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South Gobi Region Urban Infrastructure Background Study

Dalanzadgad, Mongolia

September 2008

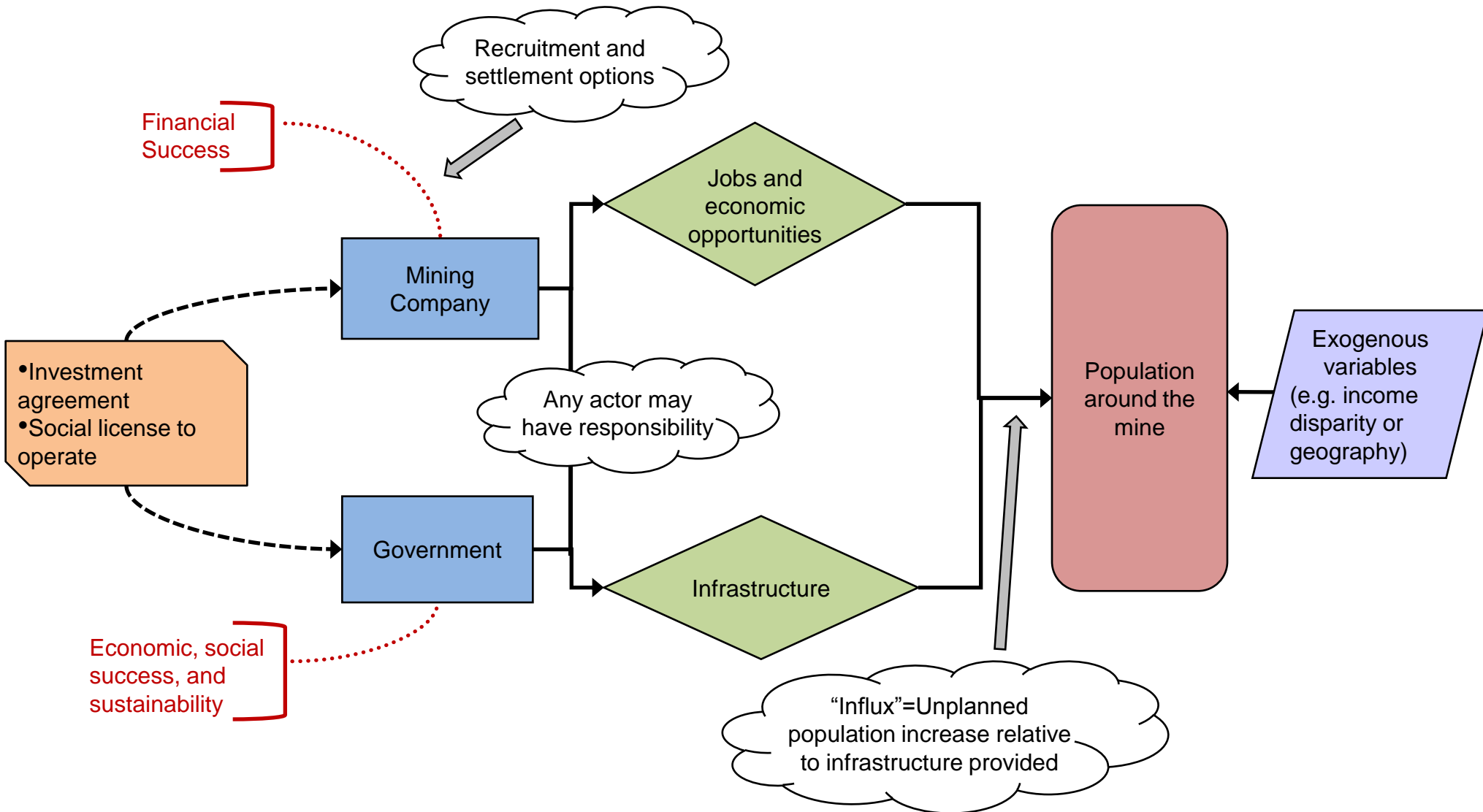
What topics will this presentation cover?

- **Castalia's Terms of Reference**
- **What international experience is relevant for South Gobi?**
 - **What are the drivers of population influx and infrastructure needs?**
 - **What are examples from Mongolia and abroad?**
 - **What are the lessons for South Gobi?**
- **What urban infrastructure will be needed?**
 - **What are the physical needs for infrastructure?**
 - **What will this infrastructure cost?**
- **What are the cost implications for customers or users of this infrastructure?**
- **Who will pay the costs?**
- **What are the options for service provision?**

What is Castalia's Terms of Reference?

- **Review international experience with population influx to mining regions**
- **Assess the scope and scale of infrastructure required to support likely population influx to the South Gobi Region, and estimate the cost of that infrastructure**
- **Identify options for providing the infrastructure the new populations will need, and help the Government identify the advantages and disadvantages of each of these options.**

What are the drivers of population influx and infrastructure needs?



How are workers recruited and settled in mining areas (examples)?

Gated Community

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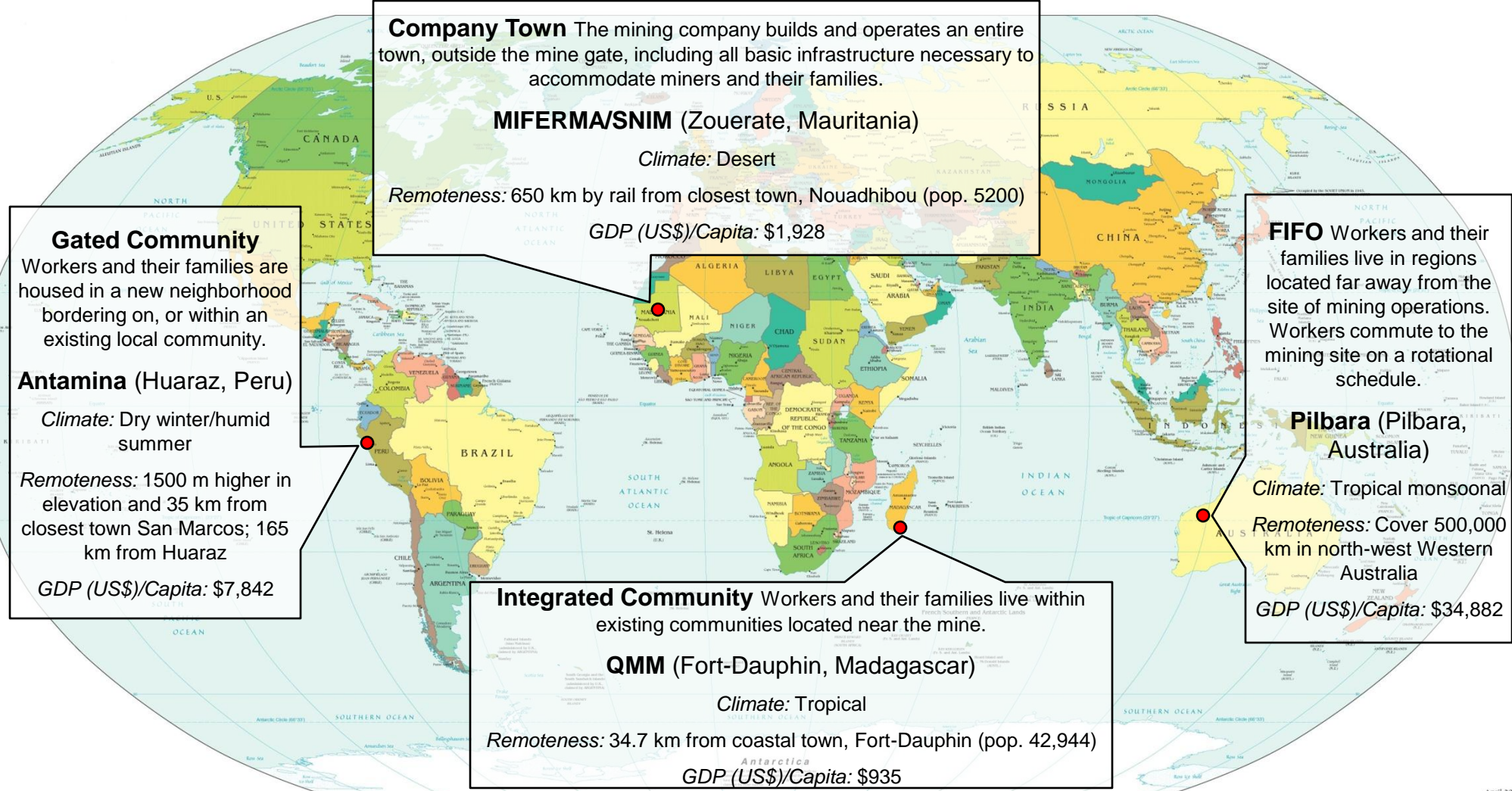
Company Town

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Integrated Community

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FIFO



Gated Community
 Workers and their families are housed in a new neighborhood bordering on, or within an existing local community.

