

Attachment 2

2. Implementation Schedule

Table 3 Implementation Schedule

(cost in 1000 US\$)

Serial month from E/N	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Year	03 /04												04 /05						05 /06								
Calender month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	
1 Preparation stage	▲																										
Exchange of note	▲																										
Consul Agreement																											
Detailed survey																											
Design & cost estimation																											
Preparation of Tender Doc.																											
Tender floating																											
Tender Evaluation																											
Contract negotiation																											
Approval of Contract																											
2 ETC's work																											
Land acquisition																											
OSP (Woreta & Marawi)																											
Shelter (Rep. st & PCO)																											
Commercial power for B. station																											
New subs. Connection																											
Permit from reletive authority																											
Payment of road reinstatement																											
PCO telephone terminal sets																											
3 Project implementation																											
Construction design																											
Design Review meeting																											
Manufacturing																											
VoIP																											
OSP																											
Tr & PCO																											
Transportation upto site																											
Site implementation																											
Civil work																											
Cable work																											
VoIP																											
Transmission																											
PCO																											
Acceptance test & commissioning																											
4 Issuance of ATP																											

Attachment 3

3.1 Point to Multi-Point Microwave Radio Link

3.2 Solar Power for PCO Network

3.3 Outside Plant

Note:

Technical Specifications for Outside Plant is given in Volume IV “Supporting Document”.

Specifications for Point to Multi-point Radio Link for PCO Network (VoIP) (Bahir Dar)

1. General Specifications

1.1 General

This specification covers for Point to Multi-point radio system for PCO network in rural areas. The equipment and materials to be supplied shall be in conformity with the technical specifications described hereunder.

1.2 Network Configuration

Point to Multi-point radio systems shall be established for the PCO network in Woreta Woreda and Merawi Woreda area in Amhara Region.

Detailed PCO Networks are shown in Fig. 1.2-1 and Fig. 1.2-2.

1.2.1 PCO Network basic components

Point to Multi-point radio system consists of the following components.

(1) PCO Base Station

- One PCO Base station shall be capable of controlling at least fifteen (15) PCO subscriber stations.
- The 256K bit/s data circuit shall be established between PCO Base station and PCO Subscriber station.

(2) PCO Subscriber Station

- PCO subscriber station shall be accommodated at least eight (8) VoIP telephone lines.

(3) VoIP telephone terminals

- VoIP telephone terminal shall be established 10-BaseT interface with PCO subscriber station.

(4) PC terminal (Option)

- Personal Computer (PC) terminal shall be established 10-BaseT interface with PCO subscriber station in future expansion.

1.2.2 PCO stations and site location

PCO network shall be constructed in Woreta woreda and Merawi woreda. Detail PCO site data are shown in the following documents.

(1) PCO system route configuration

- Woreta PCO system configuration is shown in Fig. 1.2-3.
- Merawi PCO system configuration is shown in Fig. 1.2-4.

(2) PCO site Location Data

- Woreta PCO site information is shown in Table 1.2.2-1.
- Merawi PCO site information is shown in Table 1.2.2-2.

(3) PCO Floor Layout (Typical)

- Typical Floor Layout Plan for PCO subscriber station (Reference) is shown in Fig. 1.2-5.

1.3 Operating Radio Frequency

The radio frequency shall be in 2.3 -2.5GHz band as defined in the ITU Recommendation F. 746-1, Annex 2.

Transmission system configuration for Woreta PCO network is shown in Fig. 1.3-1.

Transmission system configuration for Merawi PCO network is shown in Fig. 1.3-2.

1.4 Network Management System (NMS), supervisory and control System, and service channels shall be provided.

1.5 Power Supplies

There is no commercial power supply in each PCO subscriber station and base station (Merawi North Repeater Station). Therefore, solar power systems shall be provided. Base Station shall have the capacity of power supply for point to point radio equipment and for base station as well.

- Woreta Base station is available to feed from the existing commercial power supply. However, this commercial line is required the power line installation work.

1.6 Poles (Tower) and Antennas

Concrete or metal pole with 10-30 meters high shall be provided for each PCO subscriber station. Antenna for base station shall be omni-directional type and for PCO subscriber station shall be Yagi antenna or grid parabolic type antenna depending upon the distance.

