

| Source | Loan Amount | Interest Rate | Repayment years | Notes |
|--------------------------------|--|---------------|-----------------|----------------------------|
| International Financing Agency | Bill. F.CFA 47.9 (Mill. US \$177.0) | 10% | 20 years | Foreign & Domestic parts |
| Bilateral Aid | Bill. F.CFA 47.9 (Mill. US \$177.0) | 4% | 30 years | Foreign & Domestic parts |
| Domestic Fund | Bill. F.CFA 16.9 (Mill. US \$62.5) | 12% | 15 years | 15 % of total project cost |

It is assumed that no loan is given for the land acquisition and compensation as well as taxes. Repayment method is assumed equal payment for the capital during repayment years and construction years.

2) Loan repayability

Table 8.4 presents an examination of loan repayability based on the above assumptions. It is noted that average electricity tariff is fixed at US \$0.183/kWh which prevails for LT/MT consumers at the level of 1991. As shown in the said table, annual balance of the revenue and expenditures of the Project would become surplus from the first commissioning year.

8.5 Overall Evaluation of the Project

As discussed in the preceding sections, the Project was assessed viable in both economic and financial terms. Furthermore, the Project would affect very little environmental and social impact.

The Memvé Elé hydro plant must be a very important project for Cameroon; its project cost, F.CFA 112.7 billion, occupies 19% of the government's annual budget and is equivalent to 180% of SONEL's annual revenue. Therefore, the project implementation requires careful promotion after close communications with related agencies and/or ministries in Cameroon as well as international financing bodies such as the World Bank.

As discussed in Chapter 5, the development scale and timing optimization concludes that the series development in the order of Nachtigal I, Memvé Elé 1, Nachtigal II, Memvé Elé 2, and Nachtigal III is the optimal concerning the maximum net benefit of the South Interconnection Network. This development option will make the hydropower resources concentrate in only the Sanaga basin. As understood from Fig. 8.1, the population concentrates on and along the existing transmission line route. When the Nachtigal Project is realized first, such the situation

will be accelerated by another power development in Sanaga river. Contrarily, development of the Ntem basin will result the other social development in the basin area.

Therefore, if distribution of the hydropower resources is sought, there still exists the possibility of Memvé Elé's precedent development in the South Interconnected Network. Transmission line route connecting to Edéa might be an alternative solution depending on the distribution of power demand in the future. Review of the development timing of the system as well as the transmission line route shall be made during further detailed design stage of the Memvé Elé Project.

**Table 8.1 Estimate of Alternative Thermal Power Cost
(Hydro Benefit)**

| Item | Gas-Turbine | Oil-fired Thermal | Remarks |
|---|-------------|-------------------|---|
| 1 Capital Cost | | | |
| a) Plant Size (MW) | 20 | 50 | |
| b) Construction Cost (US \$/kW) | 1,000 | 1,500 | Financial cost basis |
| c) Economic Construction Cost (US \$/kW) | 985 | 1,478 | (b) x (0.9 + 0.1 x 0.85) |
| d) Construction Period (years) | 2 | 5 | |
| e) Disbursement (%) | 40/60 | 5/25/40/20/10 | |
| f) Commissioned Factor | 1,090 | 1,269 | i = 10% assumed |
| g) Commissioned Cost (US \$/kW) | 1,074 | 1,876 | Cost at completion |
| h) Life Time (years) | 15 | 30 | |
| i) Discount Rate (%) | 10 | 10 | |
| j) Recovery Factor | 0.1315 | 0.1061 | |
| k) Annual Capital Charge (US \$/kW) | 141.2 | 199.0 | |
| l) O&M Cost (%) | 2 | 2 | |
| (\$/kW/yr) | 19.7 | 29.6 | |
| m) Total Fixed Cost (US \$/kW/year) | 160.9 | 228.6 | |
| n) Adjustment Factor | 1.148 | 1.198 | See Note below |
| o) kW Value (US \$/kW/year) | 184.7 | 273.9 | |
| 2 Variable Cost (based on International Oil Price) | | | |
| a) Fuel | | | |
| i) Type | Gas-Oil | MFO | Based on Crude Oil Price of US\$20/bbl. |
| ii) Price (US \$/bbl) | 32 | 19 | |
| iii) Specific gravity | 0.84 | 0.99 | |
| iv) Calorific value (Kcal/kg) | 10,800 | 11,000 | |
| v) Operation efficiency (%) | 26.0 | 29.0 | |
| vi) Heat rate (Kcal/kWh) | 3,308 | 2,965 | |
| vii) Fuel cost (US \$/kWh) | 0.0734 | 0.0325 | |
| b) Variable O&M (US \$/kWh) | 0.0030 | 0.0006 | |
| c) Total Variable Cost (US \$/kWh) | 0.0764 | 0.0331 | |
| d) Adjustment Factor | 1.007 | 1.028 | See Note below |
| e) kWh Value (US \$/kWh) | 0.0769 | 0.0340 | |
| 2' Variable Cost (based on Domestic Fuel Price) | | | |
| a) Fuel | | | |
| ii) Price (US\$/l) | 0.658 | 0.391 | US\$ 1 = F.CFA 270.6 |
| (F. CFA/l) | (178.0) | (105.7) | |
| b) Variable O&M (US \$/kWh) | 0.0030 | 0.0006 | |
| c) Total Variable Cost (US \$/kWh) | 0.2403 | 0.1071 | |
| d) Adjustment Factor | 1.007 | 1.028 | See Note below |
| e) kWh Value (US \$/kWh) | 0.242 | 0.110 | |
| Note: Adjustmrrt factor | | | |
| i) Station use (%) | 4.0 | 6.0 | 0.3 |
| ii) Transmmission line loss (%) | 1.0 | 2.0 | 5.0 |
| iii) Forced outage (%) | 7.0 | 7.0 | 0.5 |
| iv) Scheduled outage (%) | 8.0 | 10.0 | 2.0 |
| v) Adjustment factors | | | |
| - kW value | 1.148 | 1.198 | |
| - kWh value | 1.007 | 1.028 | |