Antamina (Huaraz, Peru)
Climate: Dry winter/humid summer
Remoteness: 1500 m higher in elevation and 35 km from closest town San Marcos; 165 km from Huaraz
GDP (US\$)/Capita: \$7,842

Company Town The mining company builds and operates an entire town, outside the mine gate, including all basic infrastructure necessary to accommodate miners and their families.

MIFERMA/SNIM (Zouerate, Mauritania)
Climate: Desert
Remoteness: 650 km by rail from closest town, Nouadhibou (pop. 5200)
GDP (US\$)/Capita: \$1,928

Integrated Community Workers and their families live within existing communities located near the mine.

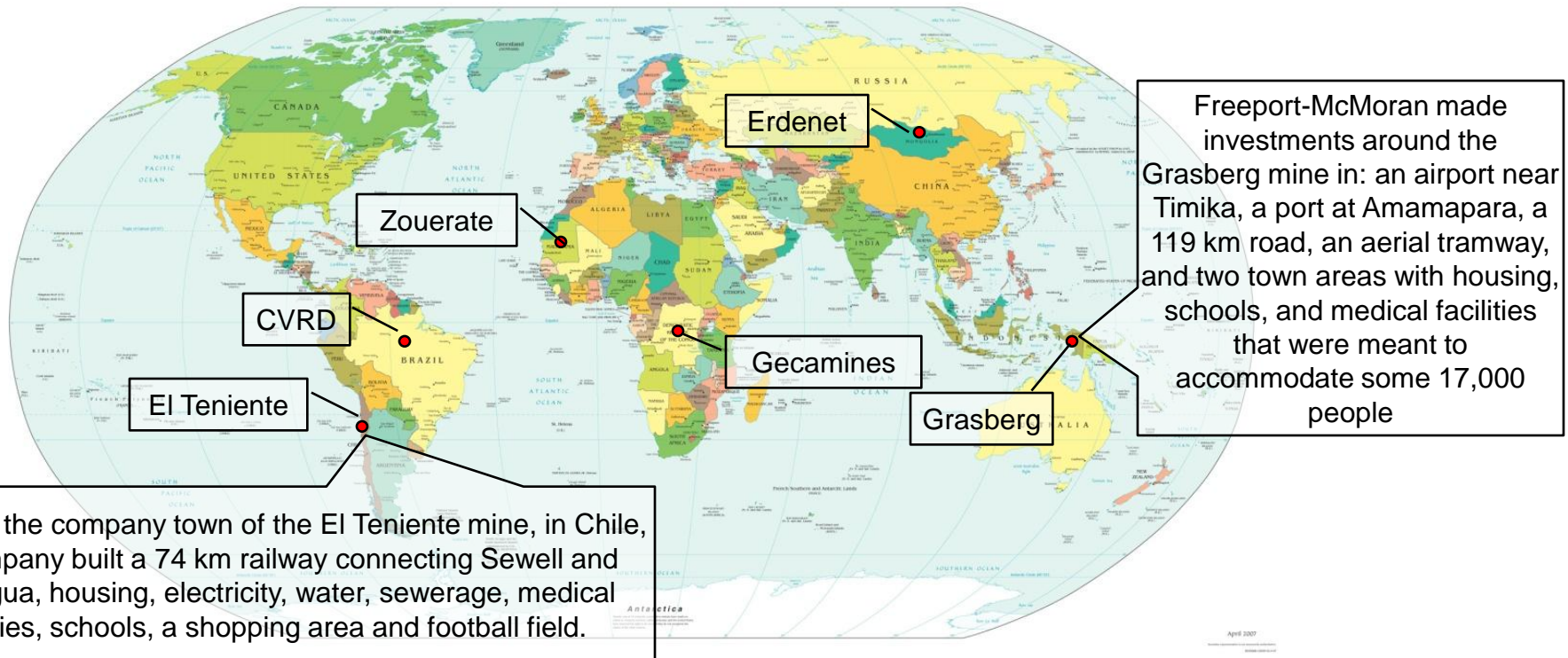
QMM (Fort-Dauphin, Madagascar)
Climate: Tropical
Remoteness: 34.7 km from coastal town, Fort-Dauphin (pop. 42,944)
GDP (US\$)/Capita: \$935

FIFO Workers and their families live in regions located far away from the site of mining operations. Workers commute to the mining site on a rotational schedule.

Pilbara (Pilbara, Australia)
Climate: Tropical monsoonal
Remoteness: Cover 500,000 km in north-west Western Australia
GDP (US\$)/Capita: \$34,882

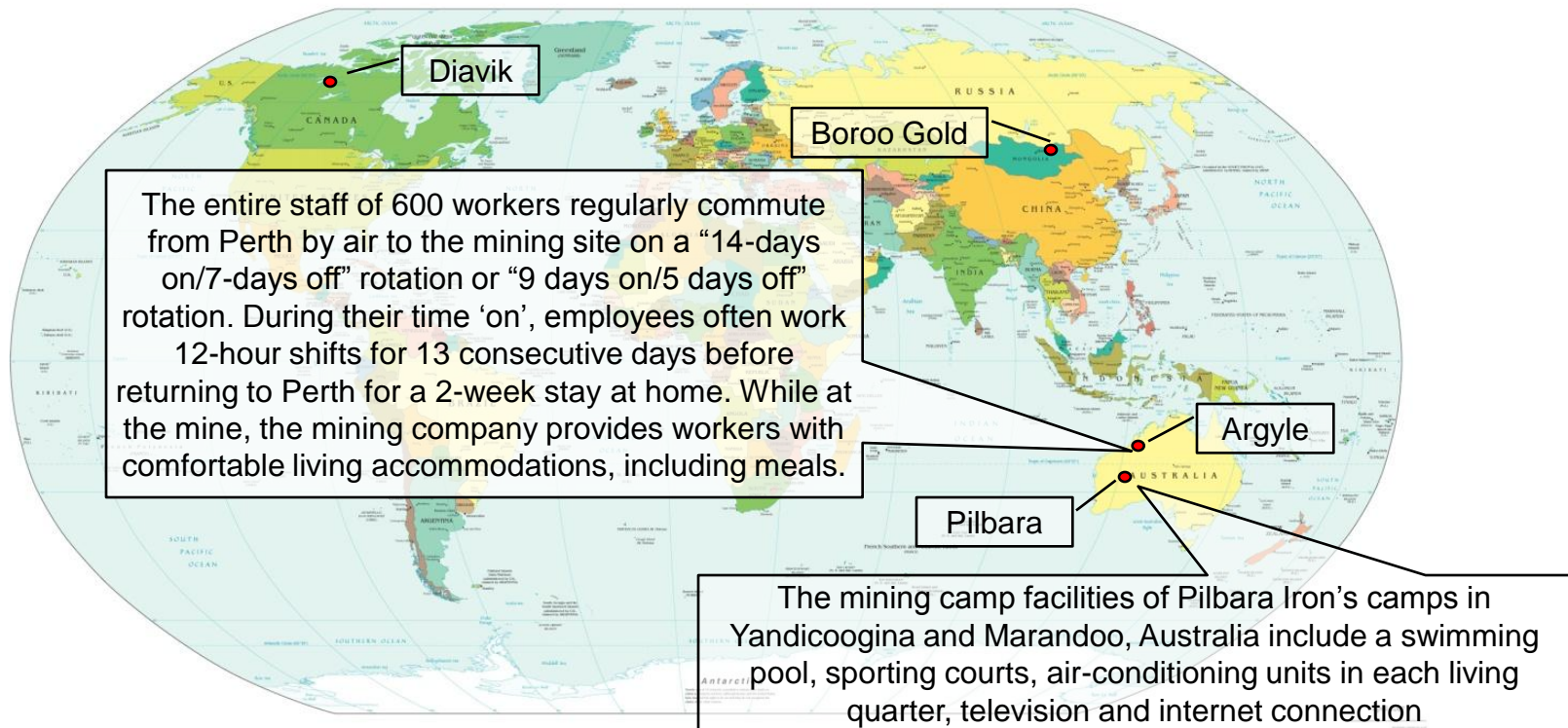
What has international experience shown about the company town model?