1.7 Applicable Specifications and Standards

The proposed system shall be within the framework of and in accordance with the relevant ITU-R and ITU-T Recommendations.

The manufacturing facilities for the proposed equipment shall be certified to the ISO 9000 series quality standard.

1.8 System of Requirements

1.8.1 Woreta PCO network

Equipment to be supplied for Point to Multipoint radio system is given in Table 1.8-1.

Table 1.8-1 Equipment Required for Woreta PCO Network (Tentative)

No.	Station Name	Base St. Eq'pt	Rep. St. Eq'pt	Subscriber St. Eq'pt	Solar Power	Antenna & Feeder	Pole (Tower)
1	Woreta Base	X					X
2	PCO(Rep. No.1)		X		X	X	X
3	PCO (Rep. No.2)		X		X	X	X
4	Gala Minder			X	X	X	X
5	Wore Meda			X	X	X	X
6	Arbaba			X	X		
7	Sheleko Medhane			X	X	X	X
8	Anguko			X	X	X	X
9	Mobil Gas Station			X			
10	ATVET College			X		X	X
11	Bawabat			X	X	X	X
12	Shiga Maryam			X	X	X	X
13	Shena Tekele Haymanot			X	X	X	X
14	Hod GEBEYA			X	X	X	X
15	Kidiste Hana			X	X	X	X
16	Rice Farm Research			X	X	X	X
17	SEFATRA			X	X	X	X

* Commercial power supply is available at Woreta PCO Base station.

1.8.2 Merawi PCO network

Equipment to be supplied for Point to Multipoint radio system are given in Table 1.8-2.

Table 1.8-2 System of Equipment Required for Merawi PCO

N o.	Station Name	Base St. Equipment	Rep. St. Eq'pt	Subscriber St. Eq'pt	Solar Power	Antenna & Feeder	Pole (Tower)
1	Mearwi/North Base	X			X		
2	Inguti (Rep No.1)		X		X	X	X
3	Meshenti No.1			X		X	X
4	Meshenti No.2			X		X	X
5	Bachuma			X	X		
6	INAMRT Farmer Office			X	X	X	X
7	Anbo Mask School			X	X	X	X
8	Anbo Mask Farmer Office			X		X	X
9	Kudimi School			X	X	X	X
10	Inguti School			X	X	X	X
11	Inguti (Road side)			X	X	X	X
12	Wetet ABAY			X		X	X
13	KURT BAHIR			X	X	X	X
14	RIM			X	X	X	X
15	Kurkurit Giyorgis			X	X	X	X

2. Technical Requirements

2.1 Base Station Equipment

2.1.1 RF Transmitter/Receiver Characteristics

- (1) System Operation : 1+1, hot standby
- (2) Radio Frequency Band : 2.3 – 2.5 GHz band (Rec. ITU-R F.746-1, Annex 2)
- (3) RF Channel Bandwidth : Not more than 3.5 MHz
- (4) RF Channel Spacing : Not more than 4 MHz
- (5) Transmission Capacity : 2 x 2 Mb/s
- (6) Modem Method : QPSK (with roll-off filter)
- (7) Output Power : 30 dBm at the output terminal of Tx unit
- (8) Output Frequency Stability : $\pm 5 \times 10^{-6}$
- (9) Output Impedance : 50 ohms, unbalanced
- (10) Spurious Radiation : -60 dB or more, at the ANT port of the equipment
- (11) Overall BER : -90 dBm or less, in BER= 10^{-3} at input terminal of Rx unit