Table 8.2 Economic Cash Flow

Unit: Mill. US\$

| Year in order | Construction Cost | Replace, O&M Cost | Total Cost | Benefit | Net Benefit (B - C) | Present Value | | Notes | |
|--|-------------------|-------------------|------------|---------|---------------------|---------------|---------|--------------------------------|---------------|
| | | | | | | Cost | Benefit | | |
| 1 | 9.137 | 0.000 | 9.137 | 0.000 | -9.137 | 8.307 | 0.000 | MVL-1 construction begins. | |
| 2 | 45.686 | 0.000 | 45.686 | 0.000 | -45.686 | 37.757 | 0.000 | | |
| 3 | 91.372 | 0.000 | 91.372 | 0.000 | -91.372 | 68.649 | 0.000 | | |
| 4 | 121.829 | 0.000 | 121.829 | 45.511 | -76.318 | 83.211 | 31.085 | | |
| 5 | 36.549 | 0.000 | 36.549 | 68.267 | 31.718 | 22.694 | 42.389 | MVL-1 complete (Thermal-1 put) | |
| 6 | 0.000 | 3.273 | 3.273 | 39.934 | 36.661 | 1.847 | 22.541 | | |
| 7 | 0.000 | 3.273 | 3.273 | 39.934 | 36.661 | 1.680 | 20.492 | | |
| 8 | 0.000 | 3.273 | 3.273 | 39.934 | 36.661 | 1.527 | 18.629 | | |
| 9 | 0.000 | 3.273 | 3.273 | 39.934 | 36.661 | 1.388 | 16.936 | | |
| 10 | 56.040 | 3.273 | 59.313 | 85.445 | 26.133 | 22.868 | 32.943 | MVL-2 construction begins. | |
| 11 | 56.040 | 3.273 | 59.313 | 108.201 | 48.888 | 20.789 | 37.924 | MVL-2 complete (Thermal-2 put) | |
| 12 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 1.393 | 17.072 | | |
| 13 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 1.266 | 15.520 | | |
| 14 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 1.151 | 14.109 | | |
| 15 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 1.047 | 12.827 | | |
| 16 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.952 | 11.661 | | |
| 17 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.865 | 10.601 | | |
| 18 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.786 | 9.637 | | |
| 19 | 0.000 | 4.372 | 4.372 | 99.092 | 94.720 | 0.715 | 16.202 | | |
| 20 | 0.000 | 4.372 | 4.372 | 121.848 | 117.475 | 0.650 | 18.112 | (Thermal-1 replaced) | |
| 21 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.591 | 7.240 | | |
| 22 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.537 | 6.582 | | |
| 23 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.488 | 5.984 | | |
| 24 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.444 | 5.440 | | |
| 25 | 0.000 | 4.372 | 4.372 | 99.092 | 94.720 | 0.404 | 9.146 | | |
| 26 | 0.000 | 4.372 | 4.372 | 121.848 | 117.475 | 0.367 | 10.224 | (Thermal-2 replaced) | |
| 27 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.334 | 4.087 | | |
| 28 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.303 | 3.715 | | |
| 29 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.276 | 3.378 | | |
| 30 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.251 | 3.071 | | |
| 31 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.228 | 2.791 | | |
| 32 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.207 | 2.538 | | |
| 33 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.188 | 2.307 | | |
| 34 | 0.000 | 4.372 | 4.372 | 99.092 | 94.720 | 0.171 | 3.879 | | |
| 35 | 0.000 | 4.372 | 4.372 | 121.848 | 117.475 | 0.156 | 4.336 | (Thermal-1 replaced) | |
| 36 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.141 | 1.733 | | |
| 37 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.129 | 1.576 | | |
| 38 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.117 | 1.432 | | |
| 39 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.106 | 1.302 | | |
| 40 | 0.000 | 121.002 | 121.002 | 99.092 | -21.910 | 2.674 | 2.189 | G/E & Metal [MVL-1] replaced | |
| 41 | 0.000 | 4.372 | 4.372 | 121.848 | 117.475 | 0.088 | 2.447 | (Thermal-2 replaced) | |
| 42 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.080 | 0.978 | | |
| 43 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.073 | 0.889 | | |
| 44 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.066 | 0.809 | | |
| 45 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.060 | 0.735 | | |
| 46 | 0.000 | 40.343 | 40.343 | 53.581 | 13.237 | 0.503 | 0.668 | G/E & Metal [MVL-2] replaced | |
| 47 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.050 | 0.608 | | |
| 48 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.045 | 0.552 | | |
| 49 | 0.000 | 4.372 | 4.372 | 99.092 | 94.720 | 0.041 | 0.929 | | |
| 50 | 0.000 | 4.372 | 4.372 | 121.848 | 117.475 | 0.037 | 1.038 | (Thermal-1 replaced) | |
| 51 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.034 | 0.415 | | |
| 52 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.031 | 0.377 | | |
| 53 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.028 | 0.343 | | |
| 54 | 0.000 | 4.372 | 4.372 | 53.581 | 49.208 | 0.025 | 0.312 | | |
| 55 | 0.000 | 97.823 | 97.823 | 53.581 | -44.242 | 0.517 | 0.283 | Civil [MVL-1] replaced | |
| Note: Total economic cost = Mill. US \$416.652 | | | | | | Total | 289.328 | 443.014 | EIRR = 16.52% |

Installed capacity = 201.2 MW in total

Capital recovery factor = 0.1005

Annual cost = Mill. US \$29.087

B / C = 1.53 (Benefit-cost ratio)