How is infrastructure provided?	
Who receives it?	Miners and families, suppliers, contractors, service, and some existing populations
What is provided?	Housing, basic infrastructure, health and education facilities, recreation and leisure facilities (including restaurants, retail shops, community centers, hotels and movie theaters)



What has international experience shown about the FIFO model?

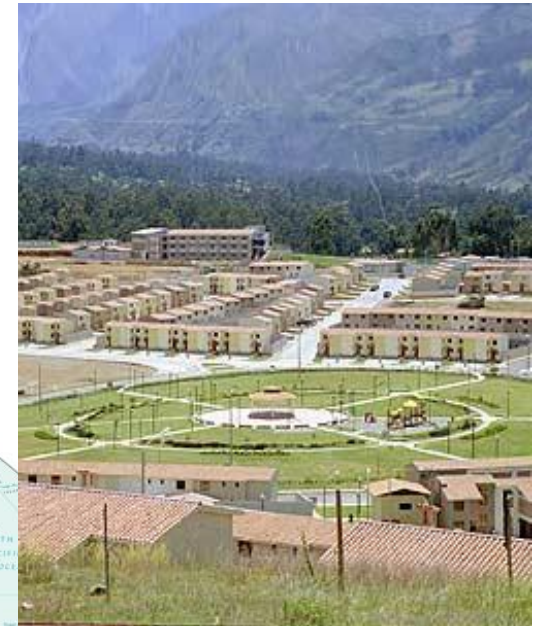
How is infrastructure provided?	
Who receives it?	Miners only
What is provided?	Camp accommodations, basic infrastructure, food in mess hall-type setting, health facility, recreation facilities (sometimes)



What has international experience shown about the gated community model?

How is infrastructure provided?

Who receives it?	Miners and families
What is provided?	Housing, basic infrastructure, health and education facilities, recreation and leisure facilities



In the year 2000, El Pinar was built next to the city of Huaraz to house workers and their families of the Antamina mine. El Pinar consists of 276 homes. Miners pay a small monthly rent for housing which is built and maintained by the mining company. The mining company also provides electricity, drinking water and sewerage service as well as healthcare and school facilities.

Antamina

Pierina

Escondida

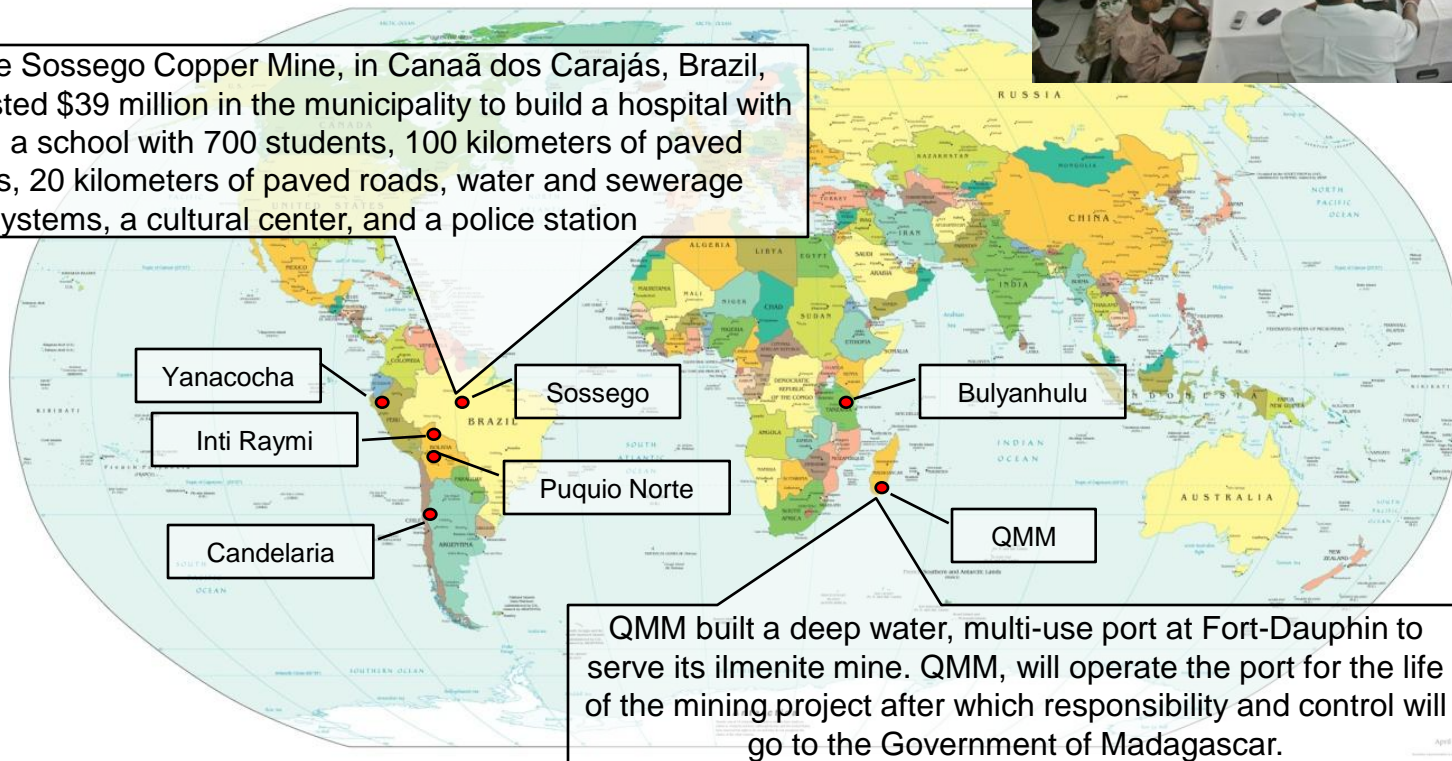
The Escondida Mining Company constructed four housing complexes for workers and their families situated in different locations in Antofagasta.

What has international experience shown about the integrated community model?

How is infrastructure provided?	
Who receives it?	Varies
What is provided?	Depends on existing infrastructure. Can include any combination of: housing (for miners and families), basic infrastructure, health and education facilities, recreation and leisure facilities



Around the Sossego Copper Mine, in Canaã dos Carajás, Brazil, CVRD invested \$39 million in the municipality to build a hospital with 40 beds, a school with 700 students, 100 kilometers of paved highways, 20 kilometers of paved roads, water and sewerage systems, a cultural center, and a police station



QMM built a deep water, multi-use port at Fort-Dauphin to serve its ilmenite mine. QMM, will operate the port for the life of the mining project after which responsibility and control will go to the Government of Madagascar.

What is the impact of the four models?