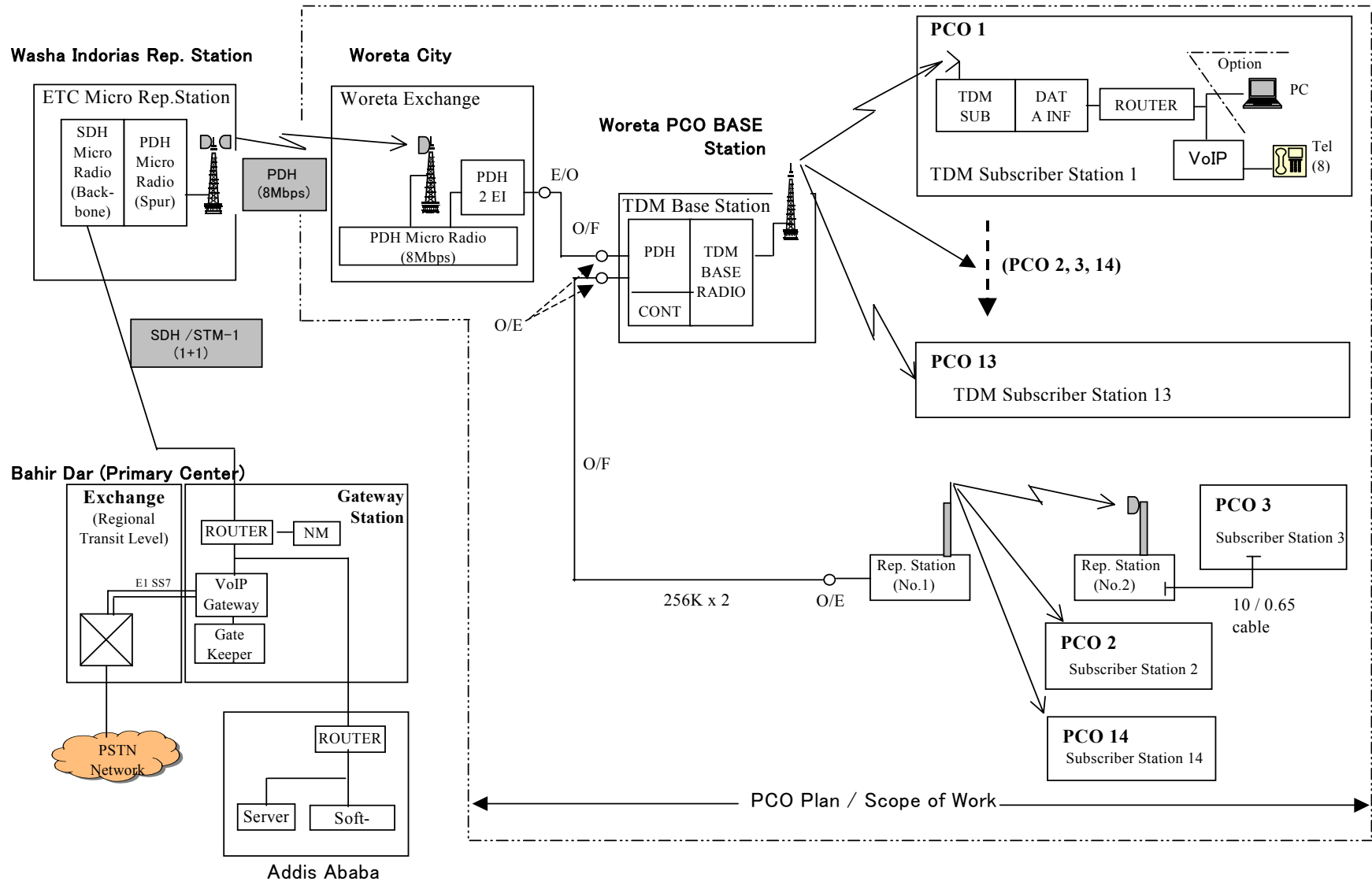


Fig. 1.2-1 Woreta Area PCO Configuration

