. In addition to an effective market mechanism, the Government should play an active role in facilitating industrial upgrading and infrastructure improvements.

10. Several Mongolian official documents – including The Action Plan of the Government of Mongolia for 2008-2012; The Millennium Development Goals-Based Comprehensive National Development Strategy of Mongolia; The Action Strategy and Formation Plan of the National Development and Innovation Committee; The List of Initial High Priority Large Projects to be Announced to Foreign and Domestic Investors by Government; and The Detailed List of Large Priority Projects to be Implemented by the Government – show the importance that the Government is giving to industrial upgrading and infrastructure improvement

11. An Energy Masterplan can be thought of as an infrastructure development strategy devised by Government in their leadership role in the improvement of hard infrastructure. In Mongolia an adequate provision of heat is essential to the accumulation of human capital in locations deemed to be important for economic growth. Similarly the provision of a secure power supply is a basic requirement for economic growth. In a market economy, and in the absence of an electricity market, the role of Government is to signal to the market the capacity and location of future power plants. In this regard the Energy Masterplan must provide a roadmap for the development of the energy sector, taking into account a range of economic growth scenarios. In this regard the issues of relevance are as follows:-

- National economic development policies of the Government;
- International and local market demand for Mongolian products which in turn drives the need for electricity (and to a lesser extent for heat);
- Economic growth targets (measured by Gross Domestic Product (GDP). Electricity consumption forecasts which should be in harmony with economic growth targets; and
- Investment constraints (borrowing limitations) or competing needs for available Foreign Direct Investment amongst Mongolia's infrastructure sectors, that would limit the development of energy supply.

² New Structural Economics: A Framework for Rethinking Development; February 2010 World Bank

II. MONGOLIA'S DEVELOPMENT STRATEGY

B. GoM Economic Strategy and Goals

12. Mongolia's economic growth and development priorities and policies are defined in the fifth chapter of the 'Millennium Development Goals-based Comprehensive National Development Strategy of Mongolia' (MDGCDS) adopted in 2009. The 16-year strategy is divided into two phases, with the first running to 2015, and the second to 2021.

13. The MDG statement of particular relevance to the Energy Master-Plan is "Exploit mineral deposits of strategic importance, generate and accumulate savings, ensure intensive and high economic growth, and develop modern processing industry". The MDG strategy is based on a policy of rapid industrialisation.

14. The MDG objectives for the period 2008 – 2015 were defined as follows:-

1. Average GDP growth for the period will be approximately 14%;
2. 50% of domestic consumption of oil supplied by national industry;
3. Processing industry increased fourfold;
4. 8,000km paved road;
5. 60% Gobi & Eastern Rail;
6. 70% of 2nd TMR; and
7. Modern town in Gobi with 10-20,000.

15. The MDG objectives for the period 2016 – 2021 were defined as follows:-

1. Average GDP growth will be approximately 12%;
2. Power, heating and energy requirements to be fully supplied from domestic production;
3. Shift from mineral extraction to end product production;
4. 11,000km paved road;
5. 100% new Rail network (Western; Gobi & Eastern; TMR); and
6. Regional centres of 100,000 people.

16. The MDG objectives have also been expressed as GDP per capita targets, viz a viz a GDP per capita outcome of USD\$5,000 by 2015 and \$12,000 by 2021.

C. United Nations Industrial Development Organization

17. A more cautious attitude towards industrialisation is presented in the UNIDO study "Strategic directions on Industrial Policy in Mongolia, February 2011. This study questions the appropriateness of heavy investments in downstream processing of Mongolia's strategic minerals deposits. The arguments are as follows:-

1. The investment required to achieve industrialization is high;
 2. Commodity markets are uncertain and volatile, and offer limited marketing options for Mongolia; and
 3. Industrialization does not result in significant employment opportunities.
18. The UNIDO study argues that revival of the existing national industrial potential should be given a high priority. New manufacturing activities should be promoted, which will broaden the industrial basis of Mongolia, serving the national market and export markets.
19. The UNIDO report recommends that development should be focused on the following production sectors: Food and beverages, Tobacco, Textiles, Wearing apparel, Publishing and printing, Chemicals, Non-metallic minerals, Basic metals and Transport equipment.
20. UNIDO considers that it is likely to be difficult to attract the investment required to develop downstream minerals processing facilities.

III. MONGOLIA'S ECONOMY

D. Historical Market Considerations

21. Over the past decade, Mongolia has seen a sustained period of significant economic growth based on mineral exports. Growth slowed as a result of the global economic downturn of 2008, but recovered quickly with acceleration.

22. The principal source of such impressive economic growth rates, and the basis on which buoyant projections have been made, is the increase in minerals extraction and minerals processing. Other factors such as increasing Government expenditure, positive movements in commodity prices (particularly coking coal, crude oil, copper and gold etc.) and increasing disposable income, have also contributed to the favourable outlook.

E. Main Trade Indicators

23. Mongolia's main trade indicators are shown in Table III-1.

24. The impact of the global recession of 2008 is evident in the 2009 export figure.

Table III-1: Mongolia: Main Trade Indicators 2008 - 2012

	2008	2009	2010	2011	2012
Exports					
Exports (current Tgs billion)	2,955.3	2,711.2	3,943.7	6,096.4	5,960.6
GDP (current Tgs billion)	6,555.6	6,590.6	8,414.5	11,087.7	13,944.2
GDP (US\$ million)	5,622.0	4,583.8	6,186.7	8,761.5	10,257.6
Exports (US\$ million)	2,534.5	1,885.4	2,908.5	4,817.5	4,384.7
Exports as % of GDP	45.1%	41.1%	47.0%	55.0%	42.7%
Imports					
Imports (current Tgs million)	3,783.2	3,073.8	4,339.0	8,350.0	9,160.0
GDP (current Tgs billion)	6,555.6	6,590.6	8,414.5	11,087.7	13,944.2
GDP (US\$ million)	5,622.0	4,583.8	6,186.7	8,761.5	10,257.6
Imports (US \$ million)	3,244.5	2,137.7	3,200.1	6,598.4	6,738.3
Imports as % of GDP	57.7%	46.6%	51.7%	75.3%	65.7%
Trade Turnover					
GDP (current Tgs billion)	6,555.6	6,590.6	8,414.5	11,087.7	13,944.2
Trade turnover (current Tgs bln)	6,738.9	5,784.4	8,282.7	14,446.8	15,120.6
Trade turnover (US\$ million)	5,779.0	4,023.1	6,108.6	11,415.9	11,123.0

Sources: National Statistics Office of Mongolia

25. Industry as a whole accounts for around half of the growth in GDP in 2012. Services accounts for the rest of GDP growth: wholesale and retail trade recovered strongly as the

economy bounced back from the recession in 2008.

26. Agriculture directly supports about a third of the population (i.e. about 0.9 million from 2.82 million people) and has fared less well having twice been hit by severe winter weather conditions (known locally in the Mongolian language as 'dzud'). These events killed large number of livestock with some estimates suggesting a loss of about 25% of the total. As a consequence, an estimated 10,000 households migrated to urban areas and most notably to the capital, Ulaanbaatar thereby hastening the established pace of rural to urban migration. Accordingly, the population of Ulaanbaatar has seen its percentage of total population grow from 27% in 1989, to 36% in 2003 to approximately 45% in 2012 (see Annex 4).

27. In 2012, the National Statistics Office reported that the nation's capital Ulaanbaatar contribution to GDP was around 40% of the national GDP.

28. Annexes 8 and 9 of this report provide a detailed breakdown of the changing structure of GDP by market sector from 2000 – 2012.

29. Mongolia's trade in 2012 led to a total turnover of US \$11,123 million, of which exports accounted for US \$4,384 million and imports for US \$6,738 million. Exports accounted for 42% of GDP. Mongolia has traditionally experienced a negative trade balance with the value of imports exceeding that of exports.

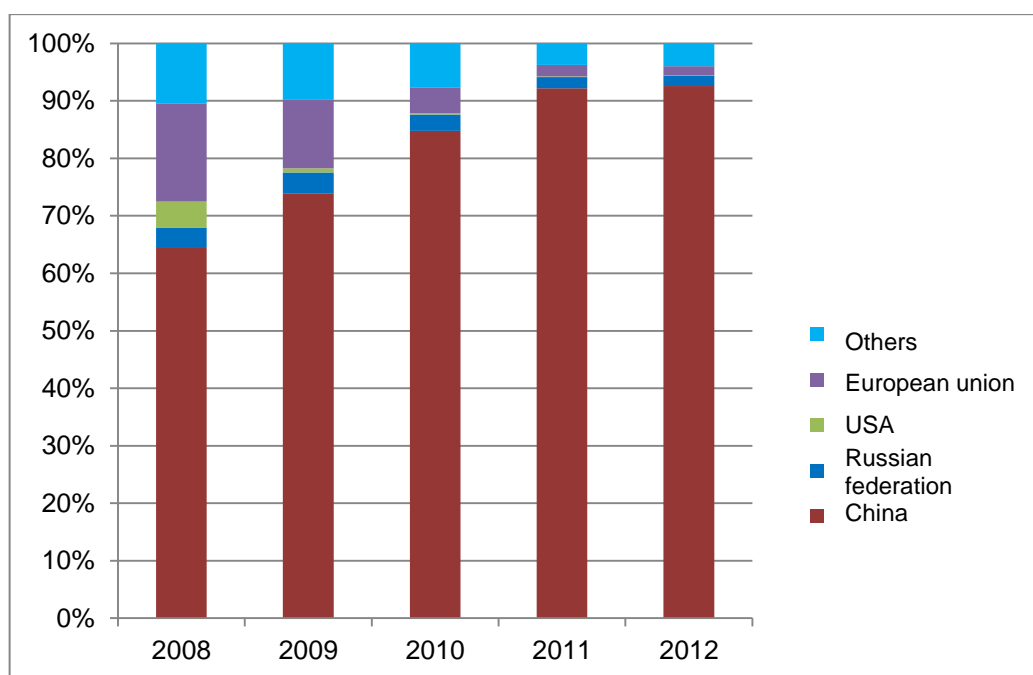
30. The World Bank has reported that the booming mining industry, and in particular the Oyu Tolgoi copper mine, has prompted a huge increase in imports, especially of transport equipment and machinery.

F. Main Export Goods and Destinations

31. Historically the overwhelming majority of Mongolia's exports are destined for China (93% in 2012 – up from 64% in 2008) and the dominance of this market is illustrated in Figure III-2 below.

32. The remaining 15% of exports was accounted for by the EU Member States (27 countries) and Russia.

Figure III-2: Mongolia's Exports by Destination 2008 – 2012 (% of total exports)*



Sources: National Statistics Office of Mongolia * Data tables provided in Annex 11 and 12

33. In 2010 coal surpassed copper as Mongolia's largest export earner. Given a near doubling of coal production witnessed in 2010, coupled with projections for further significant increases in output based on the likelihood of buoyant international coal prices, there is every reason to expect that coal export revenues will continue to increase markedly over the medium to long term horizon, notwithstanding that all necessary road, transport and trade logistics are in place.

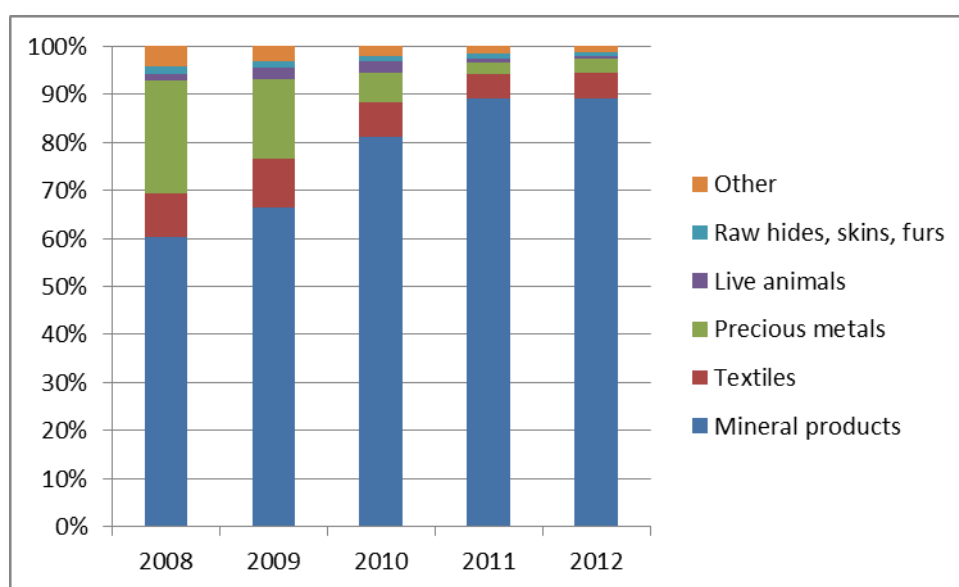
34. China is the largest coal consumer in the world (accounting for just under half the world's total coal consumption in 2010)³ and is the sole destination for Mongolia's coal exports. While China continues to install new coal-fired generation plants at recent rates of 10% for the year 2008-2009 (or additional capacity of 90 GW - the equivalent to bringing on-line a 1,700MW power plant every week of the year) the demand for Mongolian coal from the South Gobi region would appear to have an assured future. Furthermore, increasing demand for coal, particularly in the power generation sector of other Asian economies may also be possible pending the availability and cost of alternative fuel sources (mainly natural gas) or other technologies (for example, nuclear).

35. Mongolia's export sector has been dominated by mineral products and commodities and their share of the total has increased from 2008 – 2012. In 2008 for example, the share of mineral products (including, crude oil, coal and copper) amounted to just over 60% of the total but rose to 89% in 2012.

36. Figure III-3 provides a summary for 2008 – 2012.

³ BP World Statistical Review 2011 (according to which, China accounts for 48.2% of global coal consumption).

