Economics/Development

"Pay" is 7.5 pounds of bread per day or equivalent. A man needs one pound per day unless the labor is hard. A "bushel" is 60 pounds of grain. A farmer averages 10 bushels per acre of yield and pays one third in taxes to the Réjé and local lord (usually 20% Réjé, 10% local lord, 3% provincial count). A typical family of 6 needs to plant 6 acres to feed itself, 2 acres to pay the Réjé, and 2 acres more to be sure of adequate food; 10 acres total.

Wages are 1.25 dhanay per day, year 1. Food for a family wholesales at 420 dhanay per year; 140 per adult and about 70 per child. By year 20, wages are 5-10 dhanay per day depending on skill, up to 15 dhanay per day for white collar trained professionals.

A brick-making family in India of 5 adults makes $2 a day total making about 350 bricks (they are paid $5.50 per thousand bricks). This is good pay, too. They work 14 hours a day. India has 30 million construction jobs (that's got to be 5% of the workforce). A kiln consumes 200 tonnes of coal per million bricks made.

Nineteenth century US west: The twenty mule team (18 mules and two horses) pulled a train of three wagons, each 16 feet/4.9 m long, 6 feet/1.8 m wide, 3,500 kg mass, loaded with 9,000 kg of freight; total mass of the three, 33.2 tonnes. They traveled 17 miles/ per day. The wagon train and mule team stretched 180 feet/55 m.

Year "0": 250,000 people, 45,000 households; household income, 900 dhanay; GDP, 40,000,000 dhanay. Adult literacy: 0.1%

Year 10: 320,000 people, 60,000 households; household income, 1500 dhanay; GDP, 90,000,000 dhanay. Adult Literacy: 15%

Year 15 (real): 379,000 people, 72,000 households, income 2,100 dhanay; GDP, 151.6 million dhanay; palace income, 31 million dhanay

Year 17: 390,000 people, 75,000 households; household income, 2,500 dhanay; GDP, 190,000,000 dhanay. Adult literacy: 30%

Year 20: 435,000 people; 83,000 households; household income, 3,250 dhanay; GDP, 271,000,000 dhanay

Year 22: 475,000 people, 88,000 households; household income, 3,300 dhanay; GDP, 290,400,000 dhanay

Year 23: 490,000 people, 91,000 households; household income, 3,500 dhanay; GDP, 318,500,000 dhanay Adult literacy 50%

Year 24: 504,000 people; 98,000 households; household income 3,600 dhanay; GDP,

352,800,000 dhanay
Year 25: 520,000 people; 110,000 households; household income 3,900 dhanay; GDP, 430,000,000 dhanay

Note: Top 5% of population earns 15-20% of total income, so median income is 15-20% less. Bottom 5% earns 2% of income. [Year 25; 5% of 500,000 people and 400 million dhanay is 25,000 people (6,000 households) and 80 million dhanay, or 13,000 dhanay per household (not that much).

Year 21: Mennea family 15.7 million dhanay of assets, but retain 4.8 million (10.9 belongs to charities); income 1,000,000 for charities, 500,000 for them. They own 3 million shares of utilities. Kérékwɛs clan earns 4 million per year from agriculture, 1 million from investments. 60 Old Houses: rarely earn more than 25,000 per year (if they average 20,000, that's 1.2 million). Miller clan: 1,000,000 profits per year. Mitrudatu of Ora: 500,000/year. Lord Albanu of Néfa: 500,000. Kandékwɛs, Roktɛkɛstɛr, Gurwɛkɛstɛr, Aryékwɛs, Dumuzi: 250,000/year. Estoyaju: 100,000/yr. TOTAL income of the super-wealthy: 11 million/yr.

Mɛlwika Population:

2,000: autumn, year 3/621 (vol. 5, 28)
2,600: autumn, year 3/621 (vol. 5, 112)
2,749: Naw-Ruz, year 4/622 (vol. 5, 423; "2800" on p. 244)
4,000: Ridván, Year 5/623 (vol. 7, 232)
6,000: autumn, year 6/624? At that point, bigger than Néfa, Tripola, Bɛllɛdha, Isurdhuna!
6,000 adults, 3,000 little kids, autumn, year 7
12,000: autumn, year 8/626 (2,600 households)
14,500: spring, year 10/11
16,000: spring, yr 11/12.
20,500: spring, yr. 16
25,000: spring, yr. 18
28,000: spring, yr. 21
31,000: spring, yr. 23
Population grows by almost 10% per year, mostly natural increase, for next seven years. All cities grow an average of 50-75% in next seven years.

Employment in Mɛlwika (summer yr 33) (**bold, autumn yr 4**)
Mennea Tomu Companies:

Widows/Catering	7	
Hospital	5	**9**
Professors	9	
University Staff		**3**
Household	2	
Rover Drivers	2	**3**

Chemical Plant	8	**15**
Explosives		
Telephone Manuf.	8	
Telephone Co.	3	**9**
Bookkeepers	3	**5**
Cleaning Staff	3	
Business Coord	1	
Rent Coord	1	
Co-op/Grange	3	**6**
TOTAL	52	**84**

Miller Tomu Companies:

Flour Mill	3	**10**
Grain Storage		**4**
Saw Mill	3	**12**
Product Development		**6**
Iron/Steel Making	10	
Wagon Chassis	5	
Steam Engines	5	
St. Wagon Ass'y	4	
St. Wag. Accessories	8	
Plow Manuf.	2	
Agri Equip		**10**
Keys, Knives, etc.	3	
Iron Stoves	4	
Steel Roller	4	
Turbines	3	
Generators	3	
Motors	4	**6**
Wire Manufacturing	3	**10**
Electrical Equip	3	
Electrical Controls	3	
Agricultural Equip	6	**12**
Icehouse/Stable	3	**6**
Warehousing		**4**
Construction	8	**30**
Gas Plant	6	
Mitru Transport	6	**40**
Garage/Repair	2	**8**
Bookkeepers	4	**7**
Managerial	4	**10**
Cleaning	6	
Security	3	
Springs & Small Parts		**5**
Cement and gravel		**5**

Wheelbarrows	**10** 20
Timber Cutters	**20**
MILLER TOTAL:	118 **299** **500 (yr 6)**

Photography	**4**
Watergas Lamps	**3**
Paint/dye	**4**
Matches	**4**
Explosives	**4**
Bank	**3**
Art/Wallpaper	**3**
Paper **& Printing**	3 **10**
Newspaper/Publishing	**3**
Glass	4 **8**
Leather	5
Furniture	8 **12**
Canvas	5 **12**
Shoes	3 **20**
Felt	4
Misc. blacksmithy	6 **10**
Plasters	3 **4**
Clothiers	6 **10**
Weavers	15
Creamery	**6**
Market stall workers	10 **15**
Potters	3 **6**
Quarry Workers	2 **4**
TOTAL	77 **169**

Teachers	5
City Workers	4 **6**
Road Construction	**20**
TOTAL	9 **31**

GRAND TOTAL 256 **336** (spring yr4) 583 (fall yr4)

Mɛlwika Revenues, end of Year 5:

2,000 households; 300 in Ménwika, 100 in Bolakra 100 in Dɛksawsupɛrakwa, 1,600 in Miller's side; 6,000 people; 400 farmers

Lord:	Réjé	City	Miller	Mennea	
Salary Tax [1600 x 450]	480000		200000	32000	8000

Harvest Tax	160000	67,500	1500	12000 [400 x 600]	
Tax on Foundry workers x 1300 dh]	430000	184000	36000	[500	
New Knowl tax	196000				
TOTAL	1213000	451500	69500	20000	
Land rent:			50000		
Lot purchase				20000 [Menwika lots $$]	
Land mortgage				60000	
Grange Fee					60000
Génadɛma tuition [650 dh x 250 students]					162500
Hospital income [20 beds x 1200 dh]					24000

Note: end of year 3/early year 4, Mɛlwika total tax to Réjé and Lords was 500,000 dh; that was before the salary tax, before the city and Lords got much, and when the city had half the population of year late 5.