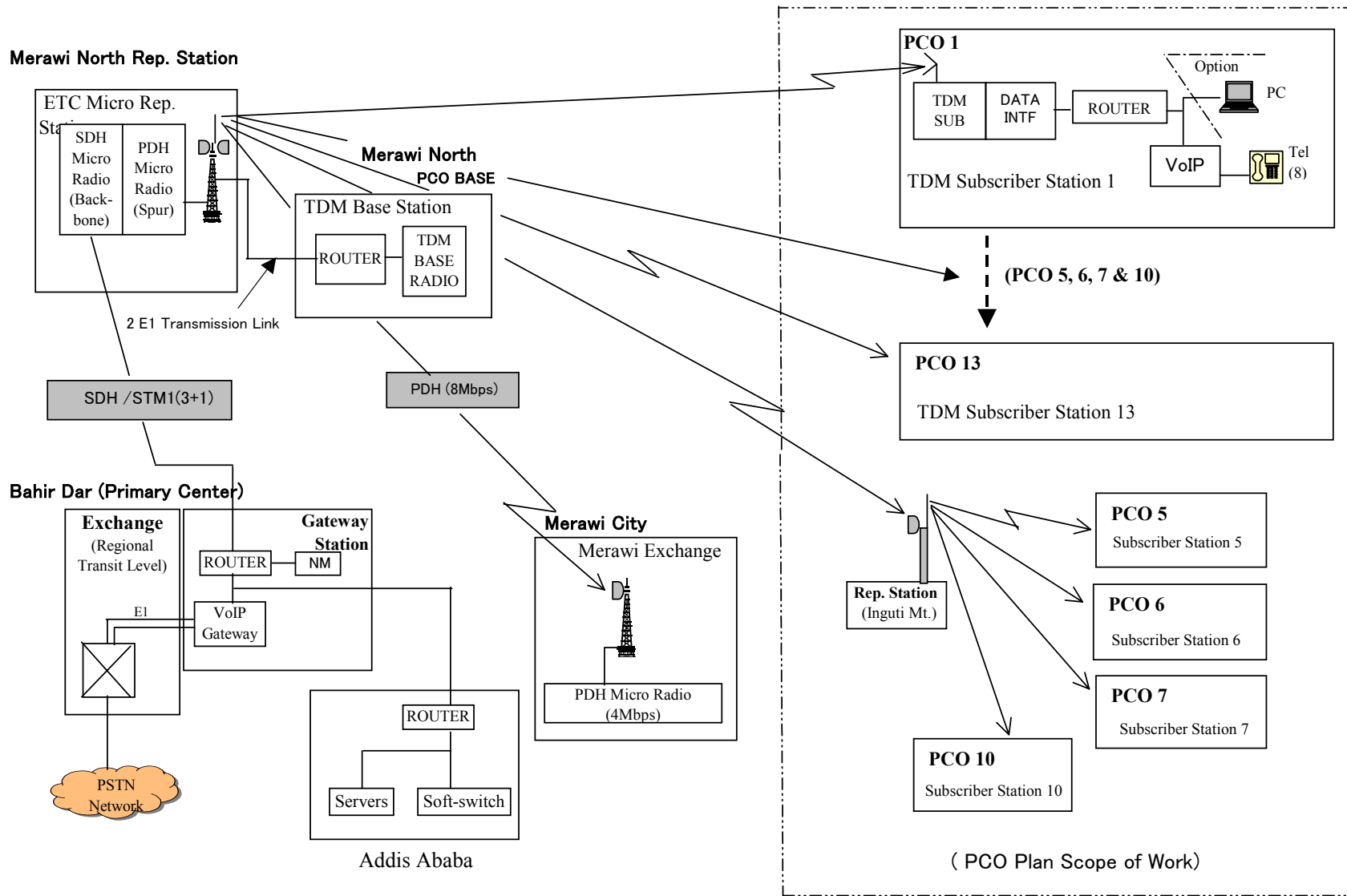


Fig. 1.2-2 Merawi Area PCO Configuration