Figure III-3: Exports by Main Commodity 2008 – 2012 (% of total exports)*



Sources: National Statistics Office of Mongolia. * Data tables provided in Annex 11 and 12

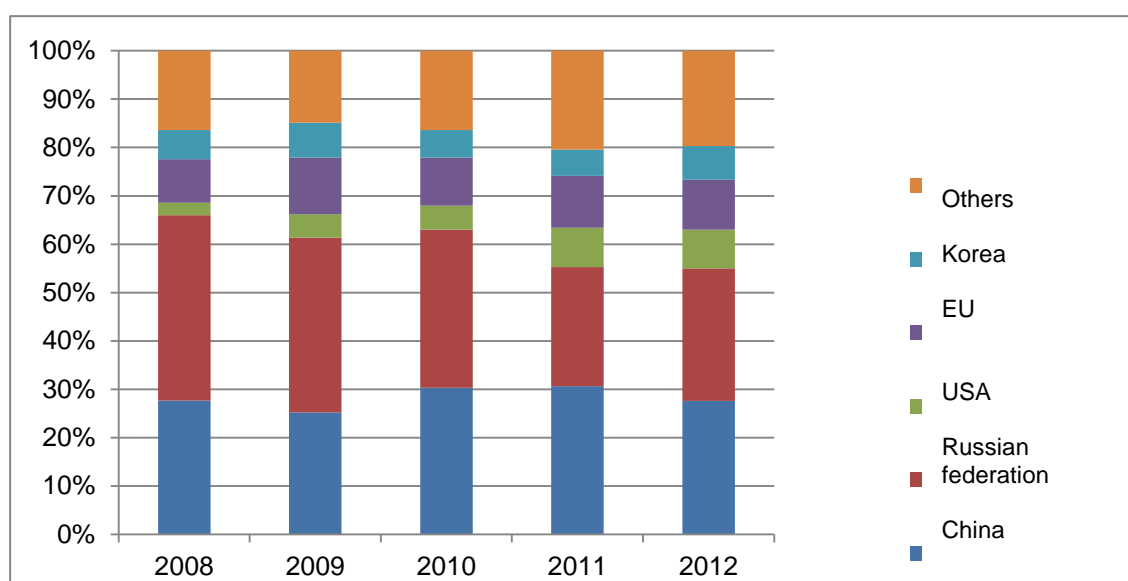
37. The likely increase in production of crude oil, copper and coal in the coming years points to an increase in this component of exported goods from current levels. The preponderance and growing influence of China as the main market for Mongolian exports also represents a challenge in that until Mongolia is able to diversify both its economic and manufacturing base as well as the range of its trading partners, then the country's economic fortunes will be tied inextricably to those of China. While the Chinese economy continues to grow at current rates this fact may not seem so pressing. However other factors such as Mongolia's longer-term economic security and its development of a higher value-added manufacturing sector to reduce over-dependence on the commodity sector, implies the need to significantly extend the range of its trading partners to a more widely balanced portfolio.

38. In summary, Mongolia's exports account for over 40% of total GDP and this figure is likely to increase in the coming few years. Furthermore, the majority is dominated by relatively few commodities (copper, coal and crude oil) and by a single trading partner, namely China. The Mongolia economy is therefore almost totally dependent on a few products and one importer for close to 40% of its total GDP.

G. Main Imported Goods and Sources

39. While the situation is not quite as marked as in the case of Mongolia's export trading partners, nevertheless the country's imports are sourced from only a few countries. Figure III-4 below provides the summary.

Figure III-4: Mongolia's Imports by Main Country 2008 – 2012 (% of total exports)*



Sources: National Statistics Office of Mongolia. * Data tables provided in Annex 11 and 12

40. Mongolia receives around one half of its imports from Russia and China, with the EU Member States, Japan, South Korea and others accounting for the remaining third. Imports are dominated by manufactured goods, followed by fuel and minerals, mainly in the form of refined oil products from Russia which account for close to 100% of total refined product imports and over 80% of Mongolia's total mineral product imports. Imports of these products are likely to increase dramatically in-line with car ownership, which has grown at an average of 15 p.a. 2000 – 2012 (see Annex 14). Table III-5 provides a breakdown of petroleum product imports by main country 2008 – 2012.

Table III-5: Petroleum Product Imports by Main Country 2008-2012

(Th.USD)	2008	2009	2010	2011	2012
Motor gasoline from Russia	333.4	223.0	228.7	308.3	387.1
Motor gasoline from China	26.4	4.6	4.8	9.4	-
Diesel from Russia	451.7	257	397.8	704.9	802.6
Diesel from China	14.8	16.9	0.9	15.6	1.4
Other mineral products	137.9	69.3	123	235.3	392.4
Total mineral products	964.2	570.8	755.2	1273.5	1583.5

Sources: National Statistics Office of Mongolia

H. Mineral Products

41. Mongolia's rich mineral wealth has provided the country's economy with a steady 20% of its GDP for several years.

42. Large committed mining projects at Oyu Tolgoi and Tavan Tolgoi are expected to support sustained increases in GDP through the next decade. Other smaller coal mines will also contribute to economic welfare.

1. The Oyu Tolgoi Mining Complex

43. Exploration activities that have been conducted at Oyu Tolgoi since 2002 indicate that the fields contain approximately 36.8 million tonnes of copper (81 billion pounds) and 46 million ounces of gold. This makes the Oyu Tolgoi deposits one of the richest in the world. In the first instance, the Oyu Tolgoi Project is being developed as an open-pit operation, with the first phase of mining planned to start at the near-surface Southern and Central Oyu deposits.

44. A copper concentrator plant, related facilities and necessary infrastructure that will support an initial throughput of 100,000 tonnes of ore per day are currently being constructed to process ore scheduled to be mined from the Southern Oyu open pit. The ore will provide feed for the commissioning of the concentrator in advance of the planned start of commercial production of copper-gold-silver concentrate.

45. Subsequently, an 85,000-tonne per day underground mining operation also is being developed at the Hugo North Deposit, with initial production scheduled to begin in 2015. The throughput capacity of the concentrator plant is expected to be expanded when the underground mine begins production. Oyu Tolgoi is expected to produce 544,000 tons (1.2 billion pounds) of copper and 650,000 ounces of gold per year in the first decade of operation.

46. At current market prices, and assuming that such production schedules are realised, this would yield annual revenues of US\$4.1 billion and US\$ 1.1 billion respectively. The development cost of this mine complex, including support infrastructure is put at US\$ 4.6 billion scheduled over a three year period. Clearly, the significant rise in direct foreign investment in 2011 and 2012 (see Section III of this Report) indicates that already a substantial part of this investment has been implemented. The mine is located some 80km from border with China which will be the principal market for its output.

47. It is reported that mining operations would remain profitable even with international copper prices at a third of current levels of US\$ 7,500/tonne. A major reason for the huge profitability of the project is that gold deposits are essentially extracted as a by-product of the copper mining process. In other words, one of the two metals effectively has a zero production cost.

48. In summary, the external risk to the development of the mine and an interruption of investment inflows is very low. Funds are committed and predicated on an agreed production schedule. They are already committed and are likely to take place almost irrespective of short-term global economic conditions, for example continuing financial uncertainty in the Eurozone area and low growth prospects for the USA. The most serious possible negative consequence of a global economic downturn for this project would be to increase the cost of capital as financing is based on debt-equity loans.

49. According to analysts, the internal risk to the project is also very slight with only a handful of parliamentarians opposing the project (from both government and opposition parties) who lack in support both within the government, parliament and in the country as a whole. In summary, it is highly unlikely that there is any external or internal risk that would delay or derail the project and its investments.

2. Tavan Tolgoi Mining Complex

50. While some coal production is already taking place in the Tavan Tolgoi fields, preparations are being made to develop much larger coal deposits there. Tavan Tolgoi is considered one of the largest undeveloped coalfields in the world and is thought to contain five to six billion tons of coal, which could sustain a mine life of 50 years at annual production of 100 million tons i.e. more than four times the level scheduled for 2015. Like Oyu Tolgoi, these deposits are close to the border with China as the most prospective market for the minerals extracted and exported.

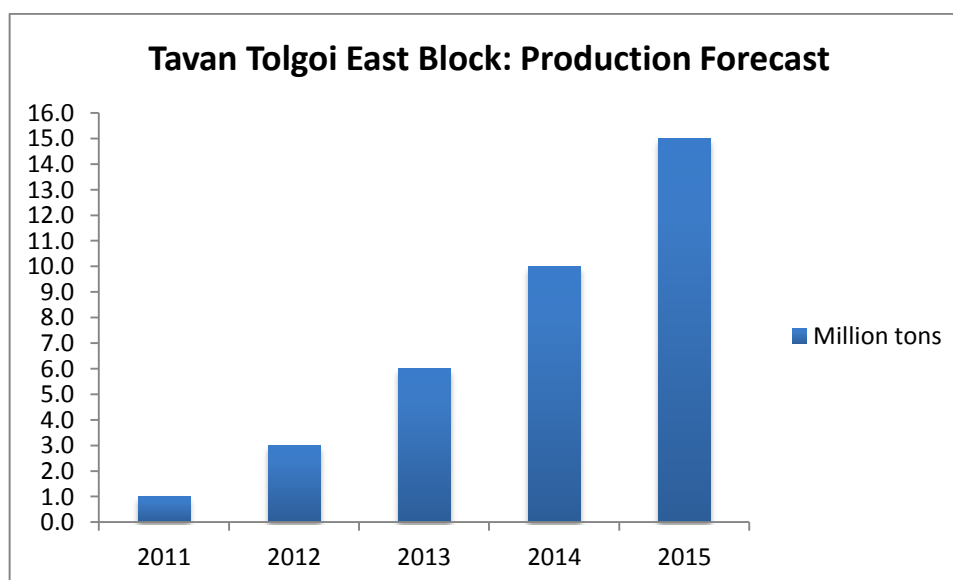
51. Production from smaller deposits on Tavan Tolgoi field is already ongoing – high grade coking coal for China's electricity generation plants and industrial units. The full-scale development of the Tavan Tolgoi mining complex would imply an investment of over US\$3 billion, which would be spread over the period from 2012 – 2015.

52. Operating at full capacity, Tavan Tolgoi has the potential produce 15 million tons of coal a year. The mine's owners, Erdenes MGL expect capacity production to be achieved by 2015. According to the Government of Mongolia, there are a number of other projects in addition to the straight-forward coal mining option that are under consideration for Tavan Tolgoi. Both the Government of Mongolia as well as a range of domestic and foreign companies are also viewing the gasification potential of parts of the Tavan Tolgoi complex as well as other options such as coal-to-liquid fuels which could be used for the transport sector thereby increasing Mongolia's energy security of supply. The coal-to-liquids option would be based on industrial processes established and successfully operating in South Africa since the 1950s.

53. Other options include the creation of a mine-mouth power plant for the export of electricity, a coal to gas plant (gaseous gas or LNG) option etc. The amounts of inward investment for Tavan Tolgoi would ultimately depend on the selection of the projects and the configuration of output e.g. coal only, coal and electricity, coal, electricity and gas etc. There is reportedly one tender outstanding for the creation of a metallurgical factory utilising gas from coking coal at the complex. The development of substantial coal bed methane supplies from Tavan Tolgoi is a further development option and has already attracted the attention of large multinational companies such as South Korean LG which has signed a memorandum of understanding for potential gasification options from the Tavan Tolgoi complex.

54. However, whatever particular configuration of options emerges, once the final agreements have been signed, the Government of Mongolia expects large scale inward investment flows, followed by significant increases in export revenue as a direct consequence of the Tavan Tolgoi projects.

Figure III-6: Coal Production Forecast for the Tavan Tolgoi Coal Field



Sources: Erdenes TT

55. The total expected revenue from the Tavan Tolgoi mining complex is estimated to be US\$5.9 billion from 2011 - 2015.

56. In the longer term more structural changes may exert sustained upward pressure on coking coal prices, which would significantly boost the profitability of Tavan Tolgoi and have an impact across the whole of the Mongolian economy. For example, assuming a global recovery in the steel market, coking coal demand is likely to increase. This is particularly the case in China where strong demand from the construction industry has led to a sharp rise in China's imports of coking coal in recent years. During 2009 for example, China imported some 34.4 million tonnes of coking coal, which represented a threefold increase over the previous year. By 2010 the figure had shown yet another 38% rise to 47.3 million tonnes for the year. The likelihood of continuing strong growth in Chinese demand augurs well for the Tavan Tolgoi mining complex in particular and the Mongolian economy in general.

I. Economic Development Outlook

57. Future economic developments with significant electricity needs are considered in detail. Such developments fall under the categories of minerals processing, coking coal production for export, natural fibres, red meat processing, oil production and electricity production for export.

1. Minerals Processing

58. The outlook for minerals extraction and minerals processing has been studied by the United Nations Industrial Development Organization (UNIDO) and a report tabled in February 2011. UNIDO considered the merits of an industrial development strategy developed by the Boston Consulting Group in 2009 for Mongolia's NDIC, and argued that it cannot be assumed that mineral processing is economically viable. UNIDO's argument applies to both copper smelting and coal cleaning as well as to a range of metallurgical processing activities. In the short run UNIDO recommended that the country should continue to extract and export raw mineral products. Any decision concerning the processing of minerals can be taken only after detailed profitability analyses have been done.

59. At the same time as the UNIDO study was in preparation, the outlook for non-coal minerals extraction and minerals processing was also being studied for the Government of Mongolia and the World Bank by an expert consortium comprising Worley Parsons, Evans & Peck and MMREC in mid-2010.

60. After due consideration of local and international market demand for minerals in the coming decade, Worley Parsons developed a priority matrix for mineral product options as shown in Table III-7.

Table III-7: Minerals Processing Priority

Product Option	Recommendation	Priority
Gold Concentrate	Keep producing as a priority feed for refining	√
Gold Ingots	Priority product from local refinery to absorb entire value add	√√
Silver Metal Concentrate	Should not be a priority due to remote location	X
Silver Metal	Should not be a priority due to remote location	X
Zinc Metal Concentrate	Keep producing as potential export product or feedstock for the zinc smelter	√
Zinc Metal	There is no direct domestic consumer, feasibility of the smelter shall be investigated further to assess economic implications	?
Copper Concentrate	Critical priority product for further downstream processing	√
Copper Metal (Cathode)	Critical priority product for further downstream processing	√
Copper Extrusion	Recommend as an alternative product to copper cable	√√

Product Option	Recommendation	Priority
Copper Cable	High priority product, significant value-add due to global market demand and ease of transportation	√√√
Moly Concentrate	Can be used as an additive to the lubrication product, but it requires further chemical improvement. External market is currently overloaded with supply. Not recommended as a priority.	X
Ferromolybdenum	High demand from steel market. Not expensive pyro-metallurgical exothermic processing. Recommended as a high priority product.	√√
Phosphate Fertilizers	Not recommended due to ecologically sensitive mine location and wide availability in the market place at reasonable price	X
Iron Ore Concentrate	Priority product for downstream processing	√
Iron Ore Pellets	Priority product as key input into domestic steel manufacture and for export	√√
Pig Iron	Cannot be produced by Electrical Arc Furnace technology	X
Steel	Priority product for further downstream processing	√
Steel Products	Priority product required extensively for domestic consumption	√√√
Cement	Priority product required extensively for domestic consumption	√√
Thermal Coal Concentrate	Priority product required extensively for local power generation or direct export	√√
Electricity	Priority product required to support significantly increasing internal power consumption requirements and for export	√√√
Synthetic Diesel	Priority product required extensively for local power generation and export	√√
Syngas (Coal to Gas)	Priority product for generating energy for domestic market and improvement of ecological situation in Ulaanbaatar	√√
Coal to Liquid	Further cost analysis and feasibility studies recommended	?
Coking Coal Concentrate	Good resource for export	√
Coke	Not recommended due to significant pollution issues and no internal consumers	X
Bricks	Priority product required extensively for domestic consumption	√√
Light Concrete Pellets	Priority product required extensively for domestic consumption	√√
Yellow Cake	Not recommended as an immediate priority due to weak market and political issues relating to national security	X

Sources: Worley Parsons - 20100531 Mongolia Industrialization & Downstream Processing Study

61. The Worley Parsons study provides a comprehensive analysis of the potential sales of mineral products. The priorities for mineral product development inform where and when the development of industrial processing facilities shall take place. Accordingly the Worley Parsons findings are adopted as the basis for forecasting the extent and rate of minerals extraction and processing in Mongolia.