1st harvest, Year 6: “80,000 bɛrwoni at 14 dhanay per bɛrwoni. . . that’s . . . 1,120,000 dhanay, 124,000 more than expected.” “And sales of vegetables, flax, and other products so far have been 750,000,” added Kérdu. “So total taxes paid have been 623,000 dhanay, 415,000 to the crown, 173,000 to the city, and 35,000 to you. Mortgage fees have been 187,500 and grange fees the same. If the second crop of wheat is equally bountiful and the sales of vegetables and other agricultural products stay about the same, all these figures will double.” Vol. 9. p. 156.

Note: According to “Furlong” (Wikipedia article) one ox could plow one acre in one day and usually 15 per “season.” A furlong is 660 feet or 201 meters (1/8 mile exactly; about 1/5 km) and represents the distance an ox could plow before it had to rest. Typical fields were laid out 1 furlong long and 4 rods (16.5 feet per rod) wide, the area equaling exactly one acre. Chicago, Salt Lake City, and Phoenix lay out major streets one per furlong and allocate 800 numbers per mile (100 per furlong).

Year 10: Mennea family income (company profits are only partially theirs):
Mɛlwika farm land: 9000 agris (18,000 dh tax and 72,000 dh mortage; both per harvest)
Lower Arjakwés townships (5): 5,000 agris (10,000 dh tax and 40,000 dh mortgage per harv.)
Swadlɛndha: 6,000 agris (24,000 dh mortgage per harvest)
Pértatranisér: 10,000 agris (20,000 dh tax per harvest)
Pértatranisér: 5,000 agris of tropical forest plantation (250,000 dh income per year eventually, but 1/3 is profit; 20,000 profit, yr 10)
Ménwika lot mortgages: 50,000
Telephone company: 500,000 dh per year cash flow, year 10; employees, 125; no profit
Electric company: 1,000,000 dh per year cash flow, year 10 [average household spends 10 dh per year {for 500 kw/hr total, about 1.25 per day}; 5,000 households with power;

industrial demand for power is more than half of total]; employees, 300; no profit
Gas company: 250,000 dh per year cash flow, year 10; employees, 20; profit 10,000 dh only (1/2 Mennea)
Chemical and plastics company: 200,000 dh per year cash flow, yr 10; employees, 30; profit, 20,000 dh (1/3 Mennea)
Radio: 10 employees, 100,000 dh cash flow; 25,000 dh profit (40% Mennea)
Phonograph: 15 employees, 75,000 dh cash flow; 5,000 dh profit (60% Mennea)
Paper production: 600,000 dh per year cash flow; 100 employees; 75,000 dh profit (10 % Mennea)
Book production: 200,000 dh per year cash flow; 40 employees; 15,000 dh profit (1/3 Mennea)
Glass production: 50,000 dh per year cash flow; 10 employees; 5,000 dh profit (20% Mennea)
Assuming 20,000 dhanay profit from the Pért. plantation and 30-50% profit of the businesses and 2-3 harvests, Year 10 income is: 524,000 dh

Year 11: Add the following:
Mɛlita: 24,000 agris (192,000 mortgage, 48,000 taxes per harvest)[assuming 100 dh of crop per agri per harvest]
South Ménwika, 5,000 agris (40,000 mortgage, 10,000 tax per harvest)
Mɛlwika: 1,000 agris less mortgage (8,000)
Pértatranisér: 20,000 more profit on tropical forest
Year 11 income: 1,236,000

Year 14, fall: Mennea income expenses in vol. 19, pages 4-10.

Year 10: Estate lord system is set up for lower Arjakwés. Each agri of land is assumed to produce 100 dhanay per harvest. It pays: 33.3 dhanay taxes; 22.2 to Réjé, who remits 5 to the estate lord; 11.1 to Chris, who keeps 1, gives 2 to the estate lord, and 8.1 to the City Council. In addition, 8.33 dhanay are paid in mortgage, 6.33 to Chris, 2.00 to estate lord. Grange fee is 8.33 more. This yields:

17.22	tax to Réjé (later: 14.22 to Réjé, 3 to Count of Swadnoma)
7	tax to Estate Lord
2	mortgage to Estate Lord
6.33	mortgage to Chris
1	tax to Chris
8.11	tax to City Council
8.33	Grange fee

Total: 50

Note: income other than taxes is taxable at 23%

City expenses, year 5:
Construction of high school: 100,000 đ (16 classrooms, auditorium, library)

Student tuition:	100,000 đ (1000 elementary thru adult ed, 100 dh)
Day care subsidy:	65,000 đ (1000 small kids x 1 dh/wk)
Police:	30,000 đ
Fire	25,000 đ
Hospital	10,000 đ
Administration	20,000 đ
Sewers, roads, etc:	50,000 đ
Heat, light, phone, maintenance	50,000 đ

Year 6: Same, except construction of elementary/middle school and expansion of high school. Schools must be built early in anticipation of baby boom!

Bɛllɛdha/North Shore: tax revenue, Year 5, described in vol. 8, p. 70. Déolu collects 65,000 from the entire province, 47,000 of which comes from the city. Queen's total take from province: 445,000.

Year 10 ("last year"), described early in vol. 15, p. 30. Déolu collects 60,000 from the province and 156,000 from the city. Queen's total take from province: 945,000.