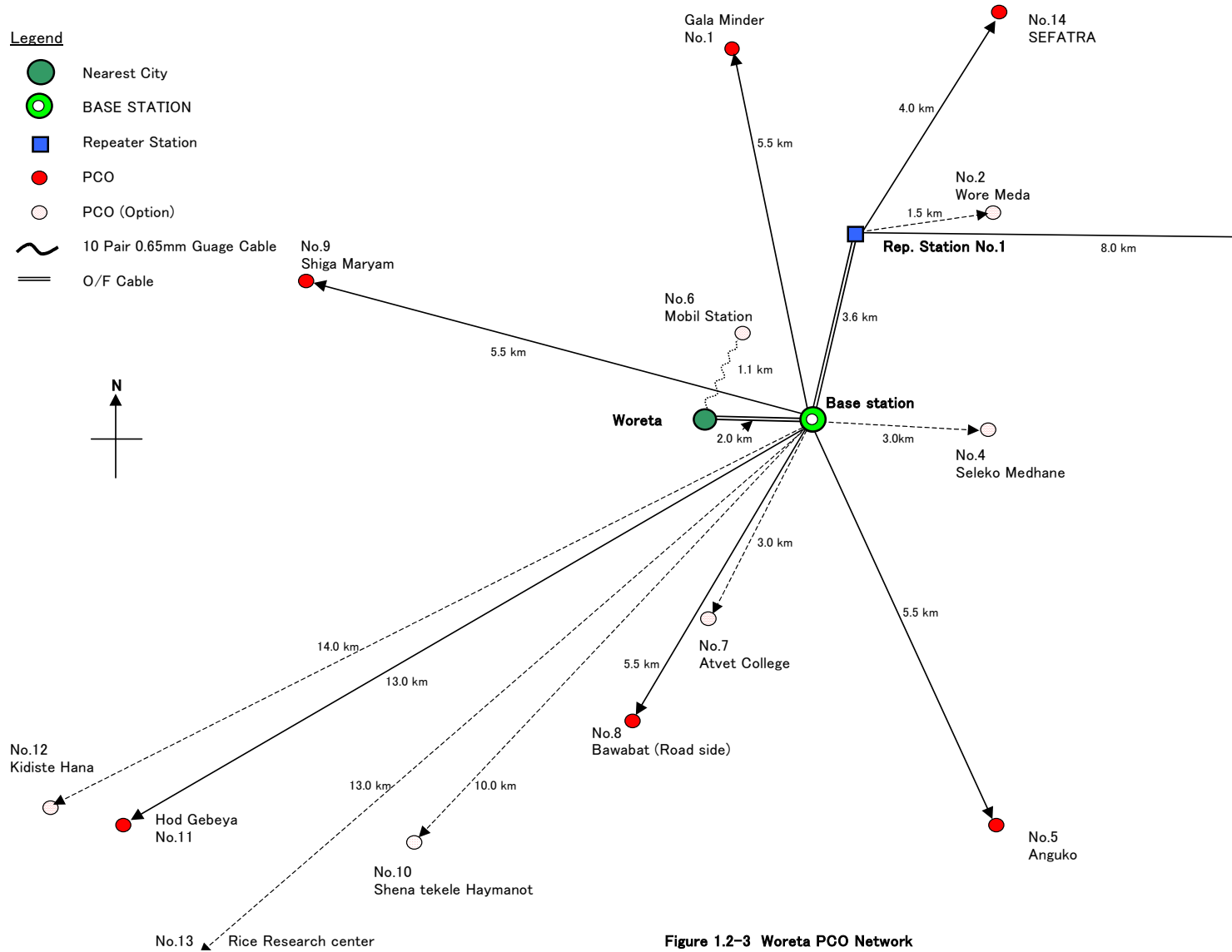


Figure 1.2-3 Woreta PCO Network

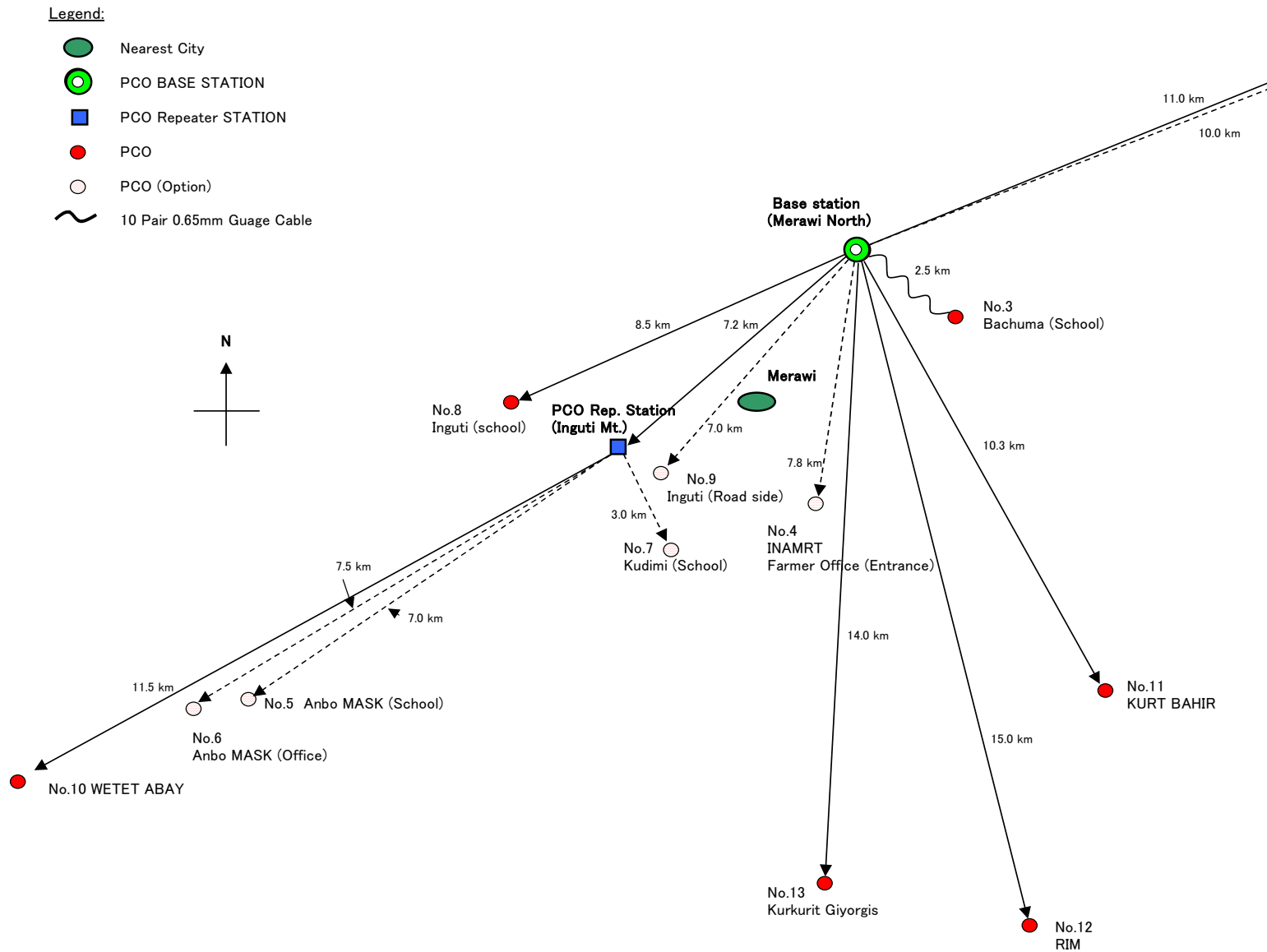


Figure 1.2-4 Merawi PCO Network

Table 1.2.2-1 Woreta PCO Station Data List (Planned)