62. Even on the basis of the known reserves at the Tavan Tolgoi fields, Mongolia has the potential to become a major exporter of coking coal. Worley Parsons estimate that Tavan Tolgoi will export 15Mt of coking coal per annum. Present infrastructural constraints, not the least of which is the lack of adequate power supplies and railway network⁴ for the mining sector poses the main challenge to be overcome in releasing its potential.

⁴ Water supply constraints for cooling purposes may also play a part in hampering power plant development on or near the coal mining complexes.

2. Natural Fibres

63. UNIDO considers that Mongolia's natural fibres industry has the potential to gain a niche in the international market. There are already Mongolian companies which are developing the capacity to compete in the international market.

64. There are considerable barriers that may hamper economic development of natural fibre products. UNIDO observes that new companies require initial support from the Government, such as preferential loans, temporary tax benefits, access to state-of-the art manufacturing techniques, designs, machinery and materials required in the production process of natural fibres products, access to markets information, etc.

65. In the period 2006 to 2009, the value of exported cashmere products increased by 27% on average despite the recession in 2008.

66. Market surveys of developers indicate that sewing and wool / cashmere production is planned to increase at a similar rate throughout the next decade in the Central region of Mongolia.

3. Red Meat & Milk Processing

67. UNIDO considers that the current meat processing industry in Mongolia does not conform to international standards of production, or to the food safety requirements of importing countries. It will take time for Mongolia to achieve the organization, production and food safety standards necessary to participate fully in the international red meat market.

68. Meat production has increased by around 9% each decade since 1989.

69. Market surveys of developers indicate that red meat and milk processing is expected to continue to increase at average rates to those of recent decades in the Central region of Mongolia.

4. Oil Production

70. Mongolia has a small but growing upstream oil sector. Since 1998, Mongolia has extracted approximately one million tons of crude oil (7.3 million barrels) nearly all of which has been exported to China. Oil extraction has steadily increased over recent years and in 2010 more than 850,000 barrels of crude oil was extracted and exported, earning some US\$ 93.5 million in export revenues. The Mineral Resource and Petroleum Authority of Mongolia (MRPAM) has estimated the capacity of oil production in Mongolia to reach nearly 4 million barrels by 2015, which would be worth around US\$450 million in export revenues per year at current oil prices.

71. Oil extraction is expected to increase in coming years with prospects such as the Toson Uul XXI field being brought into production. This field has confirmed proven and probable reserves of 119 million tons of which some 12.6 million tons is scheduled for production by 2029, thereby earning around US\$ 92 million in export revenues at current prices.

72. As Mongolia presently imports all refined oil products, mostly from Russia and China, one option would be to construct a refinery to process domestically produced crude oil and thereby to reduce the country's dependence on imports, which have in the past proved erratic. It has been known previously for imports from Russia to be curtailed due to supply problems affecting its own market. As a consequence, Mongolia has itself experienced shortages of motor gasoline and diesel due to its inability to replace Russian supplies at short notice.

IV. FOREIGN DIRECT INVESTMENT

73. In 2010, the Government's US\$ 2.3 billion capital budget, targeted at investment in major infrastructure and human development projects (social welfare, health and education), offset the need for FDI. Nevertheless taken together, Government investment funds and FDI represented over two-thirds of Mongolia's GDP in 2010.

74. Foreign Direct Investment rose to a high of around US\$ 4.4 billion in the year of 2011, mainly as a result of the development of the Oyu Tolgoi mining complex.

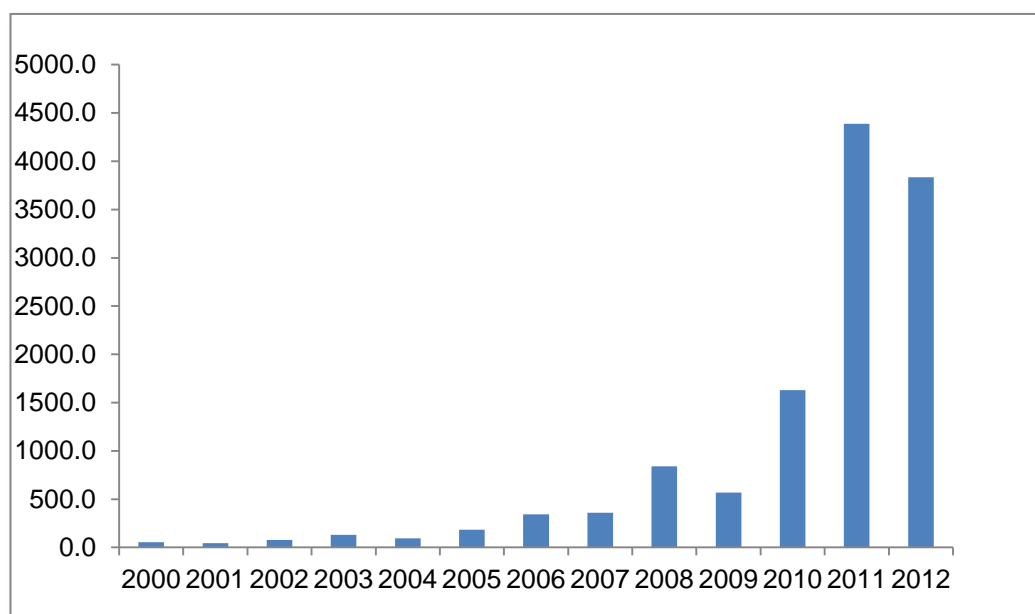
J. Foreign Direct Investment

75. A key factor in both recent and expected rises in GDP is the surge in foreign direct investment inflows to the Mongolian economy. In 2000, Mongolia attracted just under US\$54 million of foreign investment. By 2005 the figure had risen 256% to US\$185 million. As shown in Figure IV-1, by 2011 the figure had risen to US\$4.39 billion, falling by US\$0.5 billion in 2012 but nevertheless holding at a significantly higher level than in the first decade of 2000.

76. Figure IV-2 shows the relationship of these levels of foreign direct investment as a percentage of real GDP over the period 2000 - 2012.

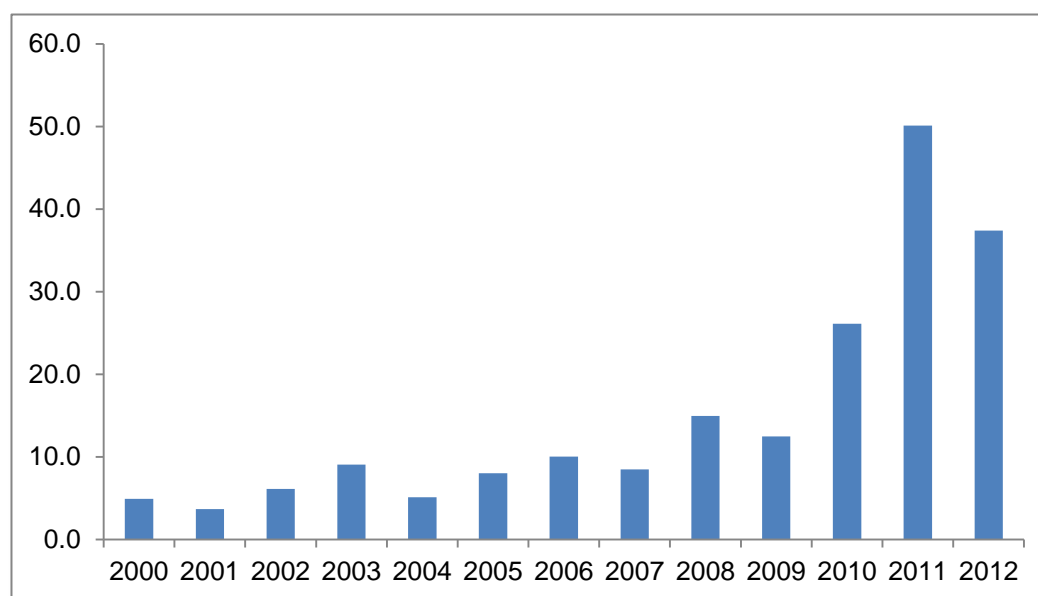
77. A foreign direct investment inflow of the magnitude experienced to date but particularly during 2011-2012, presages dynamic and rapid levels of economic growth but also presents the forecaster with a problem. As these inflows are essentially an inorganic, massive injection of funds into the economy over a relatively short period (2-3 years), they are by their nature out of the normal pattern of growth projections and trends.

Figure IV-1: FDI Inflows 2000 – 2012 (US\$ million)



Sources: National Statistics Office of Mongolia

Figure IV-2: FDI as a Percentage of Real GDP 2000 – 2012



Sources: National Statistics Office of Mongolia

78. Furthermore, the full economic implications these inflows are likely to be magnified by some factor due to operation of the so-called 'Multiplier Effect'⁵. In a sense, they are distortions to more usual growth patterns, albeit productive distortions.

79. Nevertheless, any forecast that is made from 2012 is unlikely to fully incorporate the full implications of the FDI inflows into future growth projections because the full extent of these inflows (the size and duration) is not yet known.

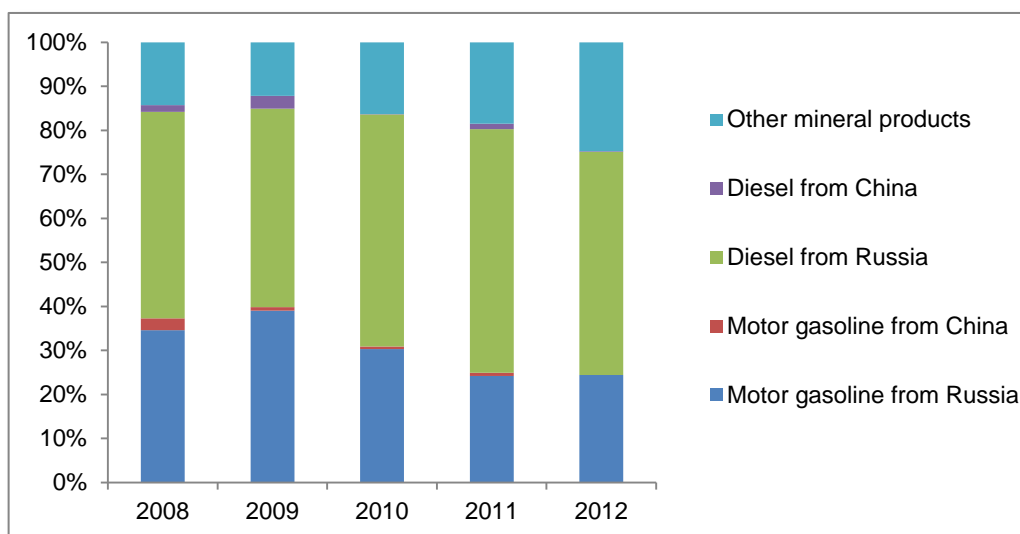
80. A forecast that is made and is predicated on a US\$1 billion inflow in the base year, will lead to vastly different outcomes than one that is made on the basis of a US\$2 billion inflow during the same year. The growth trajectories for each case will yield significantly different outcomes for the end of the forecast period.

K. Challenges Facing the Economy

81. As can be seen from the preceding section of this report, Mongolia's economy is heavily dependent on foreign trade in a relatively few products and with a relatively few trading partners. This renders the economy highly vulnerable to external shocks. The global economic downturn post-2008 and the consequent collapse in copper prices served to emphasise Mongolia's poorly diversified economy and heavy reliance on export commodities. As a direct result of the global downturn in 2009, Mongolia saw its economy contract by 1.3% that year.

⁵ A increase in spending (e.g FDI or increased government spending) produces a larger increase in income.

Figure IV-3: Breakdown of Main Mineral Product Imports 2008 – 2012



Sources: National Statistics Office of Mongolia * Data tables provided in Annex 11 and 12

82. Other factors also played their part, for example falling commodity prices (copper prices decreased by 65% in one year while a combined metal price index showed a 25% fall from 2007-2009) and falling demand for Mongolia exports each contributed to the contraction. Furthermore, the contraction reduced government revenues and forced major cuts in public spending. It has also been suggested that the situation for Mongolia could have deteriorated still further had China not reacted swiftly to global events and initiated its own large-scale capital expenditure programme which maintained the momentum in trade with Mongolia.

83. At present, commodities account for around 85% of Mongolia's exports, and mining revenues provide around 40% of the government's total budgetary income. China is overwhelmingly the largest single importer of Mongolia's exports and in 2012 it accounted for close to 93% of the total. The development and operation of the Oyu Tolgoi and Tavan Tolgoi mining complexes where nearly all the output is destined for Chinese markets, along with increasing crude oil production and exports is likely to intensify this asymmetrical trading relationship.

84. A major challenge for Mongolia is to diversify its economic base so that it is not so heavily dependent on the mining and commodities sector. Furthermore, a large increase in commodity exports such as that envisaged in the coming decade, is likely to put upward pressure on the Mongolian currency, which in turn would make exports in other sectors such as agriculture and manufacturing less competitive (the so-called Dutch Disease).

85. The Government of Mongolia has already taken some precautions against this danger through the passing of the Fiscal Stability Law in 2009. It is also planning additional measures such as the creation of special funds such as the Stability Fund for foreign currency reserves and a Sovereign Wealth Fund.

86. The lack of internal diversity of the Mongolian economy and its dependence on a limited number of trading partners is one of the main challenges facing the country. Indirectly, Mongolia is also susceptible to the global economic environment through the intermediary of China. If the Chinese economy slows as a result of recession in the western economies, then there could be a disproportionately negative effect on Mongolia. In summary, one of the most pressing challenges for Mongolia during the coming years of unprecedented high economic

growth will be to use its new-found revenues to spur the development of non-mining sectors of the economy and in so doing to provide a broader based economy that will ensure some protection against fluctuating commodity prices or potential deterioration in the terms of trade. Other challenges however, are no less formidable and subsequent sections of this report will cover some of the principle issues to be addressed in coming years.

87. In order to diversify its economy and move towards the Government of Mongolia's objective of a more broad-based, manufacturing and knowledge-based economy, the ready supply of mobile and highly-skilled labour is essential. According to the World Bank, human capital accounts for about 65% of overall economic development. Therefore, the lack of a suitably skilled and available pool of labour can represent be a very significant constraint to economic growth. In comparable cases, attempts to achieve economic objectives similar to those articulated by the Government of Mongolia have suffered due to a shortage of human capital. Domestic absorption constraints manifest themselves through an acute shortage of skilled labour, increasing wages for skilled workers and growing disparity levels with unskilled labour and rural inhabitants.

88. To some degree this trend is already beginning to manifest itself in Mongolia. The mining industry offers significantly higher wages to its employees than are currently available in all other sectors of the economy. As a consequence, companies across all sectors of the economy from finance and investment, banking, retail, construction and manufacturing, are facing increased difficulty in attracting skilled workers because the salaries that they are able to offer are uncompetitive with those available in the mining industry.

89. The Government of Mongolia is acutely aware of this issue and is considering various options to counter the problem, one of which would be a scheme to attract the Mongolian Diaspora back to Mongolia, thereby bringing with them the necessary skills and international experience that would be needed to sustain a prolonged period of economic growth.