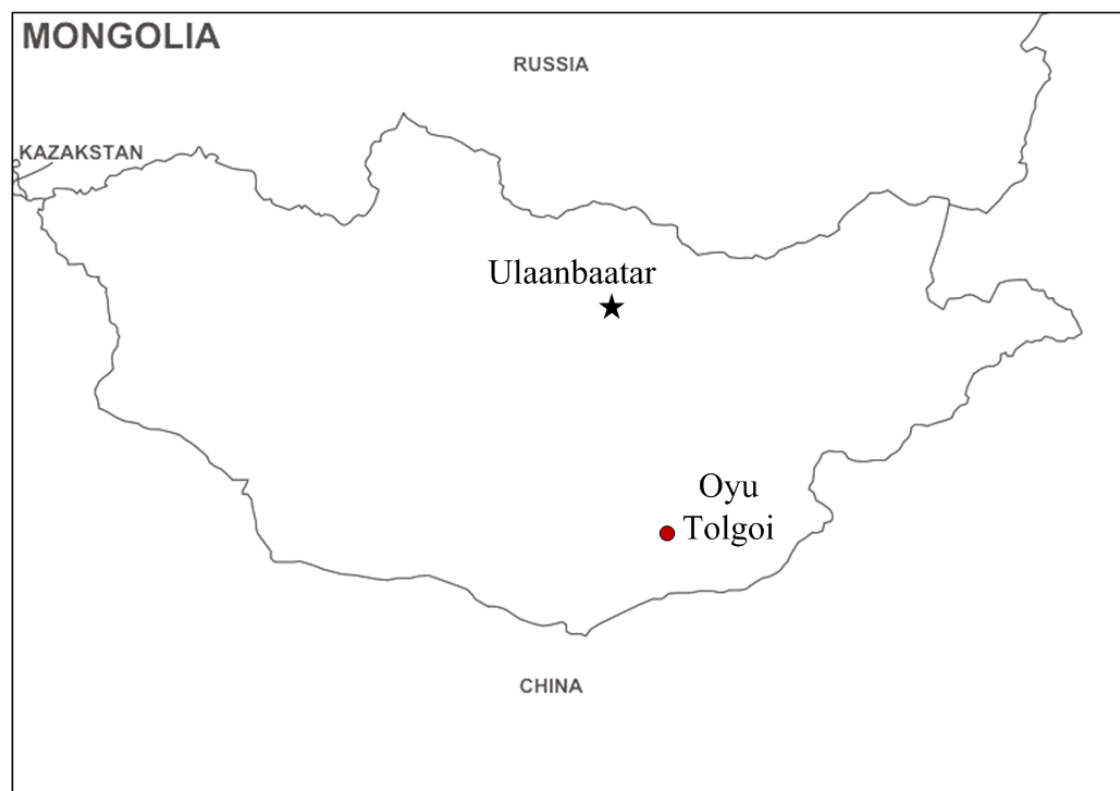
		Company Town	FIFO	Gated Community	Integrated Community
Influx	Level	High	Low	Moderate to High	Low to High
	Growth rate	>10%	<0%	2-3%	1-26% (2.5% median)
Financial	Cost	High	Low	Moderate	Depends
	Explanation	High CAPEX	Low CAPEX, but high transport costs	Moderate CAPEX	Existing infrastructure affects cost
Economic		Lower mining royalties because of higher upfront investment in infrastructure	Overall welfare gains if money saved by mining company transfers into royalty payments for government	Government royalties depend on how much infrastructure expenditures the mining company must make	Higher royalties if mining company saves money it would otherwise spend on infrastructure costs
Social		Improved health because of family-centered housing, but more impact on surroundings	Residential living flexibility for workers, but increased risk of family dysfunction and parenting problems	Health benefits for workers and their families, but possible social tensions between mining population and existing population	Health benefits as workers live with families, but risk of social tension from cultural differences or income disparities between mine workers and existing populations
Sustainability		High dependence on mine leads to few alternative employment opportunities when mine closes	Limited cultural, environmental, and economic impact locally; No direct jobs or infrastructure for local community around the mine site	Limited cultural, environmental, and economic impact on local areas	Infrastructure and job benefits for local community

What recruitment and settlement models are mining companies likely to use in South Gobi?

Ivanhoe Mines Oyu Tolgoi

Model: Hybrid of integrated community and FIFO*

Recruitment	Settlement
Local (hired in Khanbogd)	Based in Khanbogd and commute daily to site
Regional	<ul style="list-style-type: none"> •75 percent maintain current residence in South Gobi town, bus-in, bus-out (BIBO) •25 percent will relocate to Khanbogd
Other regions (including Ulaanbaatar)	<ul style="list-style-type: none"> •25 percent relocate to Khanbogd •70 percent based in a camp on site and FIFO to Ulaanbaatar •5 percent relocated to another South Gobi town
Expatriates	<ul style="list-style-type: none"> •20 percent of expatriates relocate to Khanbogd with their families •80 percent FIFO to designated country via Ulaanbaatar

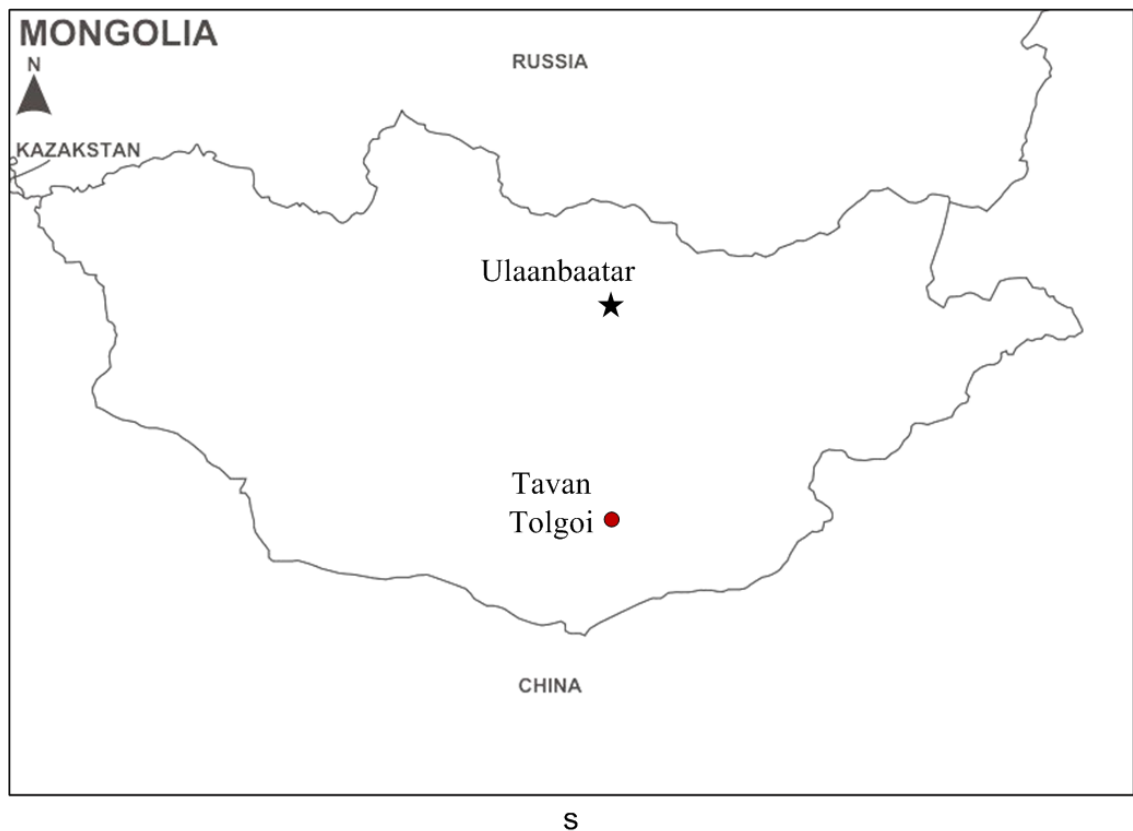


What recruitment and settlement models are mining companies likely to use in South Gobi?

**Energy Resources Mongolia
Tavan Tolgoi**

Model: Hybrid of gated community and FIFO evolving into integrated community

Recruitment	Settlement
500-600 workers	<p>Construction of a 1000 person camp roughly 1 km from the soum center of Tavan Tolgoi, and 7 km from Tsogttsetsii</p> <p>Workers FIFO from UB</p> <p>Camp accommodations: pre-fabricated, dormitory style housing with 24-hour electricity and water supply, heating, air conditioning, and indoor sewerage</p>
500 workers (predominantly drivers)	Live permanently in gers next to the prefabricated housing, but within the camp gates



Which international examples are like South Gobi?