No.	PCO	Station Name	Latitude (N)	Longitude(E)	Height (m)	Distance (Km)	Required Tower Height (m)	Remarks
	A	Washa Indorios	12° 08' 50"	37° 43' 28"	2420		62m (existing)	SDH Repeater
	B	Woreta City (Tel House)	11° 55' 30"	37° 41' 30"	1820		30	ETC Tel House
1	C	Woreta PCO(BASE)	11° 55' 20"	37° 42' 10"	1880	0	40	PCO BASE
2	D	PCO Repeater (Rep No.1)	11° 56' 48"	37° 43' 10"	1878	3.6	30	From PCO base
3	E	PCO Repeater (Rep No.2) Mt.Tizba	11° 55' 34"	37° 47' 32"	2015	11.6 (3.6+8)	20	From Rep. No.1
4	*1	Gala Minder (PCO No.1)	11° 58' 00"	37° 42' 10"	1793	5.5	10	
5	2	Wore Meda (PCO No.2)	11° 56' 50"	37° 43' 50"	1820	5.1 (3.6+1.5)	10	
6	*3	Arbaba (PCO No.3) WEJI	11° 55' 50"	37° 47' 32"	2015	12.6 (3.6+8+1)		Connected by Cable
7	4	Sheleko Medhane (PCO No.4)	11° 55' 00"	37° 48' 04"	1860	3	10	
8	*5	Anguko (PCO No.5)	11° 52' 38"	37° 43' 15"	1920	5.5	20	
9	6	Mobil Gas Station (PCO No.6)	11° 55' 58"	37° 41' 23"	1800	1.1		Connected by Cable from City
10	7	Woreta ATVET College (PCO No.7)	11° 54' 07"	37° 41' 36"	1880	3	10	
11	*8	Bawabat (Road Side) (PCO No.8)	11° 53' 28"	37° 39' 50"	1800	5.5	20	
12	*9	Shiga Maryam (PCO No.9)	11° 58' 56"	37° 39' 26"	1792	5.5	20	
13	10	Shena Tekele Haymanot (PCO No.10)	11° 53' 20"	37° 37' 13"	1790	10	20	
14	*11	Hod GEBEYA (PCO No.11)	11° 53' 20"	37° 35' 10"	1789	13	10	
15	12	Kidiste Hana (PCO No.12)	11° 54' 27"	37° 34' 27"	1789	14	10	
16	13	Rice Farm Research (PCO No.13)	11° 52' 14"	37° 35' 34"	1790	13	10	
17	*14	SEFATRA (PCO No.14)	11° 58' 50"	37° 44' 17"	1798	7.6 (3.6+4)	10	From Rep. No.1

Note:

7 sites with * marks are PCO candidates to be established under the "Optional Plan".

Table 1.2.2-2 Merawi PCO Station List (Planned)

No.	PCO	Station Name	Latitude (N)	Longitude (E)	Height (m)	Distance (Km)	Required Tower Height (m)	Remarks
	A	Merawi /North	11° 26' 57"	37° 11' 25"	2146		40m (existing)	SDH Repeater
	B	Merawi City (Tel House)				N/A	N/A	ETC Tel House
1	C	Merawi/North PCO(BASE)	11° 26' 57"	37° 11' 25"	2146	0	N/A	PCO BASE
2	D	PCO Inguti Rep. (Rep No.1)	11° 25' 14"	37° 07' 50"	2060	7.2	20	From PCO BASE
3	*1	Meshenti (PCO No.1)	11° 28' 04"	37° 16' 57"	1980	10	10	
4	2	Meshenti (PCO No.2)	11° 28' 48"	37° 17' 30"	1980	11	10	
5	*3	Bachuma (PCO No.3)	11° 26' 07"	37° 12' 37"	2020	2.5		Connected by Cable
6	4	INAMRT Farmer Office (PCO No.4)	11° 23' 04"	37° 10' 00"	2040	7.8	10	
7	5	Anbo Mask School (PCO No.5)	11° 23' 37"	37° 04' 27"	1940	14.2 (7.2+7)	30	
8	6	Anbo Mask Farmer Office (PCO No.6)	11° 23' 24"	37° 04' 10"	1920	14.7 (7.2+7.5)	30	
9	7	Kudimi School (PCO No.7)	11° 23' 45"	37° 07' 30"	1999	10.7 (7.2+3)	30	
10	*8	Inguti School (PCO No.8)	11° 25' 45"	37° 06' 53"	1990	8.5	10	
11	9	Inguti (Road side) (PCO No.9)	11° 24' 30"	37° 08' 12"	2000	7	10	
12	*10	Wetet ABAY (PCO No.10)	11° 22' 02"	37° 02' 14"	1920	18.7 (7.2+11.5)	30	
13	*11	KURT BAHIR (PCO No.11)	11° 21' 34"	37° 13' 12"	2080	10.3	20	
14	*12	RIM (PCO No.12)	11° 18' 47"	37° 12' 10"	2040	15	20	
15	*13	Kurkurit Giyorgis (PCO No.13)	11° 19' 40"	37° 10' 00"	2050	14	20	

Note:

7 sites with * marks are PCO candidates to be established under the "Optional Plan".