B - C = Mill. US \$153.686

Unit energy cost = 2.9 US\$/kWh

Exchange rate: US \$1 = F.CFA270.6

Discount rate: 10.0%

MVL-1: Memvé Elé 1, MVL-2: Memvé Elé 2

Hydro's 95% dependable power = 201.2 MW (4.3 hours/day basis)

Alternative thermal capacity = 201.2 MW for MVL-1 and MVL-2

Alternative thermal cost = Mill. US \$113.779

Alternative thermal O&M cost = US \$22.60 /kW/year

Primary energy value = US \$0.0769/kWh for Gas-turbine

Secondary energy value = US \$0.0340/kWh for Oil-fired

Table 8.3 Financial Cash Flow

Unit: Mill. US\$

| Year in order | Const- ruction Cost | Replac- ement Cost | O&M Cost | Total Cost | Benefit | B - C | Present Value | |
|---------------|---------------------------|--------------------------|-------------|---------------|---------|----------|---------------|-----------|
| | | | | | | | Cost | Benefit |
| 1 | 9.137 | 0.000 | 0.000 | 9.137 | 0.000 | -9.137 | 8.307 | 0.000 |
| 2 | 45.686 | 0.000 | 0.000 | 45.686 | 0.000 | -45.686 | 37.757 | 0.000 |
| 3 | 91.372 | 0.000 | 0.000 | 91.372 | 0.000 | -91.372 | 68.649 | 0.000 |
| 4 | 121.829 | 0.000 | 0.000 | 121.829 | 0.000 | -121.829 | 83.211 | 0.000 |
| 5 | 36.549 | 0.000 | 0.000 | 36.549 | 0.000 | -36.549 | 22.694 | 0.000 |
| 6 | 0.000 | 0.000 | 42.035 | 42.035 | 129.206 | 87.171 | 23.727 | 72.933 |
| 7 | 0.000 | 0.000 | 42.035 | 42.035 | 129.206 | 87.171 | 21.570 | 66.303 |
| 8 | 0.000 | 0.000 | 42.035 | 42.035 | 129.206 | 87.171 | 19.609 | 60.275 |
| 9 | 0.000 | 0.000 | 42.035 | 42.035 | 129.206 | 87.171 | 17.827 | 54.796 |
| 10 | 56.040 | 0.000 | 42.035 | 98.074 | 129.206 | 31.131 | 37.812 | 49.814 |
| 11 | 56.040 | 0.000 | 42.035 | 98.074 | 129.206 | 31.131 | 34.374 | 45.286 |
| 12 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 13.744 | 63.212 |
| 13 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 12.494 | 57.466 |
| 14 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 11.359 | 52.242 |
| 15 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 10.326 | 47.492 |
| 16 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 9.387 | 43.175 |
| 17 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 8.534 | 39.250 |
| 18 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 7.758 | 35.682 |
| 19 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 7.053 | 32.438 |
| 20 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 6.412 | 29.489 |
| 21 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 5.829 | 26.808 |
| 22 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 5.299 | 24.371 |
| 23 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 4.817 | 22.156 |
| 24 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 4.379 | 20.141 |
| 25 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 3.981 | 18.310 |
| 26 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 3.619 | 16.646 |
| 27 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 3.290 | 15.133 |
| 28 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 2.991 | 13.757 |
| 29 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 2.719 | 12.506 |
| 30 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 2.472 | 11.369 |
| 31 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 2.247 | 10.336 |
| 32 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 2.043 | 9.396 |
| 33 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 1.857 | 8.542 |
| 34 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 1.688 | 7.765 |
| 35 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 1.535 | 7.059 |
| 36 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 1.395 | 6.418 |
| 37 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 1.269 | 5.834 |
| 38 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 1.153 | 5.304 |
| 39 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 1.048 | 4.822 |
| 40 | 0.000 | 116.630 | 43.134 | 159.764 | 198.388 | 38.624 | 3.530 | 4.383 |
| 41 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.866 | 3.985 |
| 42 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.788 | 3.623 |
| 43 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.716 | 3.293 |
| 44 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.651 | 2.994 |
| 45 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.592 | 2.722 |
| 46 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.538 | 2.474 |
| 47 | 0.000 | 35.971 | 43.134 | 79.105 | 198.388 | 119.283 | 0.897 | 2.249 |
| 48 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.445 | 2.045 |
| 49 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.404 | 1.859 |
| 50 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.367 | 1.690 |
| 51 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.334 | 1.536 |
| 52 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.304 | 1.397 |
| 53 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.276 | 1.270 |
| 54 | 0.000 | 0.000 | 43.134 | 43.134 | 198.388 | 155.254 | 0.251 | 1.154 |
| 55 | 0.000 | 93.450 | 43.134 | 136.584 | 198.388 | 61.803 | 0.722 | 1.049 |
| Total | | | | | | | 527.917 | 1,034.252 |

Note: Total financial cost = Mill. US \$416.652

Electricity tariff = 49.5 F.CFA/kWh

US 1\$ = F. CFA270.6

Discount rate = 10.0%

O&M Cost consists of operation, maintenance and sub-transmission cost.

Sub-transmission cost is assumed 30% of annual revenue.