Miller Tomu, Kaiménu 18/636

- Flour Mill & Grain Storage (Manusunu /Manu 1983)
- Timber and Saw Mill (Manu/Awsé 1976)
- Foundry and Tool Prod (Yimu/Awsé 1971)
- Miller Motors (Rostu/Marié 1986)
- Heavy Equipment and Tool (Estodatu/Marié 1984)
- Wire Manufacturing (Klusé/Kalé 1986)
- Electrical Equip (Andru/Kalé 1981)
- Warehousing (Awssajtu/Térmér 1992)
- Construction (Ménu/Awsé 1980)
- Mitru Transport (Mitru/Awsé 1987)
- Vehicle Sales and Repair (Tomasu/Marié 1998)
- Security (son/Yimu 1994)
- Home Improvement (Glosé/Marié 1982 &Sarédatu)
- Hotel (Awsé)
- Hunting (Blésku/Awsé 1985)
- Amusement Park Rides (Primu/Yimu 1992)
- Icehouse, stable (Tritu/Marié 1977)
- Cement and gravel (Déru/Awsé 1990)
- Mɛlwika Opera House
- Mɛlwika soccer team

Note: in 620, the fight among the sons was the sons of Marié versus the others

Tomu Board in Kaiménu 18/636 consists of John, Déru, Yimu, Rostu, Ménu, Mitru, Glosé, Chris, Dumuzi

North Shore Tomu Board in 18/636 consists of Chris, Déolu, Dontu, Spondanu, Kwɛnéstu, Sulubaru, Ekwɛgéndu, Lubéstu (stayed away during troubles)

North Shore Tomu Board, 19/637, consists of Ekwɛgéndu, Sulubaru, Kwɛnéstu, Duke Déolu, Wɛranaisu Tɛntɛr, Walu Agrimanu, Chris, Pukordu, Lubéstu

Telephone, Electric, Blue Gas, Biogas Companies:

Telephone Systems:

Each telephone: 100 dhanay
Switchboard: 1,000 dhanay (including station), can handle 900 switches
Wire: 200 dhanay/km
Poles: 3 dhanay each (12/km, thus 36 dhanay/km) [note: AT&T used 20/mi, which is the same]
Operator: 500-800 dhanay/yr (by year 16, this has doubled)
Technician: 800-1200 dhanay/yr (by year 16, this has doubled)

Assume the system has 100 subscribers; fixed costs are 13 dhanay/yr

If a typical phone requires 500 meters of wire, wire costs are about 100 dhanay, but a typical phone is on a 4-party line, so it's 25 dhanay each; assume 25 dhanay more each to set up the wires and poles; with 100 dhanay to make the telephone, total fixed costs are about 150 dhanay per phone

At 1 dhanay per week (65 per year) the system pays for construction and ongoing costs in 3 years and then makes a profit. Long distance charges are 1 dhanay per fifteen minutes per day or 4 dhanay per day unlimited.

Mɛlwika to Mɛddoakwés: 16 kilometers, costs 3,200 dhanay for poles/wires and 800 dhanay for one interconnections; 4,000 dhanay total (though poles are already there for power system).

The new wire pricing (after the copper mine):

Copper is fifty dhanay per hundred lɛdhi (=600 kg, or 745 dhanay per cubic meter at 8940 kg/m3).

Telephone wiring: assume four-ply wires require an average of 1 mm thickness; 1 m3 = 1,000 km of wire, but insulation adds a lot to the cost.

Electric transmission wiring: assume two 5mm thick wires, but no insulation; 1 cubic meter = 8 km wire (4 km for two such wires). Thus copper cost is 186 dhanay/km. With cost of conversion to wire, it's about 200 dhanay/km

[Note: the above calculation is for 1,100 kg of wire per kilometer, but AT&T's first transcontinental system had 870 lbs or 400 kg/mi, which is 240 kg/km AT&T's system cost $2,000,000 for 6,800 miles, including all equipment; that's $300/mi or $200/km]

Telephone/electric lines cost 300 dhanay per kilometer to set up (wires, poles, stringing, testing).

Year 14: Telephone and electrical companies both have 4,000 km of lines, costing 1.2 million dhanay each

Town/Region	Households	Elecr.	Teleph	Cooking	Heating
Mɛlwika	3,000	2,400	500	2,000	1,000
Upper Arj.	1,000	700	100	600	300
Mɛddoakwés	2,500	1,800	500	1,500	700
Lower Arj.	2,000	1,000	200	800	200
Mɛlita	1,000	800	300	800	100
Swadnoma	1,000	500	500	400	0
Pɛnkakwés	1,000	500	100	0	0
Bɛllɛdha	800	500	150	500	300
Rest N. Shore	4,000	1,500	100	0	0
Jérnstisér	600	300	50	0	0
Néfa	1,000	700	150	500	100
Pértatranisér	1,000	800	180	600	100
Rest Rudhisér	4,000	3,000	300	300	0
Kɛrda	5,000	2,000	200	0	0
Ora	2,700	1,700	400	1,200	100
Rest Véspa	4,200	2,200	250	1,000	50
Lɛwéspa	2,200	1,600	250	1,000	400
Tripola	1,500	1,000	300	750	400
Rest S. Shore	4,000	2,000	200	1,500	1,000
Long Valley	2,000	500	100		
Gr. Kostɛkh.	700	100	50		
Gr. Gordha	1,000	400	50		
Kwolona	1,000	400	50		
Anartu	2,600	2,000	400		
Rest Sumilara	6,000	2,000	200		
TOTAL	55,800	30,400	5580	13,450	4,750
		30 dh/yr	80 dh/yr	32 dh/yr	150 dh/yr
TOTAL		900,000	446,400	430,400	712,500 dh

Telephone company: 500,000 dhanay, 100 employees. Switchboards (22): Mɛlwika, Mɛddoakwés, ɛjnopéla, Mɛlita, ɛndraidha, Tripola, Mɛddwoglubas, Ora, Pértatranisér, Néfa, Isurdhuna, Réjévika, Sumiupɛrakwa, Bɛllɛdha, Sullɛndha, Gordha, Mɛdhpéla, Kostɛkhéma, Anartu, Amurueqluma, Gadauru, Kalageduru, Galulia. Later (year 18 or 20), 12 more: NE Polar Basin, NW Polar Basin, SE Shore, SS Shore, S Véspa, N Véspa, N Rudhisér, S. Kɛrda, N. Kɛrda, Nuarjora, Arjdhura, Pékɛnwika.

Electric company: 1,500,000 dhanay including industrial demand; 300 employees; electric production is 45 million kilowatt-hours per year (25,000 kw on average)

Year 20: Electric demand is 1.5 million kw/hr per day (75,000 kw continual, 100,000 peak) at cost of đ15,000 per day or đ5,850,000 per year

Gas company: 3,000,000 đ per year cash flow (2/3, industrial use); employees, 200 (plus 700 wood cutters); total gas production, 157,365 m^3 (stoves) + 3,800,000 m^3 (heating) plus 10,000,000 m^3 (industrial), 3/14 đ (.214 đ) per cubic meter. Note: if Era, with 1/200 the population of France, consumed proportionally as much gas, it would consume 10 billion cubic feet per year, or 300 million cubic meters. India, with 3,000 times the population of Era, consumes 1.87 trillion cubic feet of gas per year (60 billion cubic meters); Era proportionally would consume 20 million.

One tonne of wood chips will produce about **2500m3 syngas**, 100kg carbon, 150-200kg wood tar

Biogas: A typical stove needs 200 liters of gas per day at 60% methane (120 liters/day of methane). It takes 0.5 kg of "volatile solids" to produce that much gas (which requires about 5 kg of manure). Methane has a heat content of 39 MJ/m^3 (120 liters is 0.12 m^3, so 120 liters has 4.7 MJ). One cubic meter of gas requires 41.7 kg of manure.