L. Infrastructure Development and Constraints

90. Mongolia suffers from an extremely weak infrastructure. In the index of 133 countries, Mongolia was places near the bottom of the list in terms of the scope and capacity of its infrastructure base. Existing infrastructure capacities are not thought sufficient to provide the scope and quality of public services that would be required for long-term sustainable growth. Only 67% of population has access to electricity and 35% to mains water supplies. Roads are in poor condition, only 3.5% of road network is paved and existing ones are mostly over 20 years of age poorly maintained and in need capital repair. The railway network capacity does not match to growing export-import cargo flows and in particular expectations for imminent volumes of coal and copper ore exports.

91. Such infrastructure bottlenecks narrowed still further from 2012-2013 when major mines started production (Baruun Naran in 2012 and especially Oyu Tolgoi in 2013). It is estimated that some 2,000km of new rail network is needed to ensure the transport and operational needs of the new mining complexes being brought on-stream by 2015. Furthermore, some 8,000 jobs are estimated to be created in the mine areas, with most of the employees coming from other regions, this is likely to lead to an increased need for water, sanitation, public services, electricity and heating supply in the southern region of the country.

92. The Government of Mongolia is keenly aware of the importance of infrastructure development and has increased capital spending in power, transport and communication over the recent years. Investments in infrastructure reached a record level in 2007 at 19% of total expenditures (10% of GDP) up from 13% (4% of GDP) in the period 2001-2006. Between 2006-2008 the capital spending tripled.

93. The development of a more comprehensive and modern infrastructure system also opens

new economic possibilities for Mongolia to take full advantage of its geographical position. Mongolia's geographical position between Russia with its vast energy and mineral resources and China with its urgent need for Russian commodities puts the country in a potentially advantageous position as a major trade conduit between the two. Trade between Russia and China has been increasing steadily and between 2000 and 2006, year-on-year exports from Russia to China increased by an average of 17%. During the same period exports from China to Russia increased by an average of 39% per year. However, the global economic downturn in 2008-2009 did see a decline in trade between the two countries, but nevertheless reached a total value of US\$ 38.8 billion in 2009.

94. An earlier joint goal is that trade between Russia and China should reach US\$60 billion by 2010. So far the previous trade increases between the two countries do not appear to have benefitted the Mongolian transport sector despite it having experienced one of the largest growth rates in terms of contribution to GDP in recent years (see Annex 9). However, with the development and modernisation of its infrastructure sector, Mongolia could potentially take part of the growing trade between its two neighbours, as well as trade between Asia and Europe to a larger scale and more efficient way.

95. A total of 17 trade agreements were reached during Prime Minister Putin's visit to China in October 2011 including a cooperation accord between ZAO Sibur Holding, eastern Europe's biggest petrochemical producer, and China Petrochemical Corp., the nation's biggest refinery all of which points to increased trade and transit opportunities for Mongolia in the near future pending the upgrading of its weak infrastructure.

M. International Financing of Infrastructure Projects

96. Although the increase in Government finance made available for infrastructure development has been impressive, nevertheless these funds may need to be supplemented both from IFI as well as private sources if sufficient progress is made during the forecast period of economic growth and in order to sustain that growth over the coming decade and beyond. Among the IFIs, the Asian Development Bank is the largest lender to Mongolia. Table IV-4 below details ADB loans to Mongolia for infrastructure projects alone during the period 1991 – 2007.

97. The US\$ 292 million loans for infrastructure represented 43% of the ADB's total financing to Mongolia over the period to 2007 (US\$ 676.5 million). By 2011 and the 20th anniversary of Mongolia's membership of the ADB, the bank has extended 45 loans totalling \$794.7 million, as well as 12 Asian Development Fund grants of just over \$170 million. The ADB also provided technical assistance support amounting to \$86 million and grants under the Japan Fund for Poverty Reduction of \$31.5 million.

Table IV-4: ADB Finance for Infrastructure Development Projects 1991 - 2007

	Number of projects	ADB Financing (US\$ million)
Transport and communications	6	171.6
Energy	4	93.8
Water supply, sanitation and waste management	2	26.9
Total	12	292.3

Sources: Eurasia Capital after ADB

98. Elsewhere, the World Bank provided US\$ 184.4 million to infrastructure projects (or 44% of its total financing). It is likely that in order to meet the challenges of infrastructure development over the coming decade, significant sums will need to be invested given the relatively low base and the huge new requirements resulting from rapid economic growth. The World Bank has estimated the need for close the US\$ 3 billion in the short to medium term (i.e. to 2015) for the transport sector alone (see Annex 12 which provides a breakdown of investment requirements by transport sub-sector). Two thirds of the estimated transport requirement is allocated to upgrading and extending the railway network (US\$ 1,955 million). These sums exclude any estimates for other infrastructure development such as electricity and heat, water, sanitation and waste management or telecommunications.

99. The Government of Mongolia has estimated total needs of US\$ 30 billion for infrastructure development over the coming 20-30 year timeframe. There are plans to prepare long term budget and expenditure programmes to meet these need within the coming period. The Government of Mongolia estimates that there will be some infrastructure projects, which, by their nature and the extremely long payback periods will be financed 100% from the state budget. The Government of Mongolia expects that other smaller scale projects will be financed from private sources as part of overall project development activities (e.g. road developments for big mining complexes such as Oyu Tolgoi).

100. The significant investment needs in infrastructure development is likely to call both for a sustained increase in Government of Mongolia expenditure as well as the continued participation of the ADB and other IFIs, but it is also likely that additional funds from the private sector for example, through new Public Private Partnerships will be essential. A successful programme of PPP infrastructure projects to be implemented would also presume a programme of institutional capacity building and strengthening in order to prepare, negotiate and manage such arrangements. A Concession Law was passed by the Parliament in 2010, opening the way for such arrangements to be initiated. The Government of Mongolia already has a short list of 122 infrastructure projects earmarked for PPP investments.

101. Sensitive political issues such as increasing tariffs to cover costs of infrastructure and public services, particularly in the road transport, electricity and water utilities, would also need to be confronted and resolved in order to attract greater private sector participation in Mongolia's infrastructure.

N. Future Foreign Direct Investment

102. Mongolia is dependent on Foreign Direct Investment (FDI) to support needed development of infrastructure including energy infrastructure. However, FDI can have negative impacts on the economy if such borrowings are too great in relation to the size of the economy.

103. Computable General Equilibrium models (CGE) are useful for assessing the impact of FDI on the economy overall. Mon-CGE is a model that has been specially developed for the purpose of assessing the impact of FDI on the Mongolian economy. The model allows computation of welfare impacts, according to changes in GDP and other economic indicators.

104. Whilst a CGE model is a macro-economic modelling tool, the output of the Mon-CGE model informs the amount and rate at which FDI can be absorbed by the economy. The results of the CGE modelling are presented in the Finance section of the Energy Master Plan.

V. THE ECONOMY & ENERGY DEVELOPMENT NEEDS

O. General Considerations

105. GDP can be considered as a lead or lag indicator of economic activity. When taken as a lead indicator, GDP forecasts are prepared based on scenarios that suppose a certain growth in the size of the economy, informed by historical trends over at least the previous decade.

106. On the other hand economic activity requires energy. Experience shows that GDP is highly correlated with non-residential electricity consumption. The correlation is poor when GDP has or is expected to include a high contribution from the sale of unrefined oil products or base metals and adjustments must be made.

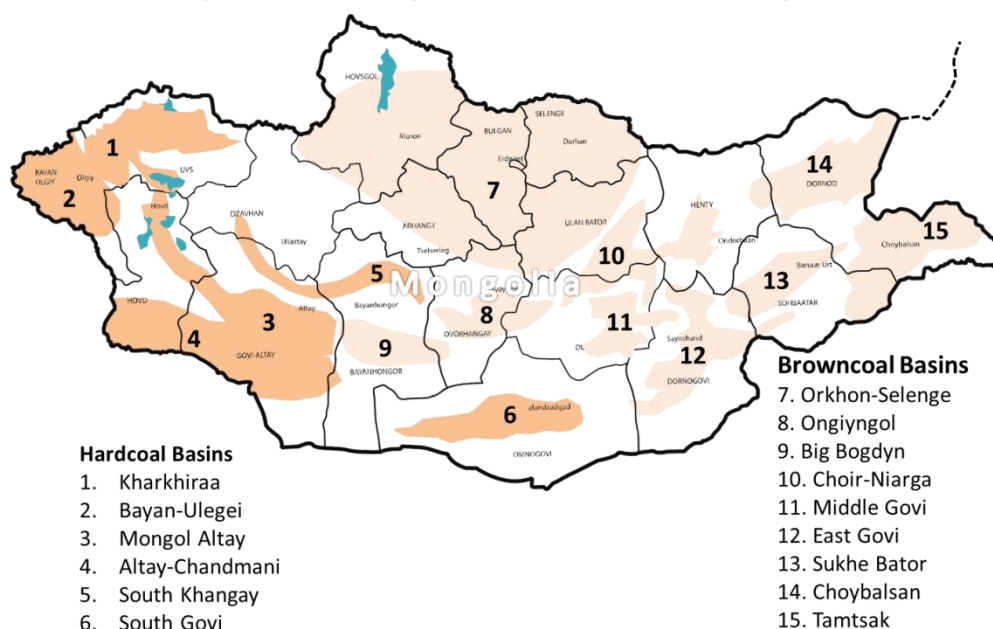
P. Industrialization

107. In Mongolia it is anticipated that GDP will continue to grow strongly as a result of minerals extraction and processing.

108. The GDP contribution of the mining sector is relatively high and power consumption relatively low per unit of GDP growth. In practice the GDP contribution from mines must be assessed on individual case basis. In the case of the minerals processing sector the GDP growth rate compared to the electricity consumption growth rate can see an increase by as much as 20% compared to the underlying economic growth. Industrial parks tend to develop gradually over time with their impact on GDP growth blended with the underlying GDP growth.

109. The industrialization strategy of the GoM is based upon the development of 15 strategic mineral basins. The basins are shown in Figure V-1.

Figure V-1: Strategic Mineral Deposits of Mongolia



110. The GoM industrialization strategy has been developed into a minerals extraction and minerals processing expansion plan by Worley Parsons, however a GDP impact study was not undertaken. A GDP impact study has been carried out for the Oyu Tolgoi mine and provides some insights into the impact that mining can have on Mongolia's GDP.

111. The Worley Parsons report identified one of the critical hurdles to achievement of the expansion plan was a lack of power sources and electricity network needed to support the development of mining and processing industries. Worley Parsons identified a large number of critical hurdles that are likely to significantly hinder development:-

1. Water resource constraints and no integrated water management strategy;
2. Significant logistical constraints with existing transport infrastructure, border crossings and access to adequate port infrastructure;
3. Lack of appropriately skilled local workforce;
4. A lack of local materials to support the construction and development of the mining and processing industry;
5. Restrictive legal framework with inadequate incentives for attracting direct foreign investment; and
6. Underdeveloped environmental governance.

112. These critical hurdles suggest that the development of the strategic mineral deposits is likely to be spread over a 10 to 20 year period. It is likely that the deposits will be developed firstly on the basis of mineral extraction and followed later by minerals processing. A further uncertainty relates to the timing of the establishment of the facilities that proceed. In this regard market attractiveness plays a role in determining the priority of minerals processing facilities. Worley Parsons study identified the priority for each facility according to the market attractiveness of each associated mineral product.

113. Table V-2, Table V-3 and Table V-4 presents a development potential for each of the envisaged industrial zones or the purpose of demand forecasting. More check marks indicate higher attractiveness of the product output to the relevant markets.

Table V-2: Development Potential Northern Region

Facility	Attractive?
Erdenet Copper Smelter	√
Erdenet Copper Concentrator Upgrade	√
Erdenet Fe/Mo Roaster/Smelter	√√
Cu Refinery	√
FE Concentrator	√
Iron Ore Pellet Plant	√√
Steel	√
Darkhan Direct Reduction Iron Plant	√
Darkhan Steel Rolling Mill	√
Darkhan Cement Plant	
Booroo Gold Refinery	√
Agriculture	

Sources: Worley Parsons, Consultants' Estimates

Table V-3: Development Potential for Central Region

Facility	Attractive?
Coal to Gas Plant	? doubtful
Coal-to-Liquids Plant	? doubtful
Cement Plant	Depends on Shivee Ovoo
Copper Extrusion Plant	√√
Copper Cables Plant	√√√
Zn Roaster / Hydrometal Plant	? Doubtful
Agriculture	Depends on Baganuur PP

Sources: Worley Parsons, ADB Consultants' Estimates

Table V-4: Development Potential for Southern Region

Facility	Attractive?
Copper Smelter / Refinery (OT)	√
Copper Smelter / Refinery (IS)	√
Concentrator (OT)	√
Concentrator (IS)	√
Tsavaan Surga mine (Cu/Mo)	
Brick Plant (TT)	
Brick Plant (NS)	
Expanded Clay Pellets Plant (TT)	
Expanded Clay Pellets Plant (NS)	
Cement Plant	
Agriculture	

Sources: Worley Parsons, ADB Consultants' Estimates

Q. GDP Targets

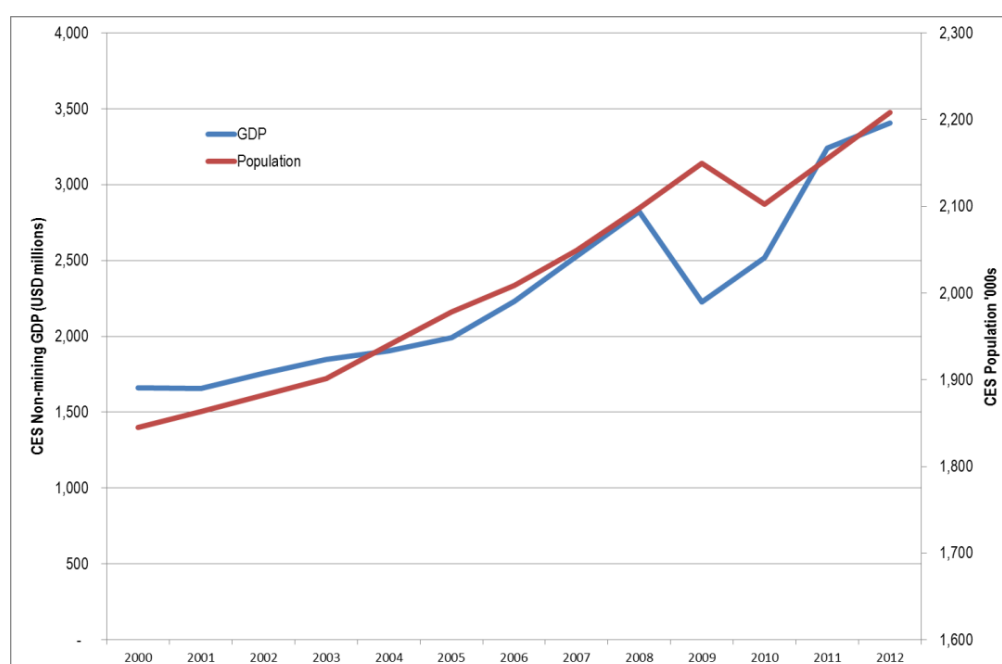
114. The GoM has set short-term targets for GDP growth with implications for energy development needs. The GDP targets are partly 'organic' wherein the GDP growth contribution is due to the normal cycles of growth and contraction in the economy, partly due to minerals processing, and partly related to the 'shocks' expected to GDP growth as a result of activities in

the mining sector.