Factor	Zouerate, Mauritania	Candelaria, Chile	Antamina, Peru	Pilbara, Australia	Sossego, Chile	Relevance to South Gobi:
Distance from large urban centers	Most	Moderate	Moderate	Most	Most	
Nearest local population	Most	Most	Most	Moderate	Most	
Climate	Most	Most	Least	Most	Moderate	
Availability of skilled labor	Most	Moderate	Most	Moderate	Moderate	
Income of local population	Most	Moderate	Moderate	Least	Most	
Availability of infrastructure and social services	Most	Least	Most	Most	Moderate	
Recruitment and Settlement Model	Company Town	Integrated Community	Gated Community	FIFO	Integrated Community	

What are the lessons for South Gobi?

- **What are the advantages of what has been proposed?**
 - **FIFO looks appropriate to minimize costs**
 - **Integrating with local towns helps avoid many social problems**

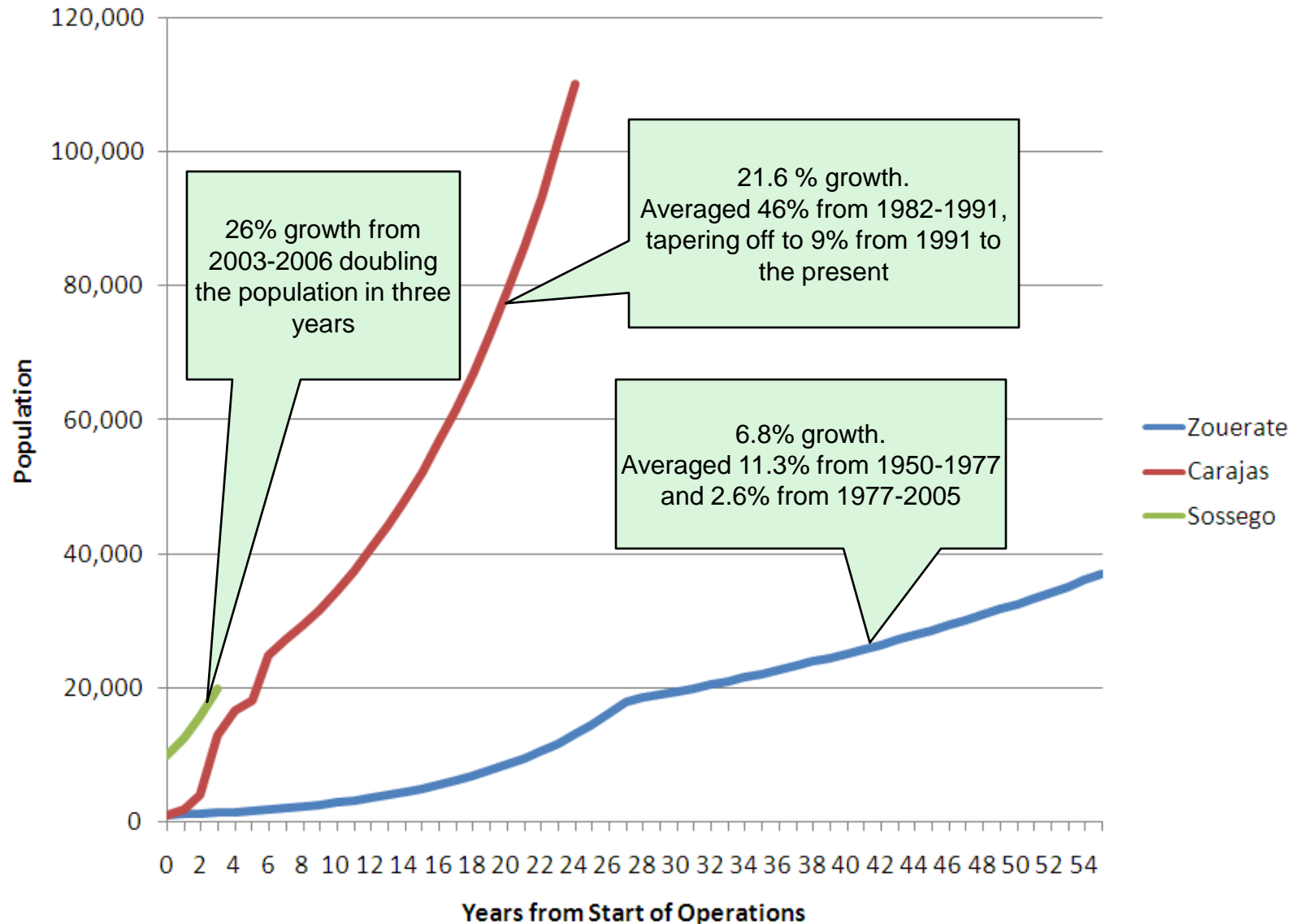
- **What are some possible areas of concern?**
 - **Risk of social tensions between miners and non-miners (especially in Tavan Tolgoi)**
 - **Risk of government or mining company not meeting expectations of what infrastructure is needed**

Your Feedback:
**What are governments' and local authorities
perceptions of the choice of model?**

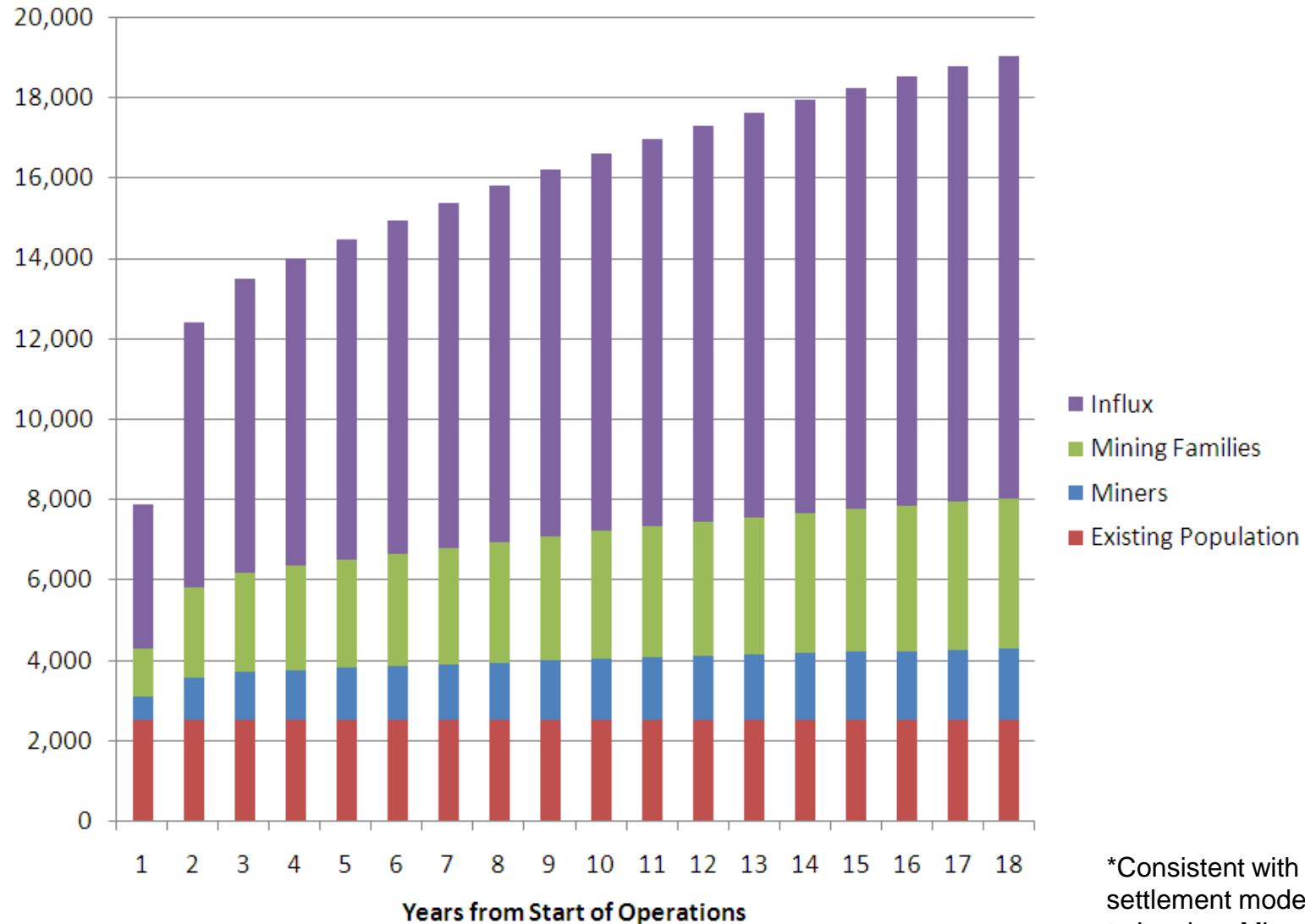
Overview of infrastructure costs and responsibilities

- **Scenarios for population growth**
- **Infrastructure requirements and capital costs**
- **Tariff implications for customers**
- **Who should:**
 - **Finance and pay for infrastructure**
 - **Plan infrastructure**
 - **Build and operate infrastructure**
- **Conclusions**

How did population grow in other mining areas (examples from our cases)?