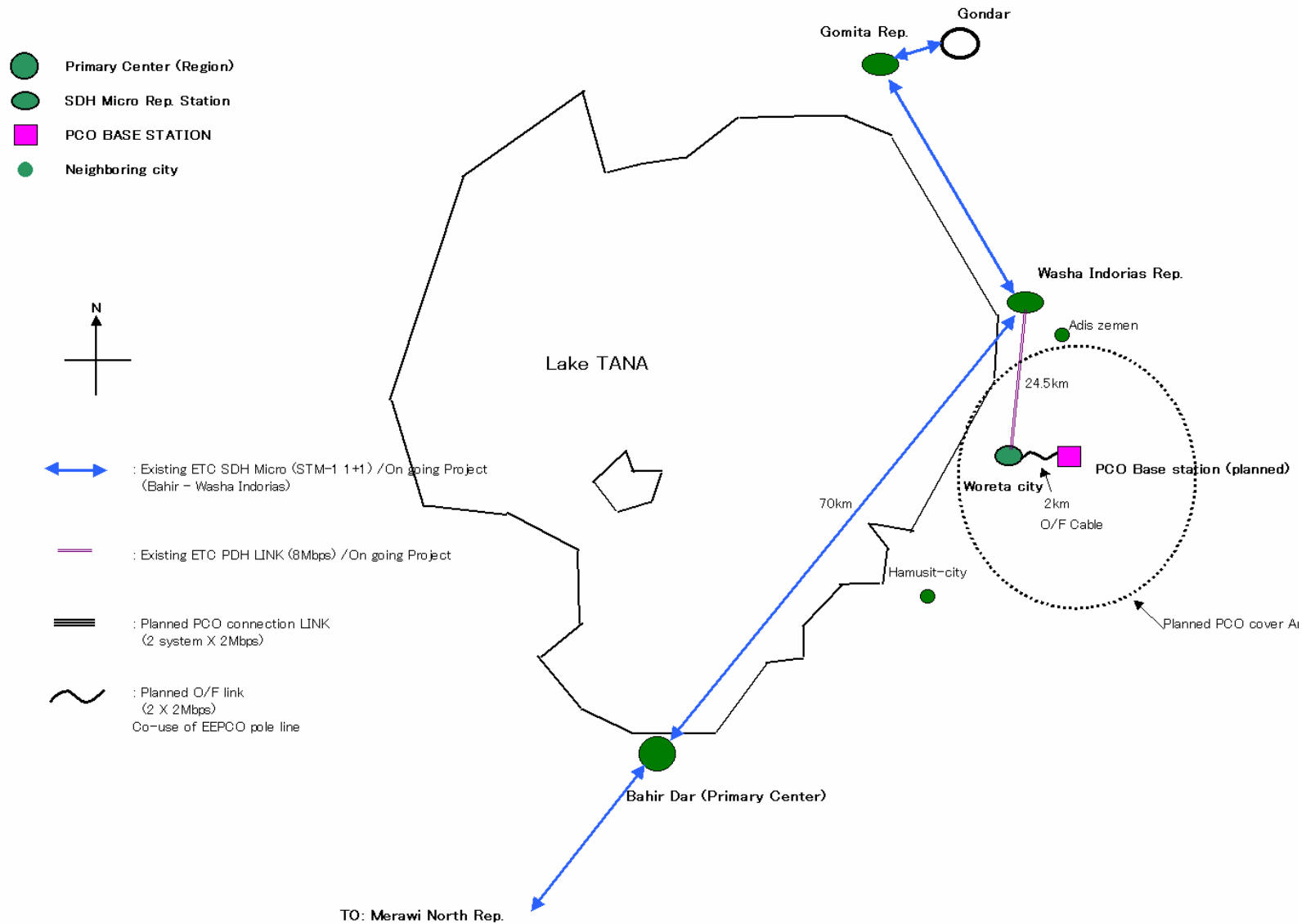


Figure 1.3-1 Transmission system configuration for Woreta PCO Station