FIRR = 22.92%

**Table 8.4 Loan Repayability
(Summary)**

Unit: Mill. US\$

| Year in order | Repayment Cost | OMR Cost | Sub-transmission Cost | Total Expenditure | Annual Revenue | Balance | Cummulative Surplus |
|---------------|----------------|----------|-----------------------|-------------------|----------------|---------|---------------------|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | 51.20 | 3.27 | 37.04 | 91.51 | 123.48 | 31.96 | 31.96 |
| 7 | 49.53 | 3.27 | 37.04 | 89.85 | 123.48 | 33.63 | 65.59 |
| 8 | 47.87 | 3.27 | 37.04 | 88.18 | 123.48 | 35.29 | 100.88 |
| 9 | 46.21 | 3.27 | 37.04 | 86.52 | 123.48 | 36.95 | 137.84 |
| 10 | 44.54 | 3.27 | 37.04 | 84.86 | 123.48 | 38.62 | 176.45 |
| 11 | 42.88 | 3.27 | 37.04 | 83.19 | 123.48 | 40.28 | 216.74 |
| 12 | 41.22 | 4.37 | 56.30 | 101.89 | 187.68 | 85.79 | 302.53 |
| 13 | 39.55 | 4.37 | 56.30 | 100.23 | 187.68 | 87.45 | 389.98 |
| 14 | 37.89 | 4.37 | 56.30 | 98.57 | 187.68 | 89.12 | 479.10 |
| 15 | 58.50 | 4.37 | 56.30 | 119.18 | 187.68 | 68.50 | 547.60 |
| 16 | 56.11 | 4.37 | 56.30 | 116.79 | 187.68 | 70.90 | 618.50 |
| 17 | 53.71 | 4.37 | 56.30 | 114.39 | 187.68 | 73.29 | 691.79 |
| 18 | 51.32 | 4.37 | 56.30 | 111.99 | 187.68 | 75.69 | 767.48 |
| 19 | 48.92 | 4.37 | 56.30 | 109.60 | 187.68 | 78.09 | 845.56 |
| 20 | 46.52 | 4.37 | 56.30 | 107.20 | 187.68 | 80.48 | 926.05 |
| 21 | 39.53 | 4.37 | 56.30 | 100.21 | 187.68 | 87.47 | 1,013.52 |
| 22 | 37.69 | 4.37 | 56.30 | 98.37 | 187.68 | 89.32 | 1,102.84 |
| 23 | 35.84 | 4.37 | 56.30 | 96.52 | 187.68 | 91.16 | 1,194.00 |
| 24 | 34.00 | 4.37 | 56.30 | 94.68 | 187.68 | 93.01 | 1,287.00 |
| 25 | 32.15 | 4.37 | 56.30 | 92.83 | 187.68 | 94.85 | 1,381.86 |
| 26 | 21.17 | 4.37 | 56.30 | 81.85 | 187.68 | 105.83 | 1,487.69 |
| 27 | 20.24 | 4.37 | 56.30 | 80.92 | 187.68 | 106.76 | 1,594.45 |
| 28 | 19.31 | 4.37 | 56.30 | 79.99 | 187.68 | 107.70 | 1,702.15 |
| 29 | 18.38 | 4.37 | 56.30 | 79.06 | 187.68 | 108.63 | 1,810.78 |
| 30 | 15.35 | 4.37 | 56.30 | 76.03 | 187.68 | 111.65 | 1,922.43 |
| 31 | 14.67 | 4.37 | 56.30 | 75.35 | 187.68 | 112.33 | 2,034.76 |
| 32 | 13.99 | 4.37 | 56.30 | 74.67 | 187.68 | 113.01 | 2,147.78 |
| 33 | 13.31 | 4.37 | 56.30 | 73.99 | 187.68 | 113.69 | 2,261.47 |
| 34 | 12.63 | 4.37 | 56.30 | 73.31 | 187.68 | 114.37 | 2,375.84 |
| 35 | 7.92 | 4.37 | 56.30 | 68.60 | 187.68 | 119.08 | 2,494.93 |
| 36 | 2.68 | 4.37 | 56.30 | 63.36 | 187.68 | 124.33 | 2,619.25 |
| 37 | 2.60 | 4.37 | 56.30 | 63.28 | 187.68 | 124.40 | 2,743.66 |
| 38 | 2.52 | 4.37 | 56.30 | 63.20 | 187.68 | 124.48 | 2,868.14 |
| 39 | 2.44 | 4.37 | 56.30 | 63.12 | 187.68 | 124.56 | 2,992.70 |
| 40 | 2.36 | 121.00 | 56.30 | 179.67 | 187.68 | 8.01 | 3,000.71 |
| 41 | 2.29 | 4.37 | 56.30 | 62.96 | 187.68 | 124.72 | 3,125.43 |
| 42 | 2.21 | 4.37 | 56.30 | 62.88 | 187.68 | 124.80 | 3,250.23 |
| 43 | 2.13 | 4.37 | 56.30 | 62.81 | 187.68 | 124.88 | 3,375.11 |
| 44 | 2.05 | 4.37 | 56.30 | 62.73 | 187.68 | 124.96 | 3,500.07 |
| 45 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 3,627.07 |
| 46 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 3,754.08 |
| 47 | | 40.34 | 56.30 | 96.65 | 187.68 | 91.03 | 3,845.11 |
| 48 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 3,972.12 |
| 49 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 4,099.13 |
| 50 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 4,226.13 |
| 51 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 4,353.14 |
| 52 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 4,480.14 |
| 53 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 4,607.15 |
| 54 | | 4.37 | 56.30 | 60.68 | 187.68 | 127.01 | 4,734.15 |
| 55 | | 97.82 | 56.30 | 154.13 | 187.68 | 33.56 | 4,767.71 |
| 56 | | 4.37 | 56.30 | 60.67 | 187.68 | 127.01 | 4,894.72 |
| 57 | | 4.37 | 56.30 | 60.67 | 187.68 | 127.01 | 5,021.73 |
| 58 | | 4.37 | 56.30 | 60.67 | 187.68 | 127.01 | 5,148.73 |
| 59 | | 4.37 | 56.30 | 60.67 | 187.68 | 127.01 | 5,275.74 |
| 60 | | 4.37 | 56.30 | 60.67 | 187.68 | 127.01 | 5,402.75 |

Note: Exchange Rate: US \$1.00 = F. CFA270.6

OMR: Operation, maintenance and replacement

Sub-transmission cost is assumed 30% of annual revenue.