115. The relationship between non-mining sector GDP growth and electricity consumption has been modelled and associated GDP forecasts developed (including the impact of industrial parks). The forecasts are compared to the GoM's GDP growth targets recognizing that the mining sector will add a further significant contribution to GDP for at least the next 30 years.

116. Non-mining sector CES GDP is plotted between 2000 and 2012 in Figure V-5. The impact of the 2008 global recession is evidenced by a dip in growth followed by a higher rate of growth from 2010. The average growth rate during the period was 7%. There is an obvious correlation between the population growth rate and the GDP growth rate demonstrating that in the CES Mongolia's economy is labour-intensive.

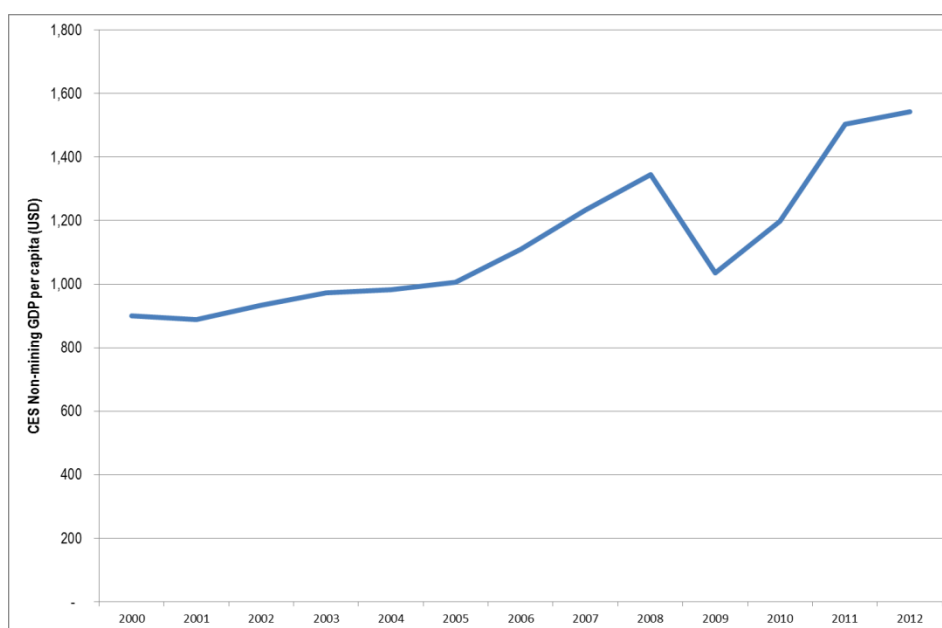
Figure V-5: CES Non-Mining Gross Domestic Product (USD\$m)



Sources: GoM, NSO

117. Figure V-6 shows that since 2004, the non-mining CES GDP per capita growth has been increased and maintained a high rate.

Figure V-6: CES Non-Mining GDP per Capita (USD)

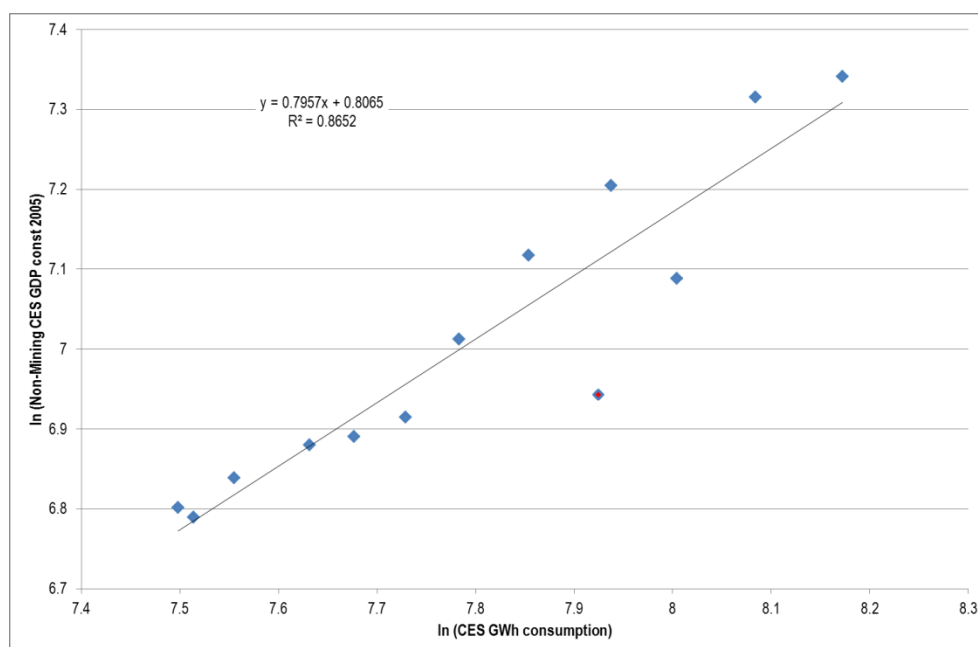


Sources: GoM, NSO

R. GDP Forecasts based on Electricity Consumption Forecasts

118. Growth in GDP has been forecast based on the correlation and regression formula shown in Figure V-7.

Figure V-7: Correlation GDP per Capita & Electricity Consumption



Sources: Consultants' Estimates

119. Electricity consumption was taken from the Electricity Load Forecast report and GDP per capita was forecast and compared to the GoM's 2009 forecast expectation for the period to 2021.

120. The load forecasts used for a low, medium and high growth outlook were those of the non-mining sector of the CES.

Table V-8: Load Forecasts CES (Non-Mining) (GWh)

	Low	Med (Bear)	High (Bull)
2000	1,805	1,805	1,805
2001	1,833	1,833	1,833
2002	1,910	1,910	1,910
2003	2,062	2,062	2,062
2004	2,158	2,158	2,158
2005	2,273	2,273	2,273
2006	2,400	2,400	2,400
2007	2,576	2,576	2,576
2008	2,801	2,801	2,801
2009	2,764	2,764	2,764
2010	2,993	2,993	2,993
2011	3,243	3,243	3,243
2012	3,542	3,542	3,542
2013	3,860	3,860	3,860
2014	4,144	4,144	4,144
2015	4,422	4,427	4,435
2016	4,817	4,807	4,864
2017	5,131	5,174	5,337
2018	5,452	5,596	5,913
2019	5,704	5,985	6,525
2020	5,932	6,429	7,236
2021	6,383	7,227	8,466
2022	6,835	8,024	9,695
2023	7,286	8,821	10,924
2024	7,738	9,619	12,154
2025	8,189	10,416	13,383
	9%	14%	21%

Sources: Consultants' Estimates

121. The GDP growth assumption of the Government of Mongolia, made in 2009, is tested against electricity consumption growth using the historical correlation between non-mining electricity consumption in the CES as shown in the previous section to extrapolate per capita GDP. In the following sub-sections the results for the non-mining sector are scaled up to the total economy with 50% uplift. The contribution of the CES to the total GDP of Mongolia is

assumed constant at 67%. The aim of the analyses is to determine how closely the electricity consumption forecasts fall in line with the GOM expectations for GDP growth, and to validate the electricity consumption forecasts as suitable for supply expansion planning.

1. Low Growth Scenario

122. The low case forecast is based on a prolonged global recession with annual GDP growth rate of 7% from 2013 to 2025. As a point of reference the historical GDP growth rate has averaged around 7% from 2003 to present.

123. The rates of growth that are envisaged under the Low Case Forecast would in part be sustained by continuing Government expenditure on infrastructure development and well as the continuing exports of commodities (albeit at lower prices) and increases both in domestic consumption and early signs of a more diversified economy.

Table V-9: Low GDP Growth Forecast (Non-Mining)

	GDP (non-mining)	% change GDP	GDP per capita (non-mining)
	USD\$m	Const 2005	US\$
2011	3,240	28.7%	1,503
2012	3,299	1.8%	1,494
2013	3,617	9.6%	1,600
2014	4,327	19.6%	1,870
2015	4,823	11.5%	2,038
2016	5,466	13.3%	2,259
2017	6,084	11.3%	2,460
2018	6,531	7.3%	2,586
2019	6,920	6.0%	2,684
2020	7,292	5.4%	2,771
2021	7,870	7.9%	2,943
2022	8,458	7.5%	3,112
2023	9,055	7.1%	3,280
2024	9,660	6.7%	3,445
2025	10,275	6.4%	3,609

Sources: Consultants' Estimates

124. Under the low case and assuming a 6% GDP growth rate in the mining sector the total average GDP real growth rate would be around 6.8%.

2. Medium (Bear) Growth Scenario

125. The medium growth forecast is based on the UNIDO industrialization strategy. Consistent with the expectations of UNIDO, processing of minerals is not significant in the forecast period. Instead commercial and light industrial activity grows strongly, and along with

minerals extraction (mining), the conditions support the development of service industries.

126. The economy diversifies, developing in the Food and Beverages, Tobacco, Textiles, Wearing Apparel, Publishing and Printing, Chemicals, Non-metallic Minerals, Basic Metals and Transport Equipment sectors. If the UNIDO development path is realized, then the development of minerals processing industries will be delayed. Nevertheless power demands for minerals extraction will be significant.

127. Timing of the development of mines and mineral processing could also expect to be gradual, according to the attractiveness of the basic metals and non-metallic products to local and export markets. In the case of the 'bear' forecast it is assumed that development will take place over a 30 year period from 2015 to 2045. This scenario is closely aligned to the 'minerals-only' extraction strategy supported by UNIDO. The starting point of 2015 recognizes that the industrial facilities to be established in the industrial zones will require a construction lead time and therefore an electricity demand lead time.

128. The GDP per capita growth rate remains relatively strong at around 10% per annum in real terms from 2013 to 2025.

Table V-10: Medium GDP Growth Forecast (Non-Mining)

	GDP (non-mining)	% change GDP	GDP per capita (non-mining)
	USD\$m	Const 2005	US\$
2011	3,240	28.7%	1,503
2012	3,299	1.8%	1,494
2013	3,617	9.6%	1,600
2014	4,473	23.6%	1,933
2015	4,991	11.6%	2,109
2016	5,644	13.1%	2,332
2017	6,338	12.3%	2,563
2018	7,147	12.8%	2,830
2019	8,152	14.1%	3,162
2020	9,082	11.4%	3,451
2021	10,398	14.5%	3,888
2022	11,536	10.9%	4,245
2023	12,689	10.0%	4,596
2024	13,858	9.2%	4,942
2025	15,043	8.6%	5,284

Sources: Consultants' Estimates

129. Under the low case and assuming an 8% GDP growth rate in the mining sector the total average GDP real growth rate would be around 9.7%.

3. High (Bull) GDP Growth Scenario

130. The high GDP growth scenario assumes that the global economy grows strongly, the GoM

initiates a major push forward in the expansion and development of the country's infrastructure.

131. Consistent with the expectations of the Government, processing of minerals is significant in the forecast period. Commercial and light industrial activity grows strongly, and mining prospers from the extraction and sale of base metals. Minerals processing expands in the preferred industrial zones. In the case of the 'bull' forecast the development period is assumed to be 2015 to 2035 with a peak in 2025. This scenario is closely aligned with the minerals extraction and minerals processing strategy elaborated in the Worley Parsons study. Again, the starting point of 2015 recognizes that the industrial facilities to be established in the industrial zones will require a construction lead time and therefore an electricity demand lead time.

132. The GDP growth per capita is sustained at an average rate of 12.5% per annum from 2013 to 2025.

Table V-11: High GDP Growth Forecast (Non-Mining)

	GDP (non-mining)	% change GDP	GDP per capita (non-mining)
	USD\$m	Const 2005	US\$
2011	3,240	29%	1,503
2012	3,299	1.8%	1,494
2013	3,617	9.6%	1,600
2014	4,473	23.6%	1,933
2015	5,168	15.5%	2,183
2016	6,098	18.0%	2,520
2017	6,962	14.2%	2,815
2018	8,015	15.1%	3,174
2019	9,201	14.8%	3,568
2020	10,993	19.5%	4,177
2021	12,761	16.1%	4,771
2022	15,087	18.2%	5,551
2023	16,966	12.5%	6,145
2024	18,868	11.2%	6,729
2025	20,796	10.2%	7,305

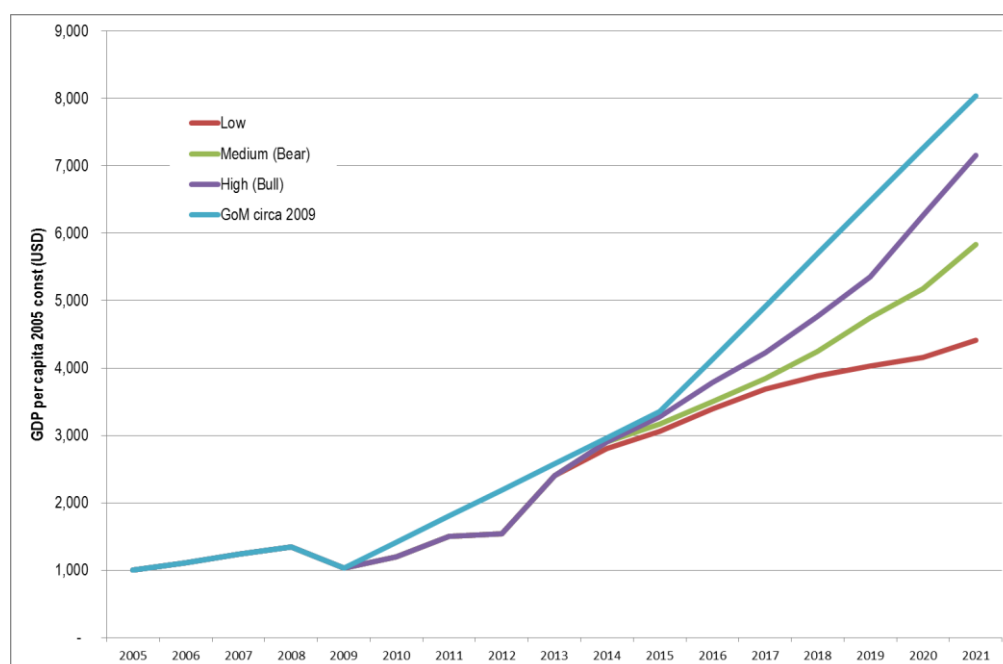
Sources: Consultants' Estimates

133. Under the low case and assuming a 10% GDP growth rate in the mining sector the total average GDP real growth rate would be around 12%.