How will population grow and how far out to plan? (Example: Khanbogd)



*Consistent with recruitment and settlement model recommended to Ivanhoe Mines

How much infrastructure will be needed: What are our assumptions? (Using Khanbogd Base Case as an example)

- ~20% population growth to 2020
- 40% of people live in gers; 60% in apartments
- Gers receive
 - Electricity service
 - Water service through standpipes
 - No other utility services
- Apartments receive all utility services (water, wastewater, electricity, heating)
- Population density of 7.44 people per hectare
- 4.2 people per family
- Investments are “large and lumpy”. No fractional investments in heating, generating, water pumping, and wastewater pumping below a certain increment of capacity
- Does not include infrastructure outside the town center (for example, highways, or new electric transmission line from Middle Gobi)

How much will buildings cost?

Buildings	How Many?		Per Unit	Total
Apartments	2,858	Apartments	\$ 78,868	\$ 225,403,601
Gers	1,905	Gers		\$ -
Schools	4,800	Students	\$ 1,317	\$ 6,321,600
Kindergartens	1,200	Children	\$ 2,677	\$ 3,212,400
Dormitory	400	Beds	\$ 2,388	\$ 955,200
Family Hospitals	700	persons/day	\$ 2,944	\$ 2,061,110
General Hospitals	180	beds	\$ 13,047	\$ 2,348,460
Polytechnic Schools	360	Students	\$ 12,739	\$ 4,586,069
Dining Places	800	Seats	\$ 2,554	\$ 2,042,827
Hotels	120	Beds	\$ 9,962	\$ 1,195,388
Grocery Stores	1,800	m2	\$ 334	\$ 601,513
Non-grocery store	2,800	m2	\$ 334	\$ 935,687
Office Buildings	1,429	jobs	\$ 6,055	\$ 8,652,471
Common Services	200	workers	\$ 74,855	\$ 14,970,991
Swimming Pools	1	Swimming Pools	\$ 106,936	\$ 106,936
Sports Centers	1	Sports Centers	\$ 668,348	\$ 668,348
Total				\$ 274,062,602

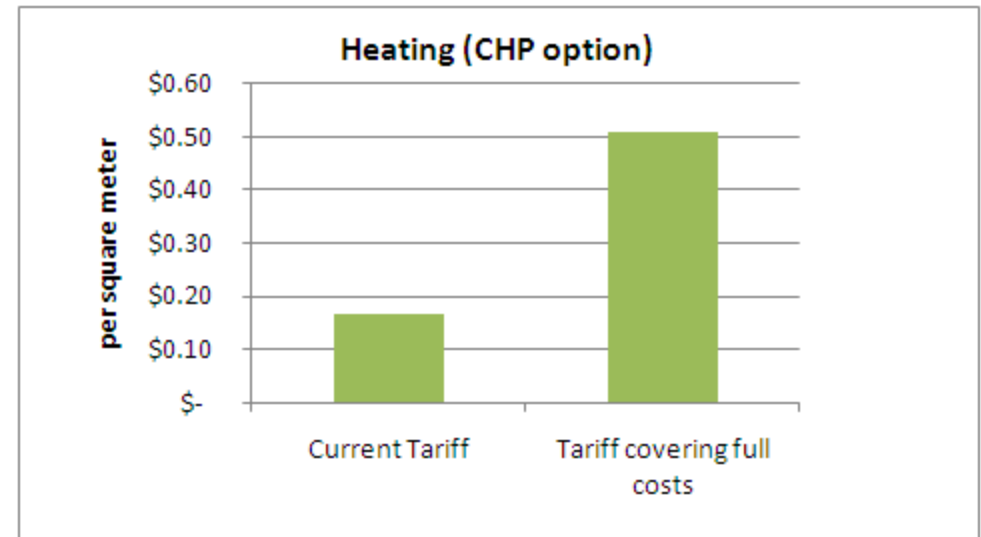
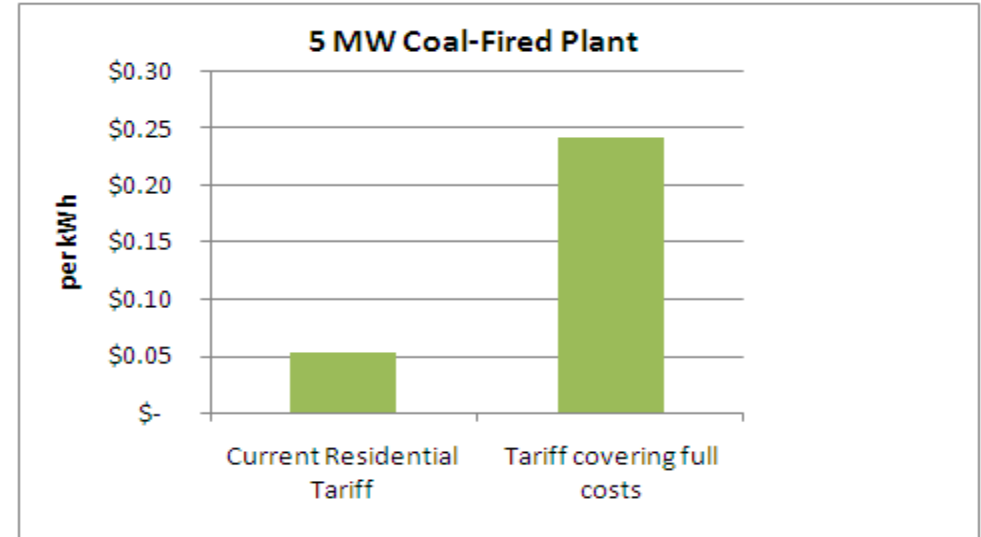
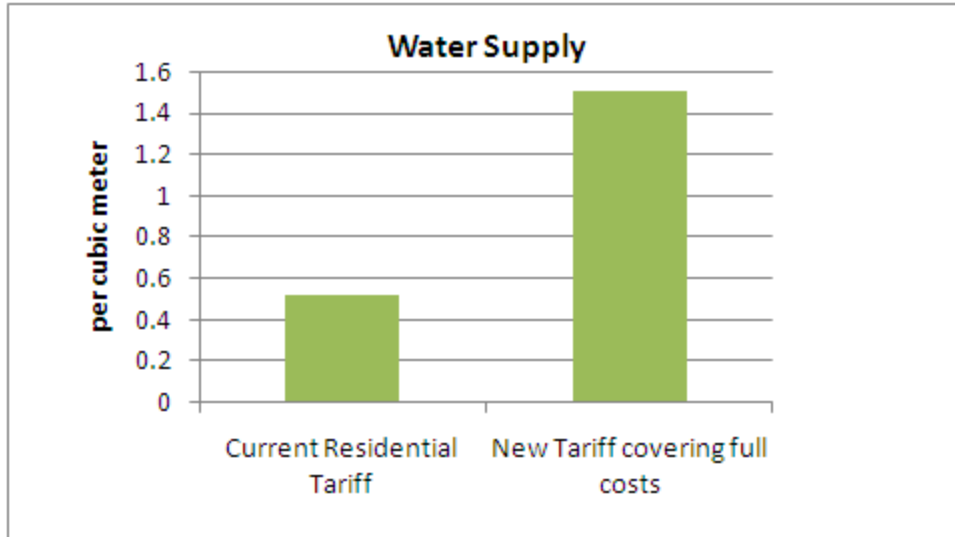
How much will water and sewerage cost?