Table 8.4 Loan Repayability
(Repayment for International Financing Agency)

Unit: Mill. US\$

| Year in order | Memve Ele 1 | | | | | | Memve Ele 2 | | | | | | Repay- ment Total |
|---------------------|-------------------|-------------|---------------|-----------|----------|-------|-------------------|-------------|---------------|-----------|----------|-------|-------------------------|
| | Loan Disbursement | | | Repayment | | | Loan Disbursement | | | Repayment | | | |
| | Capital Cost | IDC Cost | Cumm. Debt | Interest | rincipal | Total | Capital Cost | IDC Cost | Cumm. Debt | Interest | rincipal | Total | |
| 1 | 3.88 | 0.39 | 4.27 | | | | | | | | | | |
| 2 | 19.42 | 2.37 | 26.06 | | | | | | | | | | |
| 3 | 38.83 | 6.49 | 71.38 | | | | | | | | | | |
| 4 | 51.78 | 12.32 | 135.47 | | | | | | | | | | |
| 5 | 15.53 | 15.10 | 166.11 | | | | | | | | | | |
| 6 | | 16.61 | 182.72 | 18.27 | 9.14 | 27.41 | | | | | | | 27.41 |
| 7 | | | 173.58 | 17.36 | 9.14 | 26.49 | | | | | | | 26.49 |
| 8 | | | 164.44 | 16.44 | 9.14 | 25.58 | | | | | | | 25.58 |
| 9 | | | 155.31 | 15.53 | 9.14 | 24.67 | | | | | | | 24.67 |
| 10 | | | 146.17 | 14.62 | 9.14 | 23.75 | 23.82 | 2.38 | 26.20 | | | | 23.75 |
| 11 | | | 137.04 | 13.70 | 9.14 | 22.84 | 23.82 | 5.00 | 55.02 | | | | 22.84 |
| 12 | | | 127.90 | 12.79 | 9.14 | 21.93 | 0.00 | 5.50 | 60.52 | | | | 21.93 |
| 13 | | | 118.77 | 11.88 | 9.14 | 21.01 | 0.00 | 6.05 | 66.57 | | | | 21.01 |
| 14 | | | 109.63 | 10.96 | 9.14 | 20.10 | 0.00 | 6.66 | 73.23 | | | | 20.10 |
| 15 | | | 100.49 | 10.05 | 9.14 | 19.19 | 0.00 | 7.32 | 80.55 | 8.06 | 4.03 | 12.08 | 31.27 |
| 16 | | | 91.36 | 9.14 | 9.14 | 18.27 | | | 76.52 | 7.65 | 4.03 | 11.68 | 29.95 |
| 17 | | | 82.22 | 8.22 | 9.14 | 17.36 | | | 72.50 | 7.25 | 4.03 | 11.28 | 28.64 |
| 18 | | | 73.09 | 7.31 | 9.14 | 16.44 | | | 68.47 | 6.85 | 4.03 | 10.87 | 27.32 |
| 19 | | | 63.95 | 6.40 | 9.14 | 15.53 | | | 64.44 | 6.44 | 4.03 | 10.47 | 26.00 |
| 20 | | | 54.81 | 5.48 | 9.14 | 14.62 | | | 60.41 | 6.04 | 4.03 | 10.07 | 24.69 |
| 21 | | | 45.68 | 4.57 | 9.14 | 13.70 | | | 56.39 | 5.64 | 4.03 | 9.67 | 23.37 |
| 22 | | | 36.54 | 3.65 | 9.14 | 12.79 | | | 52.36 | 5.24 | 4.03 | 9.26 | 22.05 |
| 23 | | | 27.41 | 2.74 | 9.14 | 11.88 | | | 48.33 | 4.83 | 4.03 | 8.86 | 20.74 |
| 24 | | | 18.27 | 1.83 | 9.14 | 10.96 | | | 44.30 | 4.43 | 4.03 | 8.46 | 19.42 |
| 25 | | | 9.14 | 0.91 | 9.14 | 10.05 | | | 40.28 | 4.03 | 4.03 | 8.06 | 18.10 |
| 26 | | | 0.00 | | | | | | 36.25 | 3.62 | 4.03 | 7.65 | 7.65 |
| 27 | | | | | | | | | 32.22 | 3.22 | 4.03 | 7.25 | 7.25 |
| 28 | | | | | | | | | 28.19 | 2.82 | 4.03 | 6.85 | 6.85 |
| 29 | | | | | | | | | 24.17 | 2.42 | 4.03 | 6.44 | 6.44 |
| 30 | | | | | | | | | 20.14 | 2.01 | 4.03 | 6.04 | 6.04 |
| 31 | | | | | | | | | 16.11 | 1.61 | 4.03 | 5.64 | 5.64 |
| 32 | | | | | | | | | 12.08 | 1.21 | 4.03 | 5.24 | 5.24 |
| 33 | | | | | | | | | 8.06 | 0.81 | 4.03 | 4.83 | 4.83 |
| 34 | | | | | | | | | 4.03 | 0.40 | 4.03 | 4.43 | 4.43 |
| 35 | | | | | | | | | 0.00 | | | | 0.00 |
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Note: Interest Rate: 10.00%

Loan Amount: Mill. US \$177.1

Repayment Years: 20 years

Repayment starts 5 years after construction.