S. Growth Scenarios for Energy Planning

134. Figure V-12 shows the GDP per capita forecasts for the growth scenarios presented above.

Figure V-12: Non-Mining Sector GDP per Capita Forecasts



Sources: Consultants' Estimates

135. Assuming that the mining sector adds 20% to GDP, then it can be seen that the forecasts will be greater than the 2009 expectation of the Government in 2015; after 2015 the Government's forecast will fall between the bear and bull forecasts. The low growth scenario is particularly important, representing the minimum growth expectation, whereas the medium and high growth scenario comes with greater uncertainty due to the nature of industrialization. In any case higher industrial growth can be accommodated by adding standard blocks of power to a supply strategy devised to meet the low demand growth.

136. These analyses lead to a set of expansion planning policy statements for Mongolia.

1. Low Growth (Reference) Scenario

137. Under the Base Case scenario, GDP will grow in real terms from USD\$1,600 in 2013 to USD\$3,600 per capita by 2025. Electricity consumption will grow from 1,700 kWh per capita in 2013 to 2,880 kWh per capita by 2025.

2. Medium Growth Scenario

138. Under the Medium Growth scenario GDP will grow to USD\$5,300 per capita by 2025. Electricity consumption will grow to 3,660 kWh per capita by 2025.

3. High Growth Scenario

139. Under the High Growth scenario GDP will grow to USD\$7,300 per capita by 2025. Electricity consumption will grow to 4,700 kWh per capita by 2025.

ANNEXES

ANNEX 1. MACROECONOMIC INDICATORS 2000 - 2012

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Real GDP % change p.a.	1.1	3.0	4.7	7.0	10.6	7.3	8.6	10.2	8.9	-1.3	6.4	17.5	12.3
Mining (% change p.a.)		8.5	-5.7	-0.9	30.5	12.1	5.3	1.1	-1.6	5.8	3.6	7.3	8.9
Non-mining (% change p.a.)		1.6	7.4	8.8	6.5	6.0	9.4	12.6	11.3	-2.7	7.0	19.7	12.9
GDP per capita (thousands Tgs)	512.1	574.0	630.6	734.7	937.5	1,193.7	1,561.9	1,880.9	2,442.9	2,432.2	3,050.6	3,979.3	4,910.4
GDP per capita (US\$)	475.0	522.8	567.9	640.7	790.8	990.4	1,323.8	1,619.5	2,114.8	1,691.6	2,242.9	2,562	3,335
Changes in CPI, at end of year	8.1	8.0	1.6	4.7	11.0	9.5	6.2	17.8	22.1	4.2	13.0	10.2	14.0
Trade balance (current Tgs billion)	-140.2	-170.0	-228.9	-199.6	-99.2	-99.5	136.2	-114.3	-710.0	-252.2	-300.9	-1780.9	-2353.6
Trade balance (US\$ million)	-130.1	-154.8	-206.0	-173.8	-83.6	-82.6	115.7	-97.7	-608.9	-175.4	-221.2	-2253.7	-3199.5
Exports (current Tgs billion)	535.8	523.2	523.9	627.3	872.1	1,066.1	1,543.9	1,947.5	2,534.5	1,885.6	2,899.1	4,817.5	4,384.7
Exports (US\$ million)	497.0	476.5	471.5	546.2	734.9	884.7	1,311.4	1,664.7	2,173.6	1,311.4	2,131.5	6096.4	5960.6
Exports % change p.a.		-2.3	0.1	19.7	39.0	22.2	44.8	26.1	30.1	-26.0	53.7	65.6	-9.0
Imports (current Tgs billion)	676.0	693.1	752.8	826.9	971.3	1,165.6	1,407.7	2,061.8	3,244.5	2,137.8	3,200.0	6,598.4	6,738.3
Imports (US\$ million)	627.1	631.3	677.5	719.9	818.5	967.2	1,195.8	1,762.4	2,782.4	1,486.9	2,352.8	8350.0	9160.0
Imports % change p.a.		2.5	8.6	9.8	17.5	20.0	20.8	46.5	57.4	-34.0	49.7	106.2	2.1
Net International Reserves (in millions US\$)	140.7	160.1	225.9	129.0	163.6	298.0	687.3	975.3	637.2	1,145.3	2,091.2	2,273.9	3,629.2
Months of Imports	2.7	2.8	3.6	1.9	2.0	3.1	5.9	5.7	2.4	6.4	7.8		
GDP constant 2005 price (bln Tgs)	2,221.7	2,287.3	2,395.5	2,563.3	2,835.7	3,041.4	3,301.6	3,640.0	3,964.0	3,913.7	4,162.8	4,891.8	5,492.7
Mining (bln Tgs)	433.1	469.8	443.1	439.0	573.0	642.1	676.2	683.8	672.6	711.5	736.9	791.0	861.5
Non-mining (bln Tgs)	1,788.6	1,817.5	1,952.4	2,124.4	2,262.7	2,399.3	2,625.5	2,956.1	3,291.3	3,202.2	3,425.8	4,100.8	4,631.2

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Nominal GDP (billion Tgs)	1,224.1	1,391.9	1,550.6	1,829.1	2,361.2	3,041.4	4,027.6	4,956.6	6,555.6	6,590.6	8,414.5	11,087.7	13,944.2
Exchange rate, average (1US\$=Tgs)	1,078.1	1,097.9	1,111.2	1,148.6	1,186.7	1,205.1	1,177.3	1,169.9	1,166.1	1,437.8	1,360.1	1,265.5	1,359.4
Real GDP Index (2000=100)	100.0	103.0	107.8	115.4	127.7	136.9	148.6	163.9	178.4	176.2	187.4		
Population (thousands)	2,391	2,425	2,459	2,490	2,519	2,548	2,579	2,635	2,684	2,710	2,758	2,811	2,867
Population % change p.a.		1.4	1.4	1.2	1.2	1.2	1.2	2.2	1.8	1.0	1.8	1.8	2.0
Unemployment rate %	4.6	4.6	3.4	3.5	3.6	3.3	3.2	11.3	2.8	11.6	8.6	7.7	8.2
GDP (millions US\$)	1,135.4	1,267.7	1,395.5	1,592.5	1,989.7	2,523.8	3,421.2	4,237.0	5,622.0	4,583.8	6,186.7	8761.5	10257.6

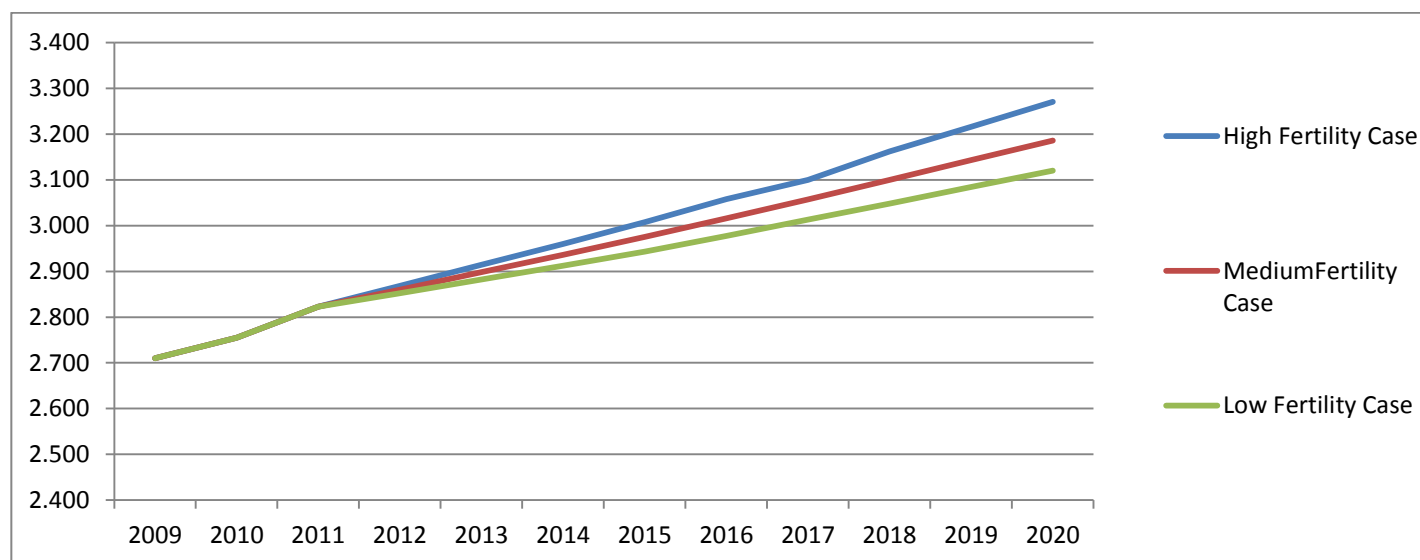
ANNEX 2. MACROECONOMIC INDICATORS: GOVERNMENT OF MONGOLIA SHORT TERM PROJECTIONS 2011 – 2014

	2012	2011	2013	2014
Real GDP % change p.a.	19.9	19.4	14.8	14.1
Mining	33.0	13.0	25.0	26.0
Non-mining	17.0	21.0	13.0	21.0
GDP per capita (thousands Tgs)	6,279.6	4,290.2	7,359.4	8,658.3
GDP per capita (US\$)	5,234.3	3,459.0	6,373.9	7,791.9
Changes in CPI, at end of year	9.0	9.7	8.0	8.0
Government Policy targets				
Trade balance (current Tgs billion)	-776.4	-1,504.6	700.3	936.1
Trade balance (US\$ million)	-647.2	-1,213.1	606.5	842.4
Exports (current Tgs billion)	6,816.4	4,395.5	8,984.0	10,628.1
Exports (US\$ million)	5,681.8	3,543.9	7,781.1	9,564.5
Exports % change p.a.	55.1	51.6	31.8	18.3
Imports (current Tgs billion)	7,592.8	5,900.1	8,283.7	9,692.0
Imports (US\$ million)	6,328.9	4,757.0	7,174.6	8,722.1
Imports % change p.a.	28.7	84.4	9.1	17.0
Net International Reserves (mlns US\$)	4,710.9	2,685.0	8,267.9	
Weeks of Imports	13.5	5.5	25.3	
GDP at constant 2005 price (billion Tgs)	5,957.5	4,978.0	6,864.9	8,375.8
Mining (billion Tgs)	1,107.6	832.7	1,384.4	1,744.4
Non-mining (billion Tgs)	4,850.0	4,145.3	5,480.5	6,631.4
Nominal GDP (billion Tgs)	18,071.4	12,093.2	21,634.3	26,004.4
Mining (billion Tgs)	4,188.3	2,802.7	5,014.0	6,026.8
Non-mining (billion Tgs)	13,883.1	9,290.5	16,620.3	19,977.6
Exchange rate, average (1US\$=Tgs)	1,199.7	1,240.3	1,154.6	1,111.2
Population (thousands)	2,860	2,823	2,898	2,936
Population % change p.a.	1.3	2.3	1.3	1.3
Unemployment rate %	6.8	7.7	6.1	5.4
GDP (millions US\$)	15,063.3	9,750.2	18,737.5	23,402.1

ANNEX 3. UN POPULATION PROJECTIONS FOR MONGOLIA (Millions)

	2009	2010	2011*	2012	2013	2014	2015	2016	2017	2018	2019	2020
High Fertility Case	2.710	2.755	2.823	2.868	2.914	2.960	3.007	3.058	3.100	3.162	3.216	3.270
Medium Fertility Case	2.710	2.755	2.823	2.860	2.898	2.936	2.975	3.016	3.057	3.100	3.143	3.186
Low Fertility Case	2.710	2.755	2.823	2.852	2.882	2.912	2.943	2.977	3.013	3.048	3.084	3.120

- Actual to October 2011 - National Statistics Office of Mongolia



Source: UN

ANNEX 4. BREAKDOWN OF POPULATION BY AIMAG AND CAPITAL 2003 – 2012 (Thousands)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bayan-Olgii	100.8	101.2	100.1	100.1	100.8	101.3	89.3	88.2	88.8	90.5
Govi-Altai	61.4	60.9	60.4	60.3	60.2	59.8	55	53.5	53.0	53.7
Zavkhan	82.9	80.7	80.1	80.6	81.1	79.8	68.9	65.4	64.2	64.6
Uvs	81.9	81	80.6	80.5	80.4	79.8	74.3	73.2	73.0	73.8
Khovd	87.5	87.8	87.9	88.5	88.6	88.4	77.8	76.8	77.2	78.3
Arkhangai	96.1	94.9	93.8	93.3	92.8	92.5	86.0	84.6	84.3	85.2
Bayankhongor	83.2	83.8	83.6	83.8	84.2	85.2	77.3	76.2	76.7	77.8
Bulgan	62.8	60.8	59.9	60.3	60.5	61.4	54.2	53.7	54.1	54.5
Orkhon	75.1	78.4	79	79.4	80.1	81.9	87.9	90.9	91.5	92.8
Ovorkhangai	113.2	113.2	113.8	114.9	115.7	116.6	102.9	101.4	101.2	102.1
Khovsgol	121.5	121.4	121.7	122.1	122.4	123	115.3	114.9	115.9	117.6
Govisumber	12.2	12.3	12.2	12.3	12.6	12.9	12.9	13.3	13.9	14.3
Darkhan-Uul	86.5	87.8	87.7	87.5	87.6	88.2	92.9	94.9	96.0	97.9
Dornogovi	52.1	52.5	53.3	54.5	55.6	57.2	57.7	58.9	60.2	61.3
Dundgovi	50.5	49.9	49.6	49.2	48.8	48.2	40.8	38.7	37.7	37.8
Omnogovi	46.7	46.8	46.1	46.5	46.9	47.7	58.9	61.6	63.4	65.4
Selenge	101.8	100.8	99.8	100.1	100.5	101.6	95.6	97.9	99.2	103.5
Tov	92.5	88.9	87.4	86.4	85.9	86.8	84.1	85.4	85.7	86.8
Dornod	74.4	73.7	73.4	73.6	72.9	73.6	69.9	69.6	70.2	71.3
Sukhbaatar	56.4	56.6	56	55.6	55.1	54.9	51.7	51.4	51.8	52.6
Khentii	71.1	71.2	70.8	71	71.3	71	66.1	65.9	66.4	67.5
Ulaanbaatar	893.4	928.5	965.3	994.3	1031.2	1071.7	1196.8	1244.4	1287.1	1318.1
Total	2,504.0	2,533.1	2,562.4	2,594.8	2,635.2	2,683.5	2,735.8	2,761.0	2811.6	2867.7

Source: National Statistical Office of Mongolia. NB – minor statistical difference with total population figures 2000-2004.