Fresh Manure Production (kg per day per 1000 kg liveweight)

Animal	Dairy	Beef	Veal	Pig	Sheep	Goat	Horse	Layer	Broiler	Turkey	Duck
Total	86	58	62	84	40	41	51	64	85	47	110
VS	10	7.2	2.3	8.5	9.2	Na	10	12	17	9.1	19

Ram, 1993 gives human waste as 3% VS, but no production figures.

For example a 60 kg pig will provide the 0.5 kg VS needed per day in 5 kg of manure. 15 litres of water must be added to this amount of solid to avoid scum formation (An et al, 1997), who also says 4-5 pigs are needed to provide the gas for a family of 4-5 (this may be because of dietry differences, decomposition of effluent outside the digester and difficulty in collecting all the manure).

Digester Size

Waste must be held in the digester for a period of time for digestion to occur, just how long depends on temperature. It is also worth considering that a longer retention time will release more of the potential gas, is likely to be more stable and does allow for future increases in demand (you can increase the loading rate a bit without fear of failure) BUT you do need a larger digester to hold the effluent long enough.

Temperature (°C)	Retention Time (days) minimum recommended

10	55
20	20
30	8

For 20° C operating temperature and a retention time of 20 days 20 litres per day input gives a design capacity of 400 litres.

As the digester needs to be 5 to 10 times longer than its diameter it is possible to come up with a range of suitable dimensions for this capacity, allowing at least 10% extra volume for the gas head space.

For 1:5 proportions Diameter = cube root (4 x Volume / 5 / pi) and for 1:10 proportions Diameter = cube root (4 x Volume / 10 / pi) and pi = 3.14 or 22/7
eg. For a volume of 440 litres (or 0.44 cubic metres) Diameter = 0.48 m, with a length of 2.4 m, to 0.37 m, with a length of 3.7 m. A larger digester will extract more gas, be more robust and allow some room for extra manure if necessary.

For any diameter of digester the required length can be found by Length = 4 x Volume / pi / Diameter squared. Knowing the Flat Width of a poly "tube" (which is half the circumference) Diameter = 2 x FlatWidth / pi

A unit for 100 households needs 40 cubic meters of volume (more for longer digestion and spare capacity) and 500 kg of inputs per day. It would produce 12 m^3 of methane per day. Another website says a 190 m^3 digester can produce 50 m^3 of gas per day (which roughly agrees). The digester is 5 meters in diameter and 9.7 meters high and produce 10 m^3 per day of effluent.

Note: 1000 BTU = 1.055 MJ; 1 ft^3 natural gas has 1,000 BTUs of energy = 1.055 MJ; 1 m^3 has 36 MJ; 1 therm = 100,000 BTUs = 105 MJ. 1 m^3 gas weighs 0.65 kg

A 640 ft^2 office heated for 55 days over winter with 1.3 cords wood. That's 305,000 BTUs per day; equivalent to 8.5 m^3 of gas/day. Wood is 7,000 BTU per lb and 2,500 lbs of seasoned wood per cord (45 lbs/day, 21 kg/day). Generating 8 m^3 of gas per day would require a 27 m^3 digester using 333 kg of stuff per day (but only 33 kg of "volatile solids," which compares favorably to 21 kg/day of wood when one recalls digesters produce 40% CO2). (I figure 1 kg of wood would make 0.4 m3 of gas at 100% conversion, but conversion is more like 75% efficient.)

Stoves need about 0.12 m^3/day; furnaces, 8-12 m^3/day, 67-100 times as much. So village digesters should be rated at 12 m^3/day (480 mj/day). Ten of them producing gas steadily for storage could heat the village all winter.

Pakistan: a 60 m^3/day gas plant employs two people full time. At 75% plant efficiency, it produces 48 m^3 per day. Purified, minus energy for purification and compression, it produces 21.6 m^2/day of compressible methane in a total of 4 cylinders (5.5 m^3 per cylinder, vol. 0.0215 m^3, 255 atms pressure, 3.5 kg mass of gas). Plant could produce 1,560 cylinders/yr, enough to heat 1,000 house-days (about 10 houses all winter). For Éra, operating cost is about 3,000 dhanay/year and houses cost 300 dhanay to heat in the winter. A larger plant that uses labor more efficiently is essential to make the system economic (costs probably need to be 100 dhanay/yr). The plant consumes 2.5 tonnes of manure per day. Dimensions: 2.5 m diameter, 12.5 m long.

Assume: village of 150 houses, 50 (50,000 m^3/winter total) with gas heat, 100 with gas stoves (5,000 m^3/year total). Adding 20% wastage, plant needs to make 66,000 m^3/yr or 172 m^3/day. It needs to store 30,000 m^3 for the winter (and make the rest during the winter). Cost: biogas plant, 5,000 đ; staffing and incidentals, 7000 đ; storage (4 x 20,000 đ, 8,000 m^3 tanks), 60,000 đ; amortization of plant and tanks over 5 years gives a cost of 20,000 đ /yr; total price of gas, 1/3 đ/m^3 (333 đ/yr for heating; still too high!). If the tanks last 10 years, annual cost drops to 14,000 đ (0.25 đ/m^3, 250 đ/yr for heating).

Cost to make the needed gas over the winter only: Production must be about 600 m^3/day and biogas production facility will cost 15,000 đ (spread over 5 years) and staffing plus will cost 10,000 đ/year; total cost, 13,000 đ/yr (.24 đ/m^3). Village needs 15 digesters, 1 during summer only. Village needs to use 25 tonnes of manure per day and must store up about 2,500 tonnes total (though probably 250-500 tonnes of straw instead). With grange labor in exchange for dues, farmers can pay for gas with labor, work more hours, and save cash. A subsidy from the Lord or crown would help immensely as well. The result will be much less tree cutting for firewood.

Gas Cylinder wikipedia article: LP5 cylinder, 12.25 inches diameter and 18.25 inches long, volume 21.7 liters/0.76 ft^3, empty weight 18.5 lbs. XG standard, 15 inches diameter, 56 inches long, 126.3 liters/4.46 ft^3 volume, empty mass 149 lbs. XG could hold 32 m^3 of gas. Assuming tank mass per cubic meter more than doubles as volume quadruples, a 500 m^3 tank (2 m^3) would mass about 400 kg. Eryan trucks can probably move tanks of 32m^3/4 tonnes mass and empty volume, able to hold 8,000 m^3 (about 5 tonnes) of methane, equal to 160 days production of a 50 m^3/day biogas plant. Small tanks should be sufficient in most cases.

My condo (1,000 ft^2) uses 5-6 therms per day in the winter for heating. The South Bend Bahá'í Center (1,500 ft^2, partially heated only) uses 2-3 therms per day in the winter.

Chicken manure biogas in Mississippi [NPR]: $250,000 unit produces enough biogas to eliminate an $8,000 per month energy bill and produce a small surplus. Assuming the production equals $9,000 of energy per month, that's about equal to the need for an entire village. Converting $250,000 to dhanay, it should be somewhere around đ10,000.