**Table 8.4 Loan Repayability
(Repayment for Bylateral Aid)**

Unit: Mill. US\$

| Year in order | Memve Ele 1 | | | | | | Memve Ele 2 | | | | | | Repay- ment Total |
|---------------------|-------------------|-------------|---------------|-----------|----------|-------|-------------------|-------------|---------------|-----------|----------|-------|-------------------------|
| | Loan Disbursement | | | Repayment | | | Loan Disbursement | | | Repayment | | | |
| | Capital Cost | IDC Cost | Cumm. Debt | Interest | rincipal | Total | Capital Cost | IDC Cost | Cumm. Debt | Interest | rincipal | Total | |
| 1 | 3.88 | 0.16 | 4.04 | | | | | | | | | | |
| 2 | 19.42 | 0.94 | 24.39 | | | | | | | | | | |
| 3 | 38.83 | 2.53 | 65.76 | | | | | | | | | | |
| 4 | 51.78 | 4.70 | 122.23 | | | | | | | | | | |
| 5 | 15.53 | 5.51 | 143.28 | | | | | | | | | | |
| 6 | | 5.73 | 149.01 | 5.96 | 4.97 | 10.93 | | | | | | | 10.93 |
| 7 | | | 144.04 | 5.76 | 4.97 | 10.73 | | | | | | | 10.73 |
| 8 | | | 139.08 | 5.56 | 4.97 | 10.53 | | | | | | | 10.53 |
| 9 | | | 134.11 | 5.36 | 4.97 | 10.33 | | | | | | | 10.33 |
| 10 | | | 129.14 | 5.17 | 4.97 | 10.13 | 23.82 | 0.95 | 24.77 | | | | 10.13 |
| 11 | | | 124.17 | 4.97 | 4.97 | 9.93 | 23.82 | 1.94 | 50.53 | | | | 9.93 |
| 12 | | | 119.21 | 4.77 | 4.97 | 9.74 | 0.00 | 2.02 | 52.55 | | | | 9.74 |
| 13 | | | 114.24 | 4.57 | 4.97 | 9.54 | 0.00 | 2.10 | 54.65 | | | | 9.54 |
| 14 | | | 109.27 | 4.37 | 4.97 | 9.34 | 0.00 | 2.19 | 56.84 | | | | 9.34 |
| 15 | | | 104.31 | 4.17 | 4.97 | 9.14 | 0.00 | 2.27 | 59.11 | 2.36 | 1.97 | 4.33 | 13.47 |
| 16 | | | 99.34 | 3.97 | 4.97 | 8.94 | | | 57.14 | 2.29 | 1.97 | 4.26 | 13.20 |
| 17 | | | 94.37 | 3.77 | 4.97 | 8.74 | | | 55.17 | 2.21 | 1.97 | 4.18 | 12.92 |
| 18 | | | 89.41 | 3.58 | 4.97 | 8.54 | | | 53.20 | 2.13 | 1.97 | 4.10 | 12.64 |
| 19 | | | 84.44 | 3.38 | 4.97 | 8.34 | | | 51.23 | 2.05 | 1.97 | 4.02 | 12.36 |
| 20 | | | 79.47 | 3.18 | 4.97 | 8.15 | | | 49.26 | 1.97 | 1.97 | 3.94 | 12.09 |
| 21 | | | 74.50 | 2.98 | 4.97 | 7.95 | | | 47.29 | 1.89 | 1.97 | 3.86 | 11.81 |
| 22 | | | 69.54 | 2.78 | 4.97 | 7.75 | | | 45.32 | 1.81 | 1.97 | 3.78 | 11.53 |
| 23 | | | 64.57 | 2.58 | 4.97 | 7.55 | | | 43.35 | 1.73 | 1.97 | 3.70 | 11.25 |
| 24 | | | 59.60 | 2.38 | 4.97 | 7.35 | | | 41.38 | 1.66 | 1.97 | 3.63 | 10.98 |
| 25 | | | 54.64 | 2.19 | 4.97 | 7.15 | | | 39.41 | 1.58 | 1.97 | 3.55 | 10.70 |
| 26 | | | 49.67 | 1.99 | 4.97 | 6.95 | | | 37.44 | 1.50 | 1.97 | 3.47 | 10.42 |
| 27 | | | 44.70 | 1.79 | 4.97 | 6.76 | | | 35.47 | 1.42 | 1.97 | 3.39 | 10.14 |
| 28 | | | 39.74 | 1.59 | 4.97 | 6.56 | | | 33.50 | 1.34 | 1.97 | 3.31 | 9.87 |
| 29 | | | 34.77 | 1.39 | 4.97 | 6.36 | | | 31.53 | 1.26 | 1.97 | 3.23 | 9.59 |
| 30 | | | 29.80 | 1.19 | 4.97 | 6.16 | | | 29.56 | 1.18 | 1.97 | 3.15 | 9.31 |
| 31 | | | 24.83 | 0.99 | 4.97 | 5.96 | | | 27.59 | 1.10 | 1.97 | 3.07 | 9.03 |
| 32 | | | 19.87 | 0.79 | 4.97 | 5.76 | | | 25.62 | 1.02 | 1.97 | 3.00 | 8.76 |
| 33 | | | 14.90 | 0.60 | 4.97 | 5.56 | | | 23.65 | 0.95 | 1.97 | 2.92 | 8.48 |
| 34 | | | 9.93 | 0.40 | 4.97 | 5.36 | | | 21.67 | 0.87 | 1.97 | 2.84 | 8.20 |
| 35 | | | 4.97 | 0.20 | 4.97 | 5.17 | | | 19.70 | 0.79 | 1.97 | 2.76 | 7.92 |
| 36 | | | 0.00 | | | | | | 17.73 | 0.71 | 1.97 | 2.68 | 2.68 |
| 37 | | | | | | | | | 15.76 | 0.63 | 1.97 | 2.60 | 2.60 |
| 38 | | | | | | | | | 13.79 | 0.55 | 1.97 | 2.52 | 2.52 |
| 39 | | | | | | | | | 11.82 | 0.47 | 1.97 | 2.44 | 2.44 |
| 40 | | | | | | | | | 9.85 | 0.39 | 1.97 | 2.36 | 2.36 |
| 41 | | | | | | | | | 7.88 | 0.32 | 1.97 | 2.29 | 2.29 |
| 42 | | | | | | | | | 5.91 | 0.24 | 1.97 | 2.21 | 2.21 |
| 43 | | | | | | | | | 3.94 | 0.16 | 1.97 | 2.13 | 2.13 |
| 44 | | | | | | | | | 1.97 | 0.08 | 1.97 | 2.05 | 2.05 |
| 45 | | | | | | | | | 0.00 | | | | 0.00 |
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Note: Interest Rate: 4.00%
 Repayment Years: 30 years
 Repayment starts 5 years after construction.