ANNEX 5. BREAKDOWN OF URBAN-RURAL POPULATION BY AIMAG AND CAPITAL 2003 – 2012
(Percentages)

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bayan-Olgii	Urban	30.4	30.9	30.1	30.4	29.8	31.6	32.2	36.0	35.3	34.8
	Rural	69.6	69.1	69.9	69.6	70.2	68.4	67.8	64.0	64.7	65.2
Govi-Altai	Urban	31.9	32.2	32.0	31.9	30.7	29.7	29.8	33.7	33.0	32.9
	Rural	68.1	67.8	68.0	68.1	69.3	70.3	70.2	66.3	67.0	67.1
Zavkhan	Urban	22.6	21.4	20.0	20.3	20.4	21.1	21.2	26.9	22.1	22.2
	Rural	77.4	78.6	80.0	79.7	79.6	78.9	78.8	73.1	77.9	77.8
Uvs	Urban	29.5	27.8	29.6	28.6	27.3	28.8	29.9	37.3	30.7	33.8
	Rural	70.5	72.2	70.4	71.4	72.7	71.2	70.1	62.7	69.3	66.2
Khovd	Urban	33.5	34.4	34.8	34.6	32.1	31.1	31.7	38.1	33.2	32.2
	Rural	66.5	65.6	65.2	65.4	67.9	68.9	68.3	61.9	66.8	67.8
Arkhangai	Urban	18.8	19.2	19.5	19.8	20.3	20.2	19.9	24.5	22.2	22.4
	Rural	81.2	80.8	80.5	80.2	79.7	79.8	80.1	75.5	77.8	77.6
Bayankhongor	Urban	28.4	30.0	28.9	29.5	31.2	33.4	32.8	39.4	33.6	34.9
	Rural	71.6	70.0	71.1	70.5	68.8	66.6	67.2	60.6	66.4	65.1
Bulgan	Urban	26.4	25.3	25.6	25.4	26.0	25.0	25.5	26.6	26.3	26.7
	Rural	73.6	74.7	74.4	74.6	74.0	75.0	74.5	73.4	73.7	73.3
Orkhon	Urban	91.9	92.8	92.5	92.6	92.8	92.7	93.2	96.6	94.1	93.3
	Rural	8.1	7.2	7.5	7.4	7.2	7.3	6.8	3.4	5.9	6.1
Ovorkhangai	Urban	19.2	19.5	20.0	21.2	21.7	21.6	22.3	37.9	23.9	24.1
	Rural	80.8	80.5	80.0	78.8	78.3	78.4	77.7	62.1	76.1	75.9
Khovsgol	Urban	31.4	31.2	31.4	31.6	31.6	31.3	31.6	33.6	32.0	31.3
	Rural	68.6	68.8	68.6	68.4	68.4	68.7	68.4	66.4	68.0	68.7
Govisumber	Urban	58.8	59.6	59.6	61.3	60.5	60.9	61.7	74.5	62.1	62.5
	Rural	41.2	40.4	40.4	38.7	39.5	39.1	38.3	25.5	37.9	37.5
Darkhan-Uul	Urban	81.6	81.9	82.4	82.1	82.6	82.1	81.1	82.7	80.7	78.9
	Rural	18.4	18.1	17.6	17.9	17.4	17.9	18.9	17.3	19.3	21.1

ANNEX 5. BREAKDOWN OF URBAN-RURAL POPULATION BY AIMAG AND CAPITAL 2003 – 2012 **(Percentages)**

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dornogovi	Urban	53.0	53.6	54.5	57.2	56.2	57.2	59.9	58.6	59.0	59.2
	Rural	47.0	46.4	45.5	42.8	43.8	42.8	40.1	41.4	41.0	40.8
Dundgovi	Urban	27.5	20.3	28.2	28.0	21.0	21.4	21.4	35.5	22.9	23.8
	Rural	72.5	79.7	71.8	72.0	79.0	78.6	78.6	64.5	77.1	76.2
Omnogovi	Urban	30.3	31.8	32.4	30.3	31.6	32.2	33.9	30.9	36.0	36.0
	Rural	69.7	68.2	67.6	69.7	68.4	67.8	66.1	69.1	64.0	64.0
Selenge	Urban	31.8	28.2	30.7	33.2	26.9	33.0	32.4	49.1	29.6	29.5
	Rural	68.2	71.8	69.3	66.8	73.1	67.0	67.6	50.9	70.4	70.5
Tov	Urban	19.1	19.1	19.8	19.2	15.8	19.7	19.9	15.9	19.7	17.5
	Rural	80.9	80.9	80.2	80.8	84.2	80.3	80.1	84.1	80.3	82.5
Dornod	Urban	50.0	53.0	53.6	53.7	53.7	51.2	53.3	56.1	54.6	55.4
	Rural	50.0	47.0	46.4	46.3	46.3	48.8	46.7	43.9	45.4	44.6
Sukhbaatar	Urban	20.7	20.5	20.5	22.0	22.5	24.1	25.5	31.6	26.8	26.8
	Rural	79.3	79.5	79.5	78.0	77.5	75.9	74.5	68.4	73.2	73.2
Khentii	Urban	40.7	40.7	42.5	43.0	37.7	39.7	41.0	46.4	45.7	30.3
	Rural	59.3	59.3	57.5	57.0	62.3	60.3	59.0	53.6	54.3	69.7
Ulaanbaatar	Urban	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Rural	0	0	0	0	0	0	0	0	0	0

Source: National Statistical Office of Mongolia. NB – minor statistical difference with total population figures 2000-2004

ANNEX 6. GDP FORECAST SCENARIOS

GDP at 2005 prices (Tgs blns)	2011*	2012*	2013*	2014*	2015	2016	2017	2018	2019	2020
High Case	4,970.4	5,959.5	6,841.5	7,806.1	8,859.9	10,011.7	11,213.1	12,446.6	13,753.5	15,128.8
Base Case	4,970.4	5,959.5	6,841.5	7,806.1	8,781.9	9,747.9	10,722.7	11,634.1	12,506.6	13,382.1
Low Case	4,970.4	5,959.5	6,841.5	7,806.1	8,672.5	9,366.3	9,928.2	10,325.4	10,686.7	11,060.8
GDP % change p.a.	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High Case	19.4%	19.9%	14.8%	14.1%	13.5%	13.0%	12.0%	11.0%	10.5%	10.0%
Base Case	19.4%	19.9%	14.8%	14.1%	12.5%	11.0%	10.0%	8.5%	7.5%	7.0%
Low Case	19.4%	19.9%	14.8%	14.1%	11.1%	8.0%	6.0%	4.0%	3.5%	3.5%
Index 2000 = 100	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High Case	223.8	268.3	308.0	351.4	398.8	450.7	504.8	560.3	619.1	681.1
Base Case	223.8	268.3	308.0	351.4	395.3	438.8	482.7	523.7	563.0	602.4
Low Case	223.8	268.3	308.0	351.4	390.4	421.6	446.9	464.8	481.1	497.9
H.C. GDP nominal (bln. Tgs)	12,093.2	18,071.4	21,634.3	26,004.4	31,985.9	39,322.1	47,730.1	56,937.6	67,454.7	78,365.8
B.C. GDP nominal (bln. Tgs)	12,093.2	18,071.4	21,634.3	26,004.4	31,704.1	38,285.8	45,642.3	53,220.8	61,339.6	69,318.1
L.C. GDP nominal (bln. Tgs)	12,093.2	18,071.4	21,634.3	26,004.4	31,309.4	36,787.0	42,260.8	47,234.0	52,413.9	57,293.9
Population (millions) **	2.823	2.860	2.898	2.936	2.975	3.016	3.057	3.100	3.143	3.186

* Based on Government of Mongolia short term projections

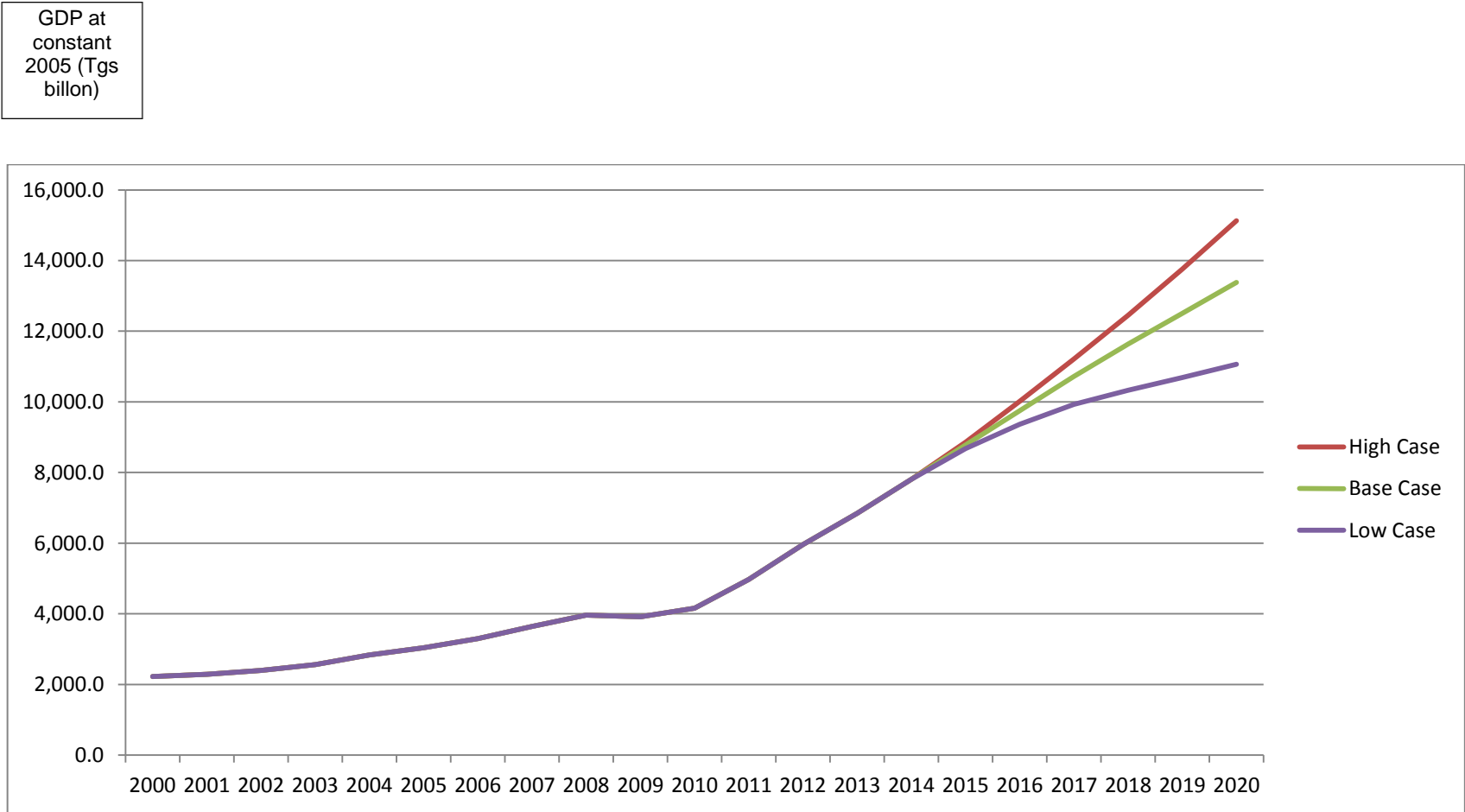
** UN Medium Fertility population projection

ANNEX 6. GDP FORECAST SCENARIOS

GDP per capita at 2005 Tgs 000	2011*	2012*	2013*	2014*	2015	2016	2017	2018	2019	2020
High Case	1,760.7	2,083.7	2,360.8	2,658.8	2,978.1	3,319.5	3,668.0	4,015.0	4,375.9	4,748.5
Base Case	1,760.7	2,083.7	2,360.8	2,658.8	2,951.9	3,232.1	3,507.6	3,752.9	3,979.2	4,200.3
Low Case	1,760.7	2,083.7	2,360.8	2,658.8	2,915.1	3,105.5	3,247.7	3,330.8	3,400.2	3,471.7
Exchange rate, (average 1US\$=Tgs)	1240.3	1199.7	1154.6	1111.2	1089.0	1067.2	1045.9	1035.4	1025.0	1014.8
Exchange Rate % change p.a.	-8.8%	-3.3%	-3.8%	-3.8%	-2.0%	-2.0%	-2.0%	-1.0%	-1.0%	-1.0%
GDP per capita (US\$)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High Case	3,454	5,267	6,466	7,971	9,873	12,217	14,929	17,739	20,938	24,238
Base Case	3,454	5,267	6,466	7,971	9,786	11,895	14,276	16,581	19,040	21,440
Low Case	3,454	5,267	6,466	7,971	9,664	11,429	13,218	14,716	16,269	17,721

* Based on Government of Mongolia short term projections

ANNEX 7. CHART OF GDP FORECAST SCENARIOS



ANNEX 8. BREAKDOWN OF GDP STRUCTURE 1995 – 2012 (GDP at 2005 Prices)

Mongolia: GDP by Sector at 2005 prices	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Mining and quarrying	355.6	433.1	642.1	676.2	683.8	672.6	711.5	736.9	791.0	861.5
Agriculture, forestry and fishing	639.7	617.4	602.1	641.5	734.1	768.4	796.3	662.6	660.7	801.2
Net taxes on products	39.1	177.8	311.7	383.4	409.5	480.2	394.0	635.8	900.1	955.3
Transportation and storage	85.0	125.5	256.7	285.1	356.8	425.5	459.4	501.2	536.3	605.0
Wholesale and retail trade, motor vehicle & motorcycle repair	115.7	158.9	227.5	259.9	274.3	315.5	278.2	343.2	535.8	591.1
Manufacturing	166.9	114.3	175.2	196.7	250.8	257.5	234.3	260.7	269.1	295.2
Real estate activities	122.8	134.4	160.5	167.0	166.5	180.3	195.5	188.6	204.8	217.5
Information and communication	32.7	47.5	96.3	106.6	132.4	157.6	169.5	184.3	189.7	226.8
Education	83.6	101.5	86.5	89.5	90.4	96.1	100.2	102.4	100.7	102.2
Electricity, gas, steam and air conditioning supply	63.7	66.8	75.9	78.6	83.5	90.3	96.0	101.5	103.8	111.6
Financial and insurance activities	44.8	44.3	112.3	108.9	130.0	169.6	143.1	98.1	198.8	249.8
Public administration and defence, compulsory social security	66.1	68.5	66.9	66.6	68.8	71.0	75.6	76.3	69.3	73.0
Administrative and support service activities	11.0	14.7	34.1	37.2	41.0	54.8	59.9	62.4	67.4	80.0
Construction	43.5	35.6	81.4	84.8	90.9	78.4	51.7	59.8	81.7	102.6
Human health and social work activities	32.7	35.5	37.5	40.6	44.5	46.6	47.9	48.1	45.3	50.9
Professional scientific and technical activities	6.2	6.8	18.0	19.2	16.8	27.4	30.4	41.9	46.5	50.7
Accommodation and food service activities	12.1	15.2	19.3	21.1	24.2	25.5	24.7	26.4	41.5	60.1
Other service activities	6.3	8.3	15.8	16.6	17.6	20.1	19.0	18.3	20.3	24.2
Water supply, sewerage and waste management activities	10.9	11.6	13.8	14.3	15.2	16.5	17.3	18.2	18.5	20.3
Arts, entertainment and recreation	3.1	4.1	7.7	8.1	8.7	9.9	9.3	9.0	9.9	12.9
Gross Domestic Product	1,941.5	2,221.7	3,041.4	3,301.6	3,640.0	3,964.0	3,913.7	4,162.8	4,891.8	5,492.7

ANNEX 9. BREAKDOWN OF GDP STRUCTURE 1995 – 2012 (by Percentage)