	How Many?		Per Unit	Total
Potable Water				
Boreholes	15	Boreholes	\$ 8,696	\$ 130,435
Main Pipelines	1,715	m	\$ 87	\$ 149,131
Water meters	2,858	Water Meters	\$ 300	\$ 857,400
Water Ring Mains (100-200 mm)	7,429	m	\$ 52	\$ 387,600
Pump Station	20,000	liters/day	\$ 15	\$ 298,137
Reservoirs	3,000	cubic meters	\$ 145	\$ 434,783
Standpipes	9	Standpipes	\$ 39,130	\$ 352,174
<i>Total</i>				\$ 2,609,659
Waste Water				
Pipelines (150-500 mm)	4,286	m	\$ 130	\$ 559,044
Pump Station	1	Pump Station	\$ 52,174	\$ 52,174
Treatment Facility (12,000 m ³ /day)	1	Treatment Facility	\$ 5,217,391	\$ 5,217,391
<i>Total</i>				\$ 5,828,609

How much will electricity, heat and roads cost?

	How Many?		Per Unit	Total
Electricity: Individual Power Generation				
Coal Plant (5 MW CHP)	1	Plants	\$ 8,000,000	\$ 8,000,000
Substation (2,500 kva)	2	Substations	\$ 349,695	\$ 699,389
Distribution Lines (10kV)	45,715	m	\$ 16	\$ 712,925
Distribution Network (0.4 kV)	228,572	m	\$ 9	\$ 2,109,720
<i>Total</i>				\$ 11,522,034
Heat Distribution				
Main Pipelines (820 mm)	11,429	m	\$ 345	\$ 3,943,005
Distribution Pipelines (100-300 mm)	17,143	m	\$ 177	\$ 3,030,584
Distribution Stations (50 Gcal/station)	4	Stations	\$ 3,000,000	\$ 12,000,000
Plate Heat Exchangers	43	Heat Exchangers	\$ 30,000	\$ 1,290,000
<i>Total</i>				\$ 20,263,589
Roads	5,406	m	\$ 198	\$ 1,070,456
<i>Total</i>				\$ 1,070,456
Total (water, sewerage, electricity, heat, roads)				\$ 41,294,346

What are the cost implication for customers?

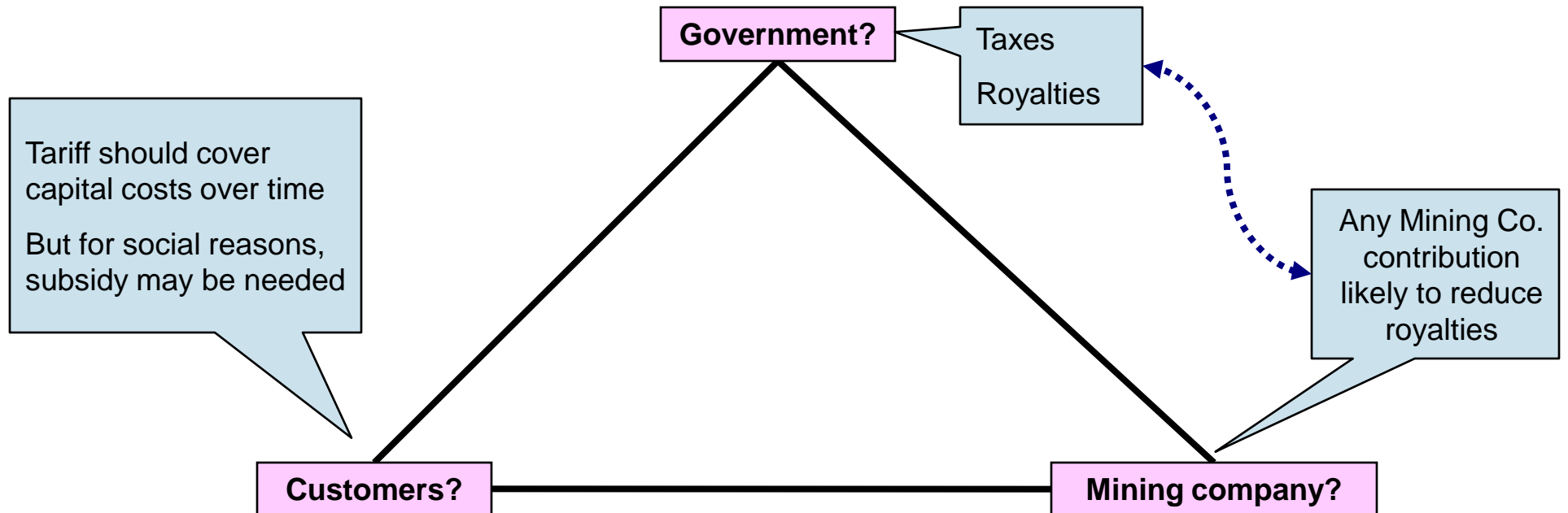


Assumes :

- 10% opportunity cost of capital (roughly equivalent to Mongolian Government Bond return)
- 20 year asset lives
- Exchange rate: 1150 MNT/USD

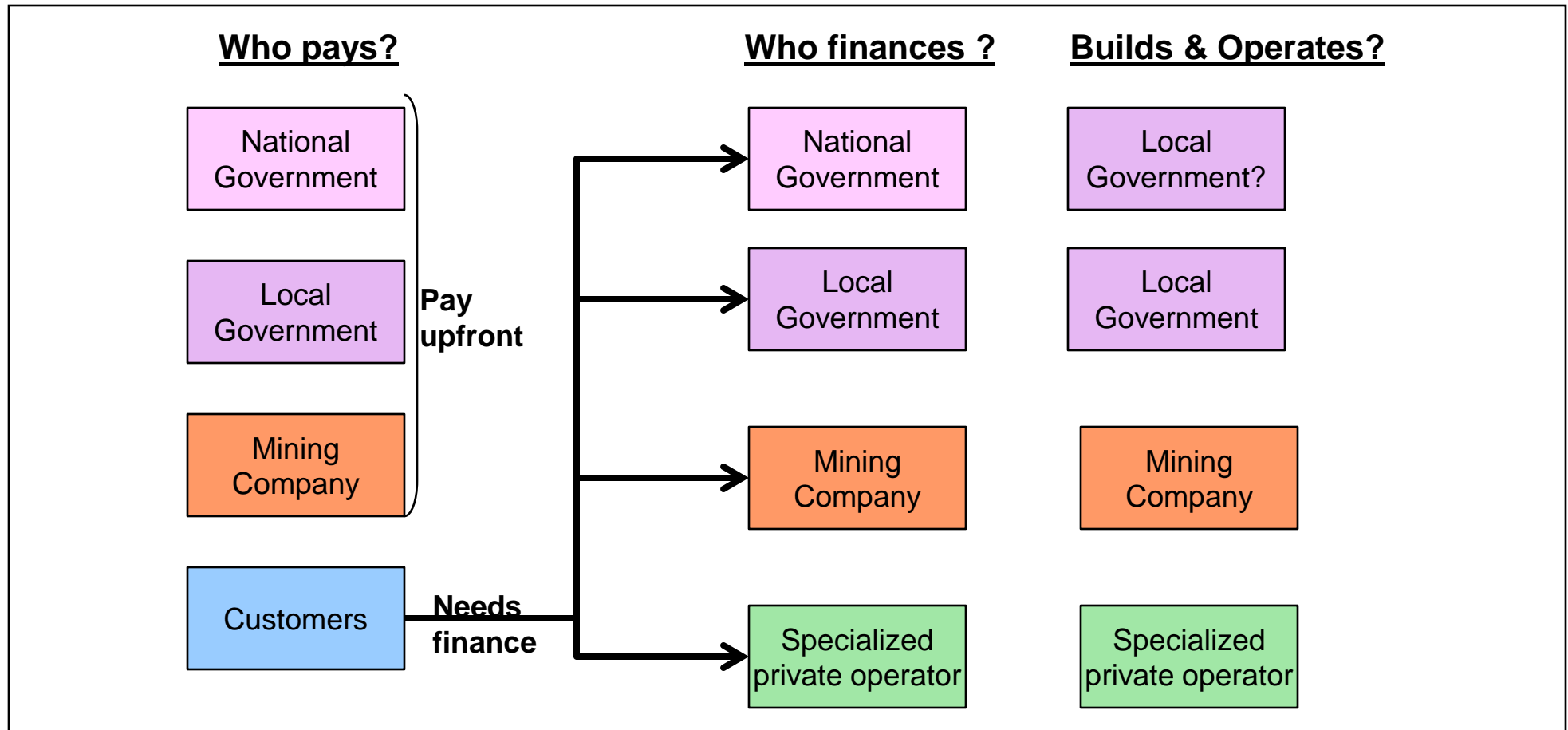
Who will pay?