Pipelines: Cost to make a nickel-steel pipe 10 meters long and 10 centimeters in

diameter: 2 dhanay. Cost of burial: 1 dhanay. With administration, control structures, and incidentals, a gas pipeline costs 500 dhanay per kilometer. But . . . the first petroleum pipeline in Russia cost 15.7 million rubles (80 million dollars, 3 million dhanay) for 900 kilometers, or 3,500 dhanay per kilometer. A later pipeline cost 4.5 million rubles (22.5 million dollars, 900,000 dhanay) for 162 kilometers, or 6,000 dhanay per kilometer. I will assume gas pipes don't require pumps and compressors and cost 3,000 dhanay/km. Welding will be particularly important, because much of the coal gas is hydrogen.

Completed pipelines:
Melwika to Mɛddoakwés (16 km) 48,000 dh (yr 10)
Mɛddoakwés to ɛjnopéla (20 km) 60,000 dhanay (yr 11)
Néfa to Ora (60 km) 180,000 dh. (yr 12)
Ora to Tripola (90 km) 270,000 dh (yr. 12-13)
ɛjnopéla to Mɛlita (35 km) 105,000 dhanay (yr. 13)
ɛjnopéla to Nuarjora (45 km) 135,000 dhanay (yr. 13)
Anartu to Anarbala (20 km), 40,000 dh (yr. 15)
Mɛlita to ɛndraidha (45 km) 135,000 dh (yr. 15)
Anartu to Gadauru to Galulia (40 km) 120,000 dh (yr. 16)
Kɛrda valley (130 km) 390,000 dh (yr. 16-17)
ɛndraidha to Tripola (126 km) 378,000 dh (yr. 18-19)
TOTAL: 1,861,000 dhanay

Pipes inside cities plus storage tanks: 800,000 dhanay
Gas production plants: 1,200,000 dhanay

Future possibilities:
Tripola to Snékhpéla (40 km) 120,000 dh (yr. 19-20)
Bɛllɛdha to Yujdwoakwés (10 km) 30,000 dh (yr 19-20)
Manuagras to Bɛllɛdha to Klɛndɛdra (60 km) 180,000 dh.(yr. 20-21)
Anartu to Kalageduru (40 km) 120,000 dh (yr. 20-21)
Kalageduru to Amurueqluma (80 km) 240,000 dh (yr. 22)
Mɛlwika to Gorda, 85 km/255,000 dh (yr. 23-24)
Mɛlwika to Mɛdhpéla, 55 km/165,000 dh (yr. 23-24)
Yujdwoakwés to N. Kɛrda (90 km) 270,000 dh (yr 24-25) and Moruagras (90 km) 270,000 dh (yr. 25-26) and Réjéivika (10 km) 30,000 dh (yr. 26-27)
Manuagras to Arjdhura 105 km (315,000 dh) (yr. 25-26)
Klɛndɛdra to Néfa 110 km (330,000 dh) (yr. 26-27)
Moruagras to Géndonatroba 35 km (105,000 dh)
TOTAL: 2,370,000 dh

Electrical Production: 5,000 kw turbines and generators cost 20,000 đ; presumably 1,000 kw units are 5000 đ. Gordha dam cost 15,000 đ; transmission line, 10,000 đ. If the dam has four turbogenerators, total installed cost = 100,000 đ. Over ten years at 50%

capacity it will produce 18,720,000 kw-hr. If maintenance runs 10,000 đ/yr, in 10 yrs it adds 100,000 đ. Thus electricity costs 1 đ per 187 kw-hr. Charge 1 đ per 100 kw-hr or 1 kɛntay/kw-hr. If a 100-watt lightbulb lasts 1,000 hrs, it will use 1 đ of power, roughly equal to the cost of making it.

Washing Machine: 7.5 loads per week, 10 cents per kilowatt hour, uses $8/yr of electricity. That's 80 kilowatt-hrs per year for 390 loads or 0.2 kw/hr per load. 80 kw-hr/yr would be 0.8 dhanay.

Vacuum Cleaner: typical power demand is 1.5 kw (thus 70 hours of use equals 1 dhanay of electricity, and probably a typical household vacuum uses a dhanay a year).

Hydropower Generation:

Mɛlwika (2):	3,700 kw
Gordha:	27,500 kw
Isérakwés:	800 kw
Pɛnkakwés:	1,000 kw
Dhudhuba:	16,600 kw
Glugluba 1:	90,000 kw
Rudhisér:	10,500 kw
Tripola:	2,500 kw
Sumilara:	6,000 kw
Ghéslonɛ 1	50,000 kw
TOTAL:	208,600 kw

Bioplastic Production

Earth uses 300 million tonnes of plastics per year, or about 42 kg per person per year. To replace 250 million tonnes with bioplastics we would need to use 100 million hectares of farmland. Assuming Era uses the same amount per person, it would need to devote 7,000 hectares (about 20,000 agris; 90% of Mɛlita) to bioplastics production (mostly corn I think).

Sixty percent of plastic is used for packaging.

Animal Census

Eryan per capita consumption: chicken, 32 kg/yr; turkey, 5 kg/yr; pork, 20 kg/yr; mutton, 15 kg/yr; beef, 20 kg/yr.
For the entire kingdom (yr. 16, pop. 370,000): chicken, 12,000 tonnes; turkey, 1,800 tonnes; pork, 7,400 tonnes; mutton, 5550 tonnes; beef, 7,400 tonnes; total, 34,000 tonnes
Meat per animal: chicken, 1 kg; turkey, 8 kg; pork, 80 kg; mutton, 50 kg; beef, 500 kg
Meat animals in kingdom: 12,000,000 chickens; 200,000 turkeys; 28,800 pigs; 11,000

sheep; 30,000 cattle, but chickens and turkeys live 1/3 year, mammals 3/4 year
Manure per species: chicken, 60 t/day; turkey, 50 t/day; pig, 600t/day; sheep, 220 tonnes; cattle, 450 t/day; total 1380 t/day
Including horses, draught animals and dairy cattle, the number may rise to 2,000 or 2,500 per day. A typical village may have 200 kg/day

Timber Production

Assume an optimum yield of 300 tonnes/hectare in higher rainfall tropical areas and 150 tonnes/hectare in temperate and drier climates. Drowned forests yield half to one quarter as much, depending on water depth, tree height, and age.

Véspa: 50 km of shoreline, harvestable out 3 km; area, 150 km^2/15,000 hect; Yield, 100 tonnes/hect., or 1,500,000 tonnes total; lasts about 15 years total

Rudhisér: 60 km of shoreline, harvestable out 10 km; 600 km^2 area (60,000 hect); average yield, 75 tonnes/hect; total yield, 4,500,000 tonnes

Lɛwéspa: 30 km of shoreline, harvestable out 5 km; 150 km^2 area (15,000 hect); average yield, 75 tonnes/hect; total yield, 1,025,000 tonnes.

South Shore: 75 km shoreline, harvestable out 5 km; 375 km^2 area (37,500 hect); average yield, 40 tonnes/hect; total yield, 1,500,000 tonnes

Jernstisér: 40 km shoreline, harvestable out 5 km; 200 km^2 area (20,000 hect); average yield, 50 tonnes per hect; total yield, 1,000,000 tonnes

North Shore: 60 km shoreline, harvestable out 5 km; 300 km^2 area (30,000 hect); average yield, 35 tonnes/hect; total yield, 1,050,000 tonnes

Pɛnkakwés: 20 km shoreline, harvestable out 5 km; 200 km^2 area (10,000 hect); average yield, 50 tonnes/hect; total yield, 500,000 tonnes.