% of total GDP	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Mining and quarrying	18.3%	19.5%	21.1%	20.5%	18.8%	17.0%	19.8%	23.6%	24.1%	21.4%
Agriculture, forestry and fishing	32.9%	27.8%	19.8%	19.4%	20.2%	19.4%	17.9%	14.3%	12.3%	14.8%
Net taxes on products	2.0%	8.0%	10.2%	11.6%	11.3%	12.1%	5%	7.50%	5.30%	1%
Transportation and storage	4.4%	5.6%	8.4%	8.6%	9.8%	10.7%	8.3%	7.8%	7.2%	6.6%
Wholesale and retail trade, repair of motor vehicles and motorcycles	6.0%	7.2%	7.5%	7.9%	7.5%	8.0%	7.1%	8.2%	12.2%	16.3%
Manufacturing	8.6%	5.1%	5.8%	6.0%	6.9%	6.5%	8.3%	8.4%	7.8%	8.0%
Real estate activities	6.3%	6.0%	5.3%	5.1%	4.6%	4.5%	7.3%	6.6%	7.0%	6.4%
Information and communication	1.7%	2.1%	3.2%	3.2%	3.6%	4.0%	3.8%	3.4%	3.1%	3.1%
Education	4.3%	4.6%	2.8%	2.7%	2.5%	2.4%	4.7%	4.0%	4.0%	4.7%
Electricity, gas, steam and air conditioning supply	3.3%	3.0%	2.5%	2.4%	2.3%	2.3%	2.4%	2.1%	1.7%	1.6%
Financial and insurance activities	2.3%	2.0%	3.7%	3.3%	3.6%	4.3%	3.3%	2.9%	3.4%	3.6%
Public administration and defence, compulsory social security	3.4%	3.1%	2.2%	2.0%	1.9%	1.8%	4.1%	3.6%	3.3%	4.3%
Administrative and support service activities	0.6%	0.7%	1.1%	1.1%	1.1%	1.4%	1.4%	1.6%	1.4%	1.4%
Construction	2.2%	1.6%	2.7%	2.6%	2.5%	2.0%	1.6%	1.7%	2.3%	2.3%
Human health and social work activities	1.7%	1.6%	1.2%	1.2%	1.2%	1.2%	1.9%	1.7%	1.7%	2.1%
Professional scientific and technical activities	0.3%	0.3%	0.6%	0.6%	0.5%	0.7%	1.1%	0.9%	1.1%	1.1%
Accommodation and food service activities	0.6%	0.7%	0.6%	0.6%	0.7%	0.6%	0.8%	0.6%	1.0%	1.2%
Other service activities	0.3%	0.4%	0.5%	0.5%	0.5%	0.5%	0.4%	0.3%	0.4%	0.4%
Water supply, sewerage AND waste management activities	0.6%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Arts, entertainment and recreation	0.2%	0.2%	0.3%	0.2%	0.2%	0.2%	0.4%	0.4%	0.3%	0.4%
Gross Domestic Product	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100%	100%

Source: National Statistics Office of Mongolia

ANNEX 10. MONGOLIA: MAIN TRADING PARTNERS 2008 – 2012

Export						%	%	%	%	%
(Current Tgs billion)	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
USA	114.2	13.9	6	5.0	3.6	4.5	0.7	0.2	0.1	1
China	1635.9	1393.9	2466.3	4439.9	4059.7	64.5	73.9	84.8	92.2	92.6
EU	436.5	224.0	131.6	95.3	66.9	17.2	11.9	4.5	2.0	1.5
Russian Federation	86.3	68.2	82.7	96.3	79.6	3.4	3.6	2.8	2.0	1.8
Others	<u>261.6</u>	<u>182.6</u>	<u>222.6</u>	<u>181.0</u>	<u>174.9</u>	<u>10.3</u>	<u>9.7</u>	<u>7.6</u>	<u>3.7</u>	<u>4.0</u>
Total	2,534.5	1,885.4	2,908.5	4817.5	4384.7	100.0	100.0	100.0	100.0	100.0
Imports:										
(Current Tgs billion)										
USA										
Russian Federation	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
China										
EU										
Japan	84.1	103.7	158.9	536.0	535.9	2.6	4.8	5.0	8.1	8.0
South Korea	1,242.3	772.8	1,046.7	1624.7	1847.4	38.3	36.1	32.7	24.6	27.4
Others	989.7	538.6	971.0	2023.9	1861.6	30.5	25.2	30.3	30.6	27.6
Total	296.2	249.8	317.5	709.6	696.9	9.1	11.7	9.9	10.7	10.3
USA	238.5	97.0	196.5	490.2	501.6	7.3	4.5	6.1	7.4	7.4
China	194.8	155.1	181.8	356.7	467.8	60.0	7.2	5.7	5.4	6.9
EU	<u>198.9</u>	<u>220.70</u>	<u>327.70</u>	857.3	827.1	6.1	10.3	10.2	13.0	12.2
Russian Federation	3,244.5	2,137.7	3,200.1	6,598.4	6,738.3	100.0	100.0	100.0	100.0	100.0

Source: National Statistics Office of Mongolia

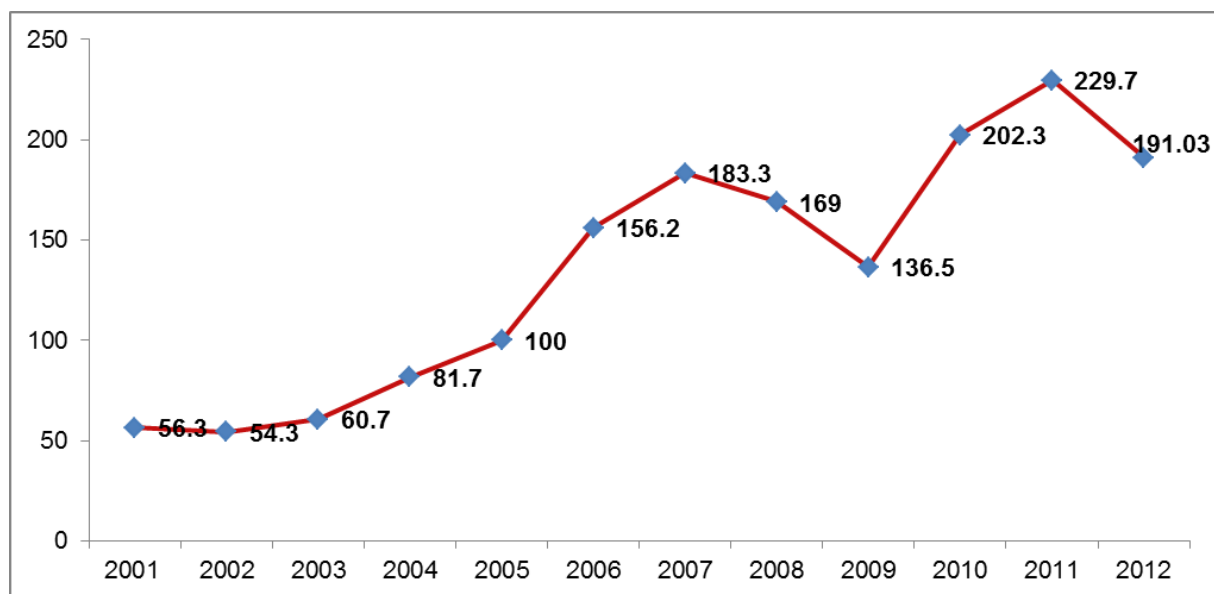
ANNEX 11. MAIN GOODS AND COMMODITIES TRADED 2008 – 2012

						%	%	%	%	%	
Exports		2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
(Current billion)	Tgs										
Mineral products		1529.4	1,251.9	2,355.9	4,297.2	3,911.2	60.34%	66.40%	81.00%	89.20%	89.20%
Textiles		226.5	192.3	215.2	240.9	232.4	8.94%	10.20%	7.40%	5.00%	5.30%
Precious metals		600.2	309.2	177.4	110.8	122.8	23.68%	16.40%	6.10%	2.30%	2.80%
Live animals		31.6	45.2	69.8	38.5	26.3	1.25%	2.40%	2.40%	0.80%	0.60%
Raw hides, skins, furs		41	28.3	32.0	53.0	30.7	1.62%	1.50%	1.10%	1.10%	0.70%
Other		105.8	58.4	58.2	77.1	61.4	4.17%	3.10%	2.00%	1.60%	1.40%
Total		2534.5	1885.4	2908.5	4817.5	4384.7	100.00%	100.00%	100.00%	100.00%	100.00%
Imports		2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
(Current billion)	Tgs										
Base Metals/products		267.3	164.6	201.6	593.9	586.2	8.24%	7.70%	6.30%	9.00%	8.70%
Electrical goods		606.4	423.3	681.6	1781.6	1650.9	18.69%	19.80%	21.30%	27.00%	24.50%
Food products		231.4	177.4	240.0	329.9	397.6	7.13%	8.30%	7.50%	5.00%	5.90%
Mineral products		964.2	570.8	755.2	1273.5	1583.5	29.72%	26.70%	23.60%	19.30%	23.50%
Chemical products		150.8	128.3	169.6	257.3	296.5	4.65%	6.00%	5.30%	3.90%	4.40%
Transport goods and parts		458.7	271.5	608.0	1511.0	1273.5	14.14%	12.70%	19.00%	22.90%	18.90%
Others		565.7	401.89	544.02	851.19	950.10	17.44%	18.80%	17.00%	12.90%	14.10%
Total		3244.5	2,137.70	3,200.10	6,598.40	6,738.30	100.00%	100.00%	100.00%	100.00%	100.00%

ANNEX 12. GOVERNMENT OF MONGOLIA: PROPOSED SHORT-TERM INVESTMENT PROGRAMME FOR TRANSPORT 2008 - 2015

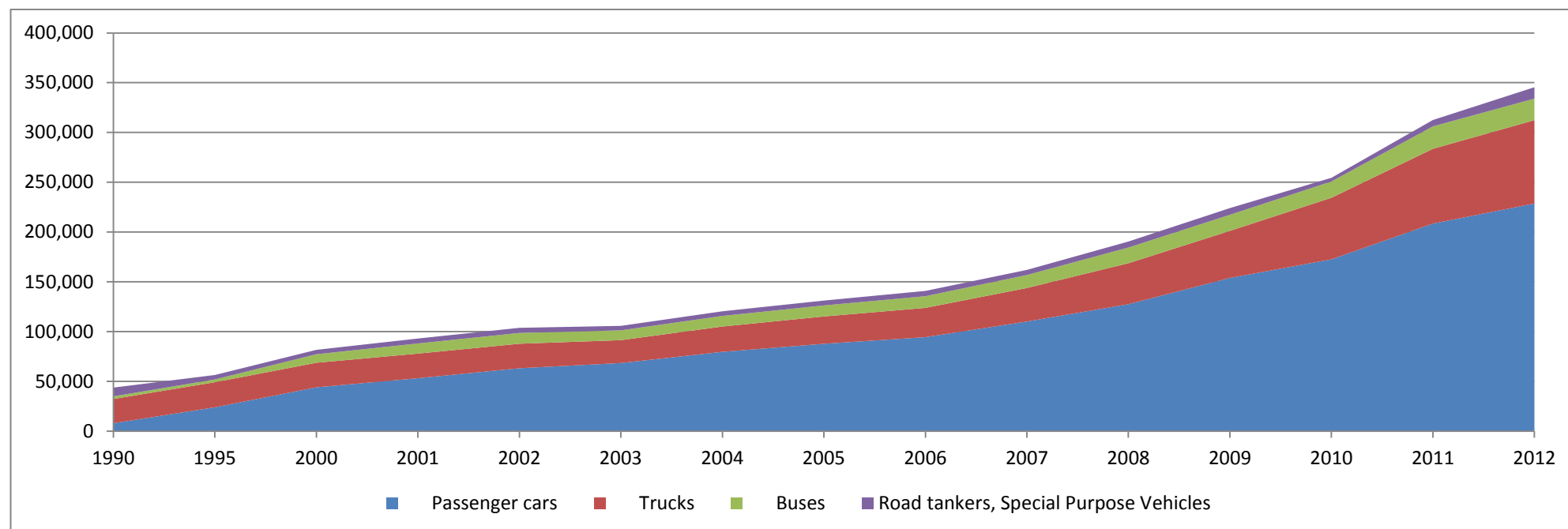
Project	Length or units	Cost (US\$ million)
Roads		
Millennium road	600	120
Western Mongolia North-South Road	800	160
Other north-south road	1100	220
Completion of UB-PRC road	300	60
Southern road to Altai	225	27
Bridge maintenance		16
Road maintenance		24
Subtotal roads		627
Railways		
New parallel railway	100	1100
Other railway extensions	500	500
Mining railways	300	300
Rail maintenance	1,100	55
Subtotal railways	100	1,955
Aviation		
New international airport	1	40
Upgrading domestic airports	4	10
Expansion of the navigation system	1	300
		350
Urban		
Roads to aimags in UB	100	10
Interchanges for outer by-pass	5	2
Traffic management in UB	1	1
Subtotal urban		13
Total transport infrastructure investment		2,945

ANNEX 13. INDEX OF GLOBAL METALS COMMODITY PRICES 2001 – 2012



Source: IMF

ANNEX 14. GROWTH OF VEHICLE FLEET BY TYPE 1990 – 2008 (Number of Vehicles)



Source: National Statistics Office of Mongolia

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Passenger cars	7,962	23,975	44,051	53,198	63,224	68,458	79,691	87,792	94,442	110,150	127,538	153,906	172,583	208,514	228,650
Trucks	24,400	25,198	24,671	24,727	24,610	22,975	25,430	27,435	29,398	33,676	41,138	47,291	61,841	75,090	83,718
Buses	2,591	2,790	8,548	10,187	10,841	9,834	10,645	11,067	11,726	13,038	15,780	16,136	16,366	22,547	21,642
Road tankers, Special Purpose Vehicles	8,839	4,465	4,423	4,939	5,130	4,508	4,652	4,890	5,315	5,125	6,003	6,735	3,696	6,391	11,463
Нийтдүн	43,792	56,428	81,693	93,051	103,805	105,775	120,418	131,184	140,881	161,989	190,459	224,068	254,486	312,542	345,473

ANNEX 14. GROWTH OF VEHICLE FLEET BY TYPE 2005 – 2012
(Number and Type of Vehicles and People Per Passenger Car)

	2005	2006	2007	2008	2009	2010	2011	2012
Passenger cars	87,792	94,442	110,150	127,538	153,906	172,583	208,514	228,650
Trucks	27,435	29,398	33,676	41,138	47,291	61,841	75,090	83,718
Buses	11,067	11,726	13,038	15,780	16,136	16,366	22,547	21,642
Road tankers, Special Purpose Vehicles	4,890	5,315	5,125	6,003	6,735	3,696	6,391	11,463
Total	131,184	140,881	161,989	190,459	224,068	254,486	312,542	345,473
Population (000)	2,548	2,579	2,635	2,684	2,716.3	2,761	2,812	2,868
People per passenger car	29	27	24	21	18	16	13	13
People per vehicle	19	18	16	14	12	11	9	8

Source: National Statistics Office of Mongolia

ANNEX 15 – References

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