Loan Amount: Mill. US \$177.1

**Table 8.4 Loan Repayability
(Total Repayment)**

Unit: Mill. US\$

| Year in order | Memve Ele 1 | | | | | | Memve Ele 2 | | | | | | Repay- ment Total |
|---------------------|-------------------|-------------|---------------|-----------|----------|-------|-------------------|-------------|---------------|-----------|----------|-------|-------------------------|
| | Loan Disbursement | | | Repayment | | | Loan Disbursement | | | Repayment | | | |
| | Capital Cost | IDC Cost | Cumm. Debt | Interest | rincipal | Total | Capital Cost | IDC Cost | Cumm. Debt | Interest | rincipal | Total | |
| 1 | 9.14 | 0.71 | 9.85 | | | | | | | | | | |
| 2 | 45.69 | 4.31 | 59.84 | | | | | | | | | | |
| 3 | 91.37 | 11.79 | 163.01 | | | | | | | | | | |
| 4 | 121.83 | 22.31 | 307.15 | | | | | | | | | | |
| 5 | 36.55 | 27.20 | 370.90 | | | | | | | | | | |
| 6 | | 29.72 | 400.63 | 32.50 | 18.70 | 51.20 | | | | | | | 51.20 |
| 7 | | | 381.93 | 30.84 | 18.70 | 49.53 | | | | | | | 49.53 |
| 8 | | | 363.23 | 29.17 | 18.70 | 47.87 | | | | | | | 47.87 |
| 9 | | | 344.54 | 27.51 | 18.70 | 46.21 | | | | | | | 46.21 |
| 10 | | | 325.84 | 25.85 | 18.70 | 44.54 | 56.04 | 4.34 | 60.38 | | | | 44.54 |
| 11 | | | 307.14 | 24.18 | 18.70 | 42.88 | 56.04 | 9.08 | 125.51 | | | | 42.88 |
| 12 | | | 288.45 | 22.52 | 18.70 | 41.22 | | 9.92 | 135.42 | | | | 41.22 |
| 13 | | | 269.75 | 20.86 | 18.70 | 39.55 | | 10.84 | 146.26 | | | | 39.55 |
| 14 | | | 251.06 | 19.19 | 18.70 | 37.89 | | 11.85 | 158.11 | | | | 37.89 |
| 15 | | | 232.36 | 17.53 | 18.70 | 36.22 | | 12.96 | 171.07 | 14.19 | 8.09 | 22.28 | 58.50 |
| 16 | | | 213.66 | 15.87 | 18.70 | 34.56 | | | 162.98 | 13.46 | 8.09 | 21.55 | 56.11 |
| 17 | | | 194.97 | 14.20 | 18.70 | 32.90 | | | 154.89 | 12.72 | 8.09 | 20.81 | 53.71 |
| 18 | | | 176.27 | 12.54 | 18.70 | 31.23 | | | 146.79 | 11.99 | 8.09 | 20.08 | 51.32 |
| 19 | | | 157.58 | 10.88 | 18.70 | 29.57 | | | 138.70 | 11.26 | 8.09 | 19.35 | 48.92 |
| 20 | | | 138.88 | 9.21 | 18.70 | 27.91 | | | 130.61 | 10.52 | 8.09 | 18.62 | 46.52 |
| 21 | | | 120.18 | 7.55 | 14.10 | 21.65 | | | 122.52 | 9.79 | 8.09 | 17.88 | 39.53 |
| 22 | | | 106.08 | 6.44 | 14.10 | 20.54 | | | 114.43 | 9.06 | 8.09 | 17.15 | 37.69 |
| 23 | | | 91.98 | 5.32 | 14.10 | 19.43 | | | 106.34 | 8.33 | 8.09 | 16.42 | 35.84 |
| 24 | | | 77.88 | 4.21 | 14.10 | 18.31 | | | 98.24 | 7.59 | 8.09 | 15.68 | 34.00 |
| 25 | | | 63.77 | 3.10 | 14.10 | 17.20 | | | 90.15 | 6.86 | 8.09 | 14.95 | 32.15 |
| 26 | | | 49.67 | 1.99 | 4.97 | 6.95 | | | 82.06 | 6.13 | 8.09 | 14.22 | 21.17 |
| 27 | | | 44.70 | 1.79 | 4.97 | 6.76 | | | 73.97 | 5.39 | 8.09 | 13.49 | 20.24 |
| 28 | | | 39.74 | 1.59 | 4.97 | 6.56 | | | 65.88 | 4.66 | 8.09 | 12.75 | 19.31 |
| 29 | | | 34.77 | 1.39 | 4.97 | 6.36 | | | 57.79 | 3.93 | 8.09 | 12.02 | 18.38 |
| 30 | | | 29.80 | 1.19 | 4.97 | 6.16 | | | 49.69 | 3.20 | 6.00 | 9.19 | 15.35 |
| 31 | | | 24.83 | 0.99 | 4.97 | 5.96 | | | 43.70 | 2.71 | 6.00 | 8.71 | 14.67 |
| 32 | | | 19.87 | 0.79 | 4.97 | 5.76 | | | 37.70 | 2.23 | 6.00 | 8.23 | 13.99 |
| 33 | | | 14.90 | 0.60 | 4.97 | 5.56 | | | 31.70 | 1.75 | 6.00 | 7.75 | 13.31 |
| 34 | | | 9.93 | 0.40 | 4.97 | 5.36 | | | 25.70 | 1.27 | 6.00 | 7.27 | 12.63 |
| 35 | | | 4.97 | 0.20 | 4.97 | 5.17 | | | 19.70 | 0.79 | 1.97 | 2.76 | 7.92 |
| 36 | | | | | | | | | 17.73 | 0.71 | 1.97 | 2.68 | 2.68 |
| 37 | | | | | | | | | 15.76 | 0.63 | 1.97 | 2.60 | 2.60 |
| 38 | | | | | | | | | 13.79 | 0.55 | 1.97 | 2.52 | 2.52 |
| 39 | | | | | | | | | 11.82 | 0.47 | 1.97 | 2.44 | 2.44 |
| 40 | | | | | | | | | 9.85 | 0.39 | 1.97 | 2.36 | 2.36 |
| 41 | | | | | | | | | 7.88 | 0.32 | 1.97 | 2.29 | 2.29 |
| 42 | | | | | | | | | 5.91 | 0.24 | 1.97 | 2.21 | 2.21 |
| 43 | | | | | | | | | 3.94 | 0.16 | 1.97 | 2.13 | 2.13 |
| 44 | | | | | | | | | 1.97 | 0.08 | 1.97 | 2.05 | 2.05 |
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Note: Loan Amount: Mill. US \$416.7