Sumilara: 190 km shoreline, harvestable out 5 km; 950 km^2 area (95,000 hect); average yield, 100 tonnes/hect; total yield, 9,500,000 tonnes

Total yield: 20,500,000 tonnes; enough to last about 60 years! Seafloor originally was 50% forest (=7,000 km^2); they are able to exploit less than 3,000 km^2 of it.

If forest yields an average of 20 tonnes/hectare/year, 360,000 tonnes per year requires 18,000 hect (180 km^2).

Timber production on land:

Western Shore: Forest belt is 160 km long (Jérnstisér through Lɛwéspa) and 10 km wide (1600 km^2). Properly managed, it can produce 8 tonnes/hect/yr (250 tonnes every 30 years) or 1,280,000 tonnes/yr.

Ghéslonɛ and Géndonɛ lands: 140 km by 40 km, 5,600 km^2; at 5 tonnes/hect/yr, can produce 2,800,000 tonnes/yr.

North Shore, South Shore, Penkakwés, Arjakwés: 160 km long, 25 km wide, 4,000 km^2; at 5 tonnes/hect/yr, 2,000,000 tonnes/yr

Eastern Slope: 140 km by 40 km, 5,600 km^2; at 3 tonnes/hect/yr, production is 1,620,000 tonnes/yr.

Total timber production on Éra: about 7,700,000 tonnes/yr on 16,800 km^2 (19% of world's surface)

On Earth, 3 billion cubic meters of wood is produced per year, about half for firewood. Of the 1.5 billion of "roundwood" 45% is used in construction, 25% fior pulp, 20% for plywood and fancy wood for furniture and small objects.

Laptops and PDAs

Media (laptops and PDAs all):

- Mɛlwika
- Mɛddoakwés
- Bɛllɛdha
- Néfa
- Ora
- Tripola
- Isurdhuna
- Anartu
- Kɛkanu/channel 1
- Channel 2

Hospitals:

- Mɛlwika (Lap)
- Mɛddoakwés (Lap)
- Bɛllɛdha (Lap)
- Néfa (Lap)
- Ora (Lap)
- Tripola (Lap)
- Isurdhuna (Lap)
- Anartu (Lap)

Gordha (PDA)
Mɛddwoglubas (Lap)
Pértatranisér (PDA)

Tax and Government records
Mɛddoakwés (Lap)
Bɛllɛdha (Lap)
Néfa (Lap)
Ora (Lap)
Tripola (Lap)
Isurdhuna (Lap)
Anartu (Lap)
Gordha (Lap)
Mɛddwoglubas (Lap)
ɛndraidha (Lap)
Réjévika (PDA)
Sullɛndha (PDA)
Gordha (PDA)
Mɛdhpéla (PDA)
Jérnstisér (PDA)
Morana (PDA)
Palace (4-Lap)(4-PDA)
Meteorology (Lap)

Génadɛmas:
Mɛlwika (2 Lap, 1 PDA)
Mɛddoakwés (2 Lap, 1 PDA)
Bɛllɛdha (PDA)
Néfa (2 PDAs)
Ora (2 Lap, 1 PDA)
Tripola (Lap, 1 PDA)
Isurdhuna (PDA)
Anartu (Lap, 1 PDA)
Gordha (PDA)
Mɛddwoglubas (PDA)
Pértatranisér (Lap)
Sullɛndha (PDA)
ɛndraidha (2 Lap, 2 PDAs)

Businesses:
Prosperity Bank (1 Lap, 10 PDAs)
Wiku Bank (1 Lap, 3 PDAs)
Royal Bank (1 Lap, 14 PDAs)
Mennea Tomu (2 Lap, 2 PDAs)
Miller Tomu (1 Lap, 3 PDAs)

Provincial Tomus (2 Lap, 2 PDAs)

Total: 53 laptops, 59 PDAs

Taxes and rents

The Réjé normally collects a third of the harvest as tax. Miller charges her ten percent for transport and grinding, so he pays thirty percent instead. (vol. 1)

A typical farmer plants 10 agris--3 hectares--of land every year with wheat and he harvests about 75 bɛrwonis--bushels--of grain. Each bushel weighs 5 lɛdhi and earns him about 12 dhanay if he sells it. He pays his taxes to the Réjé and the local Lord; 25 bɛrwonis. Some Lords charge another ten percent, or 7.5 bɛrwonis. The remaining 42.5 bɛrwonis will feed him, his wife, and three children, and leave about 7.5 bɛrwonis. If he sells it he'll get 90 dhanay, with which he can buy knives and other tools, cloth or cotton for making clothing, a pair of shoes, maybe a gift or two, and a few jugs of wine. (vol. 2, 130)

Volume 9: with guano, mechanization, irrigation, and experience, wheat harvests hit 20 bɛrwonis per agri. This is getting better than the 1914 US yield of 17 bushels per acre (which is about 15 bɛrwoni per agri).

I'll charge a third for the Rejé's taxes, 10% for my rent, and 10% more as payment toward their buying the land over twenty harvests (vol. 2, 151) Later reduced to 50% total for twenty harvests at two harvests per year. (vol. 2, 259)

In 1914: with horses only, an average bushel of wheat required 81 minutes of labor to produce; now it is less than 2 minutes. Since 1970, wheat yields per acre have gone from 0.5 tons to 1.0 tones. Rice yield has gone from 0.75 tons to about 4 tons. Corn yields have gone from 34 bushels/acre (x 60 = 2000 lbs) to 121 bushels (= 7260 lbs) because of hybridization. India currently uses 48 kg/hectare of fertilizer

1830: 100 bushels of wheat (5 acres) took 250-300 hours of labor with walking plow, brush harrow, hand broadcast, sickle, flail
1890: 100 bushels of wheat (5 acres) took 40-50 hours of labor with gang plow, seeder, harrow, thresher, wagons, horses
1930: 100 bushels of wheat (5 acres) took 15-20 hours

1850: 100 bushels of corn (2.5 acres) took 75-90 hours of labor with walking plow, harrow, hand planting
1890: 100 bushels of corn (2.5 acres) took 35-40 hours of labor
1930: 100 bushels of corn (2.5 acres) took 15-20 hours of labor

1818: Cotton yields, 300-1000 lbs/acre (depending on soil fertility), selling at 10-30 cent/lb (depending on demand)

Sugar cane produces 70-130 tonnes of mass per hectare and 8-20 tonnes of sugar per hectare (12-16%) (world average, 70). Sugar beets yield 42 tonnes mass per hectare and 7 tonnes of sugar per hectare. Brazil manages to make 870 gallons/acre of ethanol (8156 liters/hect) though they started with 375 gal/acre. Brazil averages 4000 liters/hectare/year. Assuming an average vehicle on Era needs 2,000 liters/yr, they can supply 2-4 vehicles per hectare of sugar cane. Two thousand vehicles need a thousand hectares initially. At a dontay per liter (5 cents/lit) the average vehicle needs 100 dhanay/year of alcohol. Assuming 1.5 cents per liter for the farmer, farmers make about 60-120 dhanay per hectare (20-40 dhanay per agri?) depending on yield and a farmer needs to raise 20-40 hectares to make a decent living.