- Customers should pay at least operations and maintenance costs, to promote sustainability and reduce waste
- Customers can pay capital costs in tariffs (initial capital expenditure financed through borrowing, then repaid from tariff revenue)
- If this creates a tariff that is too high, government will need to subsidize



Who pays, who finances, who builds and operates the infrastructure?

- Traditional approach—Government or Mine Company pays for the infrastructure at the start
- Alternative approach—Government or a Company *finances* the infrastructure, meaning they get their money back (with interest or profit) from the tariffs paid by customers



Choosing who finances infrastructure

	Advantages	Disadvantages
National Government	Simple, low cost	Remote from local needs May not have enough money
Aimag or Soum	Knows the local situation Accountable to local people	Does not have the money
Mining Company	Can raise the money Can move quickly Natural interest in getting infrastructure working	Interested in own workers, not the rest of the community Not specialized in infrastructure Additional costs imposed on mining company will reduce royalties, taxes etc. for government
Specialized Private Operator	Strong incentives to operate well and minimize lifetime costs	More complicated Higher financing costs Can be hard to attract good operator

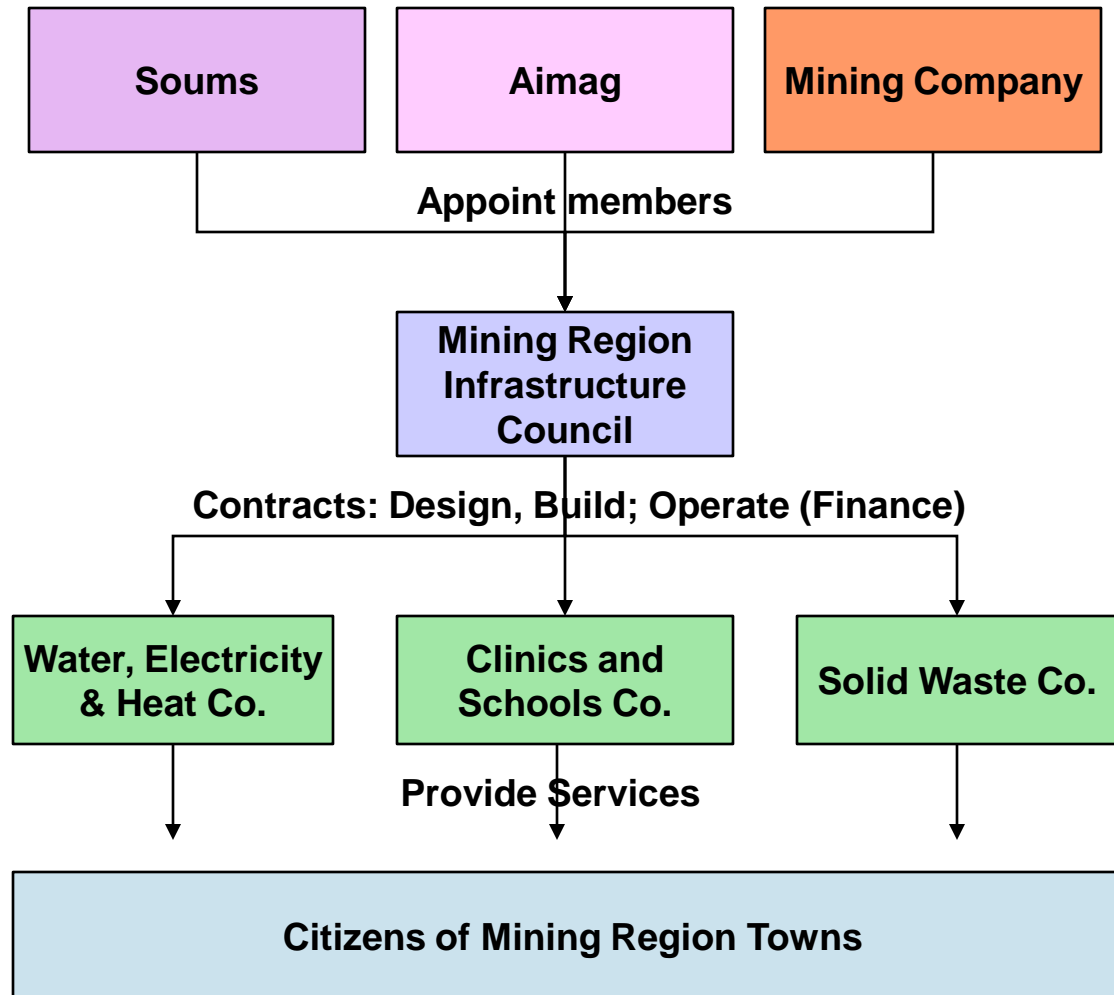
Choosing who plans and controls the infrastructure

	Advantages	Disadvantages
National Government	Highest capacity Good on national infrastructure like highways, railways, transmission	Remote from local needs
Aimag	Can coordinate development of several mines, several towns, and the links between them	Lack of capacity Still too remote from some local needs
Soum	Knows the local situation Accountable to local people	Lacks capacity Cannot coordinate No economies of scale
Mining Company	Natural interest in getting infrastructure working	Interested in own workers, not the rest of the community Not specialized in infrastructure
Regional Infrastructure Council	Can combine all above stakeholders Good for coordination	More complicated

Choosing who builds and operates infrastructure

	Advantages	Disadvantages
National Government	Has scale and capacity for large infrastructure	Government not good at business Remote from local area
Aimag / Soum / PUSO	Current arrangements Simple Accountable to local people	Lacks specialized skills Hard to hold accountable for performance May lack economies of scale
Mining Company	Natural interest in getting infrastructure working Generally well-organized	Interested in own workers, not the rest of the community Not specialized in infrastructure
Specialized Private Operator	Strong incentives to operate well and minimize lifetime costs Can be held accountable under a contract Removes direct political control	More complicated Can be hard to attract good operator Removes direct political control

Putting it all together – an option to consider



Conclusions—Settlement model and population growth

- **The recruitment and settlement model most attractive for large mines will be a mix of the “integrated community” model and FIFO**
- **Government can maximize royalties and growth of mining industry by letting the mining companies choose the most financially attractive model**
- **Mixed FIFO and integrated communities should reduce social tensions (compared to a single company town) and promote balanced regional development**
- **We expect population will have grown at least 18,000 in Khanbogd by year [number] of operations**
- **10,000 of this will be influx**
- **Where similar recruitment and settlement models are used, population growth will be similar**

Conclusions—Finance and Responsibilities

- **Growth around Tavan Tolgoi and Oyu Tolgoi alone could require at least 50 million USD of capital expenditure**

- **Who should pay for infrastructure?**
 - **We recommend customers pay, but...**
 - **With subsidies to cover some portion of capital costs**

- **Who should plan infrastructure?**
 - **Soum?**
 - **Aimag?**
 - **Mining Company?**
 - **Joint council?**

- **Who should build operate (and finance) the infrastructure?**
 - **We suggest the Government consider a specialized private operator**
 - **This means private operator might also finance some services**
 - **Government will have to pay for others (e.g. roads) up front**