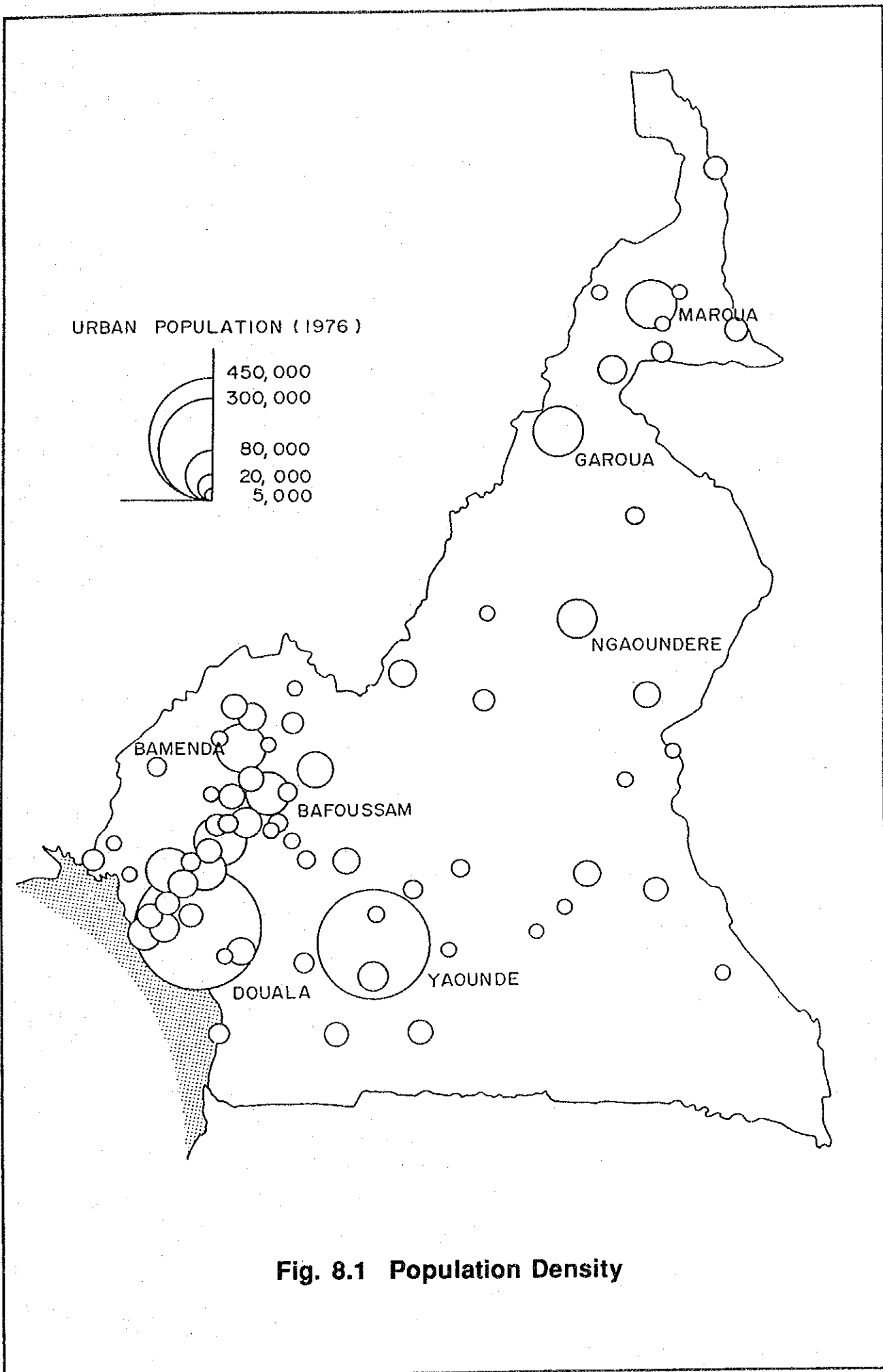


Fig. 8.1 Population Density

JICA