Ethanol production begins, early year 15, when vehicles can use it. In yr 14, 2,000 agris planted.

Vehicle production: pickups first made, early year 11; 1,000 per year by year 12 at ₫2300/yr; 1400/yr at ₫1800 each, summer yr 13; 1500/yr, start yr 14; ₫999 steam car, early yr 18 (pickups down to ₫1,500?); vehicle production reached 3,000/yr, end of yr 20. Total vehicles by then, maybe 17,000? Sugarcane maybe 15,000 agris by then?

Busses cost ₫3,500, fall yr 14.

The dam we've designed will hold 400 thousand thousand cubic doli of water, which is roughly one year's flow of the Isérakwés. . . .The villages downstream are allocated water based on their population and the area they can irrigate. My numbers come from your tax records; Mɛgdhuna will get eight percent, the other five villages [along the Isérakwés] another thirty percent, Mɛddoakwés thirty percent, and the remaining twenty-two percent goes to the five villages downstream of the capital. [Ten percent for the spring flood.] Arjakwés: fifteen percent to a flood, twenty percent to the villages above Moritua, and sixty-five percent to Moritua; that fills it with twenty percent extra, which can be used by Morituora and Mɛddoakwés. (vol. 2, 252)

[New arrangement]: The palace agreed to collect two thirds as much grain tax in the form of steady flour, or twenty-two percent of the crop instead of thirty-three. (vol. 3, 69)

[Miller] had about 200 farmers working land he owned, mostly along the southern side of the Arjakwés. He had squeezed people more; he probably got 20,000 dhanay. He also had the foundry, grist mill, saw mill, and the grain storage silos. He was probably worth 30,000 or more. [vol. 3, 70]

It also gave Chris an insight into the wealth of lords like Gilran of Anartu, Kandékwɛs of Mɛddoakwés, or Mitru of Ora. All three had about 1,500 households in their central city

and 5,500 more households in their region. The average household had an income of about 900 dhanay a year, of which they paid 200 to the Réjé and 100 to the local Lord; in addition, as regional Lord they received about 10 dhanay from the 5,500 households. Of course, most of the "income" was just harvest, which they ate rather than sold. That meant Lords Gilran, Kandékwɛs, and Mitru had incomes of 200,000 dhanay per year. No wonder they could afford palaces, servants, fine carriages, horses. The queen's wealth was even more; her kingdom encompassed perhaps 40,000 households and she extracted an average of 200 dhanay. That meant she had an income of eight million dhanay per year. With it she could pay an army of 5,000, several hundred bureaucrats, an extended royal family of several hundred more, support a royal army engineering corps, maintain three official palaces, and pay for a cavalry corps involving a thousand horses. And all of the aristocrats could patronize temples and feed the poor, especially with year-old grain that was going bad. Finally, they all lost a quarter to as much as a half of their wealth in the form of spoilage of the grain every year. It was a huge waste that could be used to build roads, bridges, and schools. [vol. 3, 71]

[Miller] collects 24 dhanay a year of rent from 550 house lots; that's 13,200 dhanay. [vol. 3, 113]

Lord Gugéndu of Tripola collects the region’s taxes: 2/9 to Réjé, 1/9 to himself.

Mɛlwika pays Réjé two ninths of grain harvest; Lords [city] keeps one ninth of grain harvest; Kandékwɛs gets ten percent of the Réjé’s collection. [vol. 4, 364][This says nothing about non-grain taxes, which presumably remained at one third.]

“It is not true that all Lords get a third of the tax revenue. The Lord of Kɛrda gets half, while the Lord of Anartu currently gets only a tenth and the Lord of Bɛllɛdha only a fifth. . . Henceforth, Lords Mɛllɛr and Ménnéa will receive three tenths of the tax revenues collected from their respective lands, and they will have full authority to collect all taxes due on those lands and to see that justice is carried out on their lands. Lord Kandékwɛs, as regional Lord, retains the right to a tenth as much as the two Lords, or three hundredths. The crown retains the right to the remaining two thirds.” [The Réjé, vol. 5, p. 326-27] The Lords agree to take their 30% and allocate it as follows: 25% to the city, 5% to themselves.

“The tax on wages is complicated and I don't know how well it'll work. A family dependent on wages pays no tax if their wages total less than 150 dhanay per year per first adult, 100 dhanay per year for second adult, and 75 dhanay per year per child under age 16. That's 400 dhanay for a father, mother, and two children. Their tax then is a third, like everyone else's, allocated to the Réjé and the local Lord according to the existing arrangement.” [vol 5, 384]

From Steven Osment, *The Age of Reform, 1250-1550,* p. 213: 120 pennies to the pound in Germany, 1400s; average unskilled day laborer earned 10-12 pennies a day (= 60-72 per week, roughly 2 pounds per month, 24 pounds/3,000 pennies per year). Priest’s charges:

9 pennies for declaring a marriage, 48 for a wedding mass, 9 for last rites, 1 for confession during Lent, 12 for a baptism; 2 pounds for burial, 1 pound for vigil and readings

Mɛlwika Hotel on Foundry Square: 36 meters long by 18 wide, 662 sq. m. per floor
Basement level: Offices, 300 sq. m. restaurant
First level: lobby, offices
Second and Third Levels: private rooms (30 sq. m each, 20 per floor)

Seven Year Development Plan: Assumes economy will double in 7 years to about 150,000,000 dhanay (2,100 dhanay per household, 65,000 households) with tax revenues of 27 million for the palace, 3 million for the provinces, and 15 million for the villages and towns. Education outlay will be 8 million, health care 7 million (10% of GDP together). In year 13, GDP hits 77 million dhanay; household income (60,000 households) reaches 1,280 dhanay; total tax collection rises to 23 million. Note that in year 11, per capita household was 1050 dhanay per year, compared to 900 in year 1; but the price of food had dropped to about half, from 500 (out of 600 after taxes) to 250 (out of 700 after taxes). Many rural incomes where farmland had not increased had seen their incomes drop to about 600/400 after taxes.

Arjakwés: In yr 12, income is 1,200 dhanay per household for 10,000 households; Total, 12 million dhanay. They want to raise it to 2,700 dhanay per household for 11,500 households; total, 31,000,000 dhanay. This will require 10% investment per year in industry.

Another way to figure it: industrialization costs up to 3,000 dhanay per worker for infrastructure and machinery (more, if the machines have to be developed). Manufactories with more hand work are cheaper. So 10,000 factory jobs will cost about 25 million dhanay. In year 12, no investment money is available because Miller Motors has sucked it all up (except for crown's development bank).

Seven Year Development Plan for Upper Pɛnkakwés

Gwɛrkaita 600 people, 120 households, 3600 dhanay investment/yr
- Gravel road 7 km 7,000 dhanay
- Power and phone 7 km 1,000 dhanay
- 4-room schoolhouse 5 jobs 10,000 dhanay
- Bakery/store/post office: 4,000 dhanay, 1 job
- Grain storage 2,000 dhanay
- Tree nursery: 5 jobs, 10,000 dhanay

Sullɛndha 1200 people, 240 households, 7200 dhanay investment/yr
- Existing: sawmill, icebox manuf., windmill manuf., store, post office, 4-room schoolhouse, 4-room high school

2 more rooms, schoolhouse; 2 jobs, 5,000 dhanay
4 more rooms, highschool; 4 jobs, 10,000 dhanay
Sawmill expansion: 20 jobs, 40,000 dhanay
Icebox manuf. expansion: 5 jobs, 10,000 dhanay
Store expansion: 5,000 dhanay, 2 jobs
Bakery: 6,000 dhanay, 3 jobs
Grain storage 6,000 dhanay, 1 job
Clinic: 10,000 dhanay, 1 doctor, 1 nurse
Génadɛma/vocational: 3 jobs (mostly part-time imported experts)
Blanket Factory: 10 jobs, 25,000 dhanay

Isurmɛnga 900 people, 180 households, 5400 dhanay investment/yr
2 more rooms, schoolhouse, 2 jobs, 5,000 dhanay
Bakery: 2,000 dhanay, 1 job
Store/post office: 4,000 dhanay, 1 job
Grain storage 2,000 dhanay
Dairy and ice house: 12,000 dhanay, 5 jobs

Réjsunidhérdha 1000 people, 200 households, 4000 dhanay investment/yr
2 more rooms, schoolhouse, 2 jobs, 5,000 dhanay
Existing: store, post office
Bakery: 4,000 dhanay, 2 job
Grain storage 4,000 dhanay
Sawmill: 10 jobs, 20,000 dhanay

Abɛldɛdra 800 people, 160 households, 4800 dhanay investment/yr
2 more rooms, schoolhouse, 2 jobs, 5,000 dhanay
Bakery/store/post office: 4,000 dhanay, 1 job
Grain storage 2,000 dhanay
Cider Press, ice house, women's salon: 10 jobs, 8,000 dhanay

Yɛmɛpɛrkas 950 people, 190 households, 5700 dhanay investment/yr
2 more rooms, schoolhouse, 2 jobs, 5,000 dhanay
Existing: store, post office
Bakery: 2,000 dhanay, 1 job
Grain storage 2,000 dhanay
Fish farm and ice house: 2 jobs, 2,000 dhanay
Blanket Factory: 10 jobs, 25,000 dhanay

Pɛdbɛrgas 600 people, 120 households, 3600 dhanay investment/yr
Gravel road 6 km 6,000 dhanay
Power and phone 6 km 1,000 dhanay
4-room schoolhouse 5 jobs 10,000 dhanay
Shoe Manufactory 20 jobs 30,000 dhanay
Bakery/store/post office: 4,000 dhanay, 1 job

Grain storage 2,000 dhanay

Upper Pɛnkakwés: 6050 people, 1210 households, 36300 dhanay investment/yr
Total new jobs: 11 + 52 + 9 + 14 + 13 + 15 + 26 = 140 jobs
Total investment: 34 + 117 + 25 + 33 + 19 + 36 + 53 = 327,000

Retail Space

The US had 20 square feet per person of retail space in 2003; Canada, 14; Australia, 6; Sweden, 3; and Sweden has more per person than any other country in Europe. In 2010 the US had 47 square feet! India in 2010 had 2 square feet per person; Mexico, 1.5 sq ft; 23 sq ft in Britain. But I have also see 2.5 sq ft in Britain and 2 sq ft in France, Italy, and Sweden. So the figures are not very reliable.

If Mɛlwika has a market population of 40,000 in year 18, at 0.3 square meters per person, it would have 12,000 square meters of commercial space; 10 meters by 400 meters, 3 stories high, for example.

Steel production worldwide: a tonne of steel requires 62,000 gallons (211 tonnes!) of water; 600 kg of coke/770 tonnes of coal; 4 kwhr (electric arc furnaces require 450 kwhr/tonne). Production is about 200 to 250 kg/person/yr

Assume, year 22: steel production is 50 kg/person/year or 22,500,000 kg = 22,500 tonnes; Mɛlwika's production is 17,000 tonnes, capacity 21,000 tonnes = 350 tonnes/week = 70 tonnes/day

Year 20: Mɛlwika consumes 50,000 tonnes of soft coal per year, half for making steel (making 17,000 tonnes/yr). The coal cost ½ dhanay per tonne; the wood costs 10 dhanay/tonne. Nickel-iron meteorite costs 15 dhanay/tonne. Labor to run the Bessemer furnace adds 2 dhanay/tonne; plant maintenance, another 2 dhanay/tonne; value added taxes, 2 dhanay/tonne; profit, 4 dhanay; total cost, 35 dhanay/tonne (equal to $500-700/tonne, similar to Chinese costs). Miller profits from steel making alone is ₫75,000/yr.

Note: Kaitɛrɛ, Ghéslonɛ, and Kwétékwonɛ receive 300,000 dhanay per year for mining and transporting nickel-iron (50%, 40%, 10% respectively).

Wood production of 50,000 tonnes generates 500,000 dhanay per year for Mɛlwika, Dwobɛrgonɛ, Pɛnkakwés, Mémɛnɛghonɛ, and Késtonɛ timber cutters and drivers (20% each?) requiring a forest area for sustainable harvesting of 1,400 hectares each (150 tonnes of harvest per hectare, once every 20 years), producing 40 to 50 jobs each.

Mitru Miller Transportation, Year 22:

A bus costs ₫14.5 per day (₫9 salary, and benefits for the driver, ₫2 to pay for the bus, ₫.5 maintenance, ₫.5 insurance and miscellaneous, ₫.5 profit, ₫2 investment). Local busses carry 50 passengers per 2 round trips and 25 per two other round trips (midday, shoppers and such) or 150 passengers per day; thus average local ticket cost is 10 kɛntay. Intercity busses carry 50 per day and thus cost 30 kɛntay per passenger.

World has 45,000 kids of high school age; half go to school; half ride busses; so that's 11,000 riders per day; also, 5,000 commute to work daily; 16,000 at 50 per bus (each way) requires 320 busses. The shoppers are added in and ride at other times. In addition there are 30 inter-provincial busses

So, 350 busses generating ₫14.5/day, 5 days per week, is ₫72.5 per week per bus; assume another 7.5 on Primdiu for ₫80/wk; times 60 wks is ₫4800/yr; x 350 busses = ₫1,680,000/yr and about ₫60,000 profit (minimum!)

The Seven Development Priorities:

1. Fostering the education of and maximizing the potential of every person
2. Improving health and extending life
3. Increasing prosperity and spreading it to every place in the kingdom
4. Reinforcing and strengthening the values of diversity, honesty, trustworthiness, service, and vocation
5. The advancement of minorities and women
6. Strengthening small businesses
7. Protecting nature and the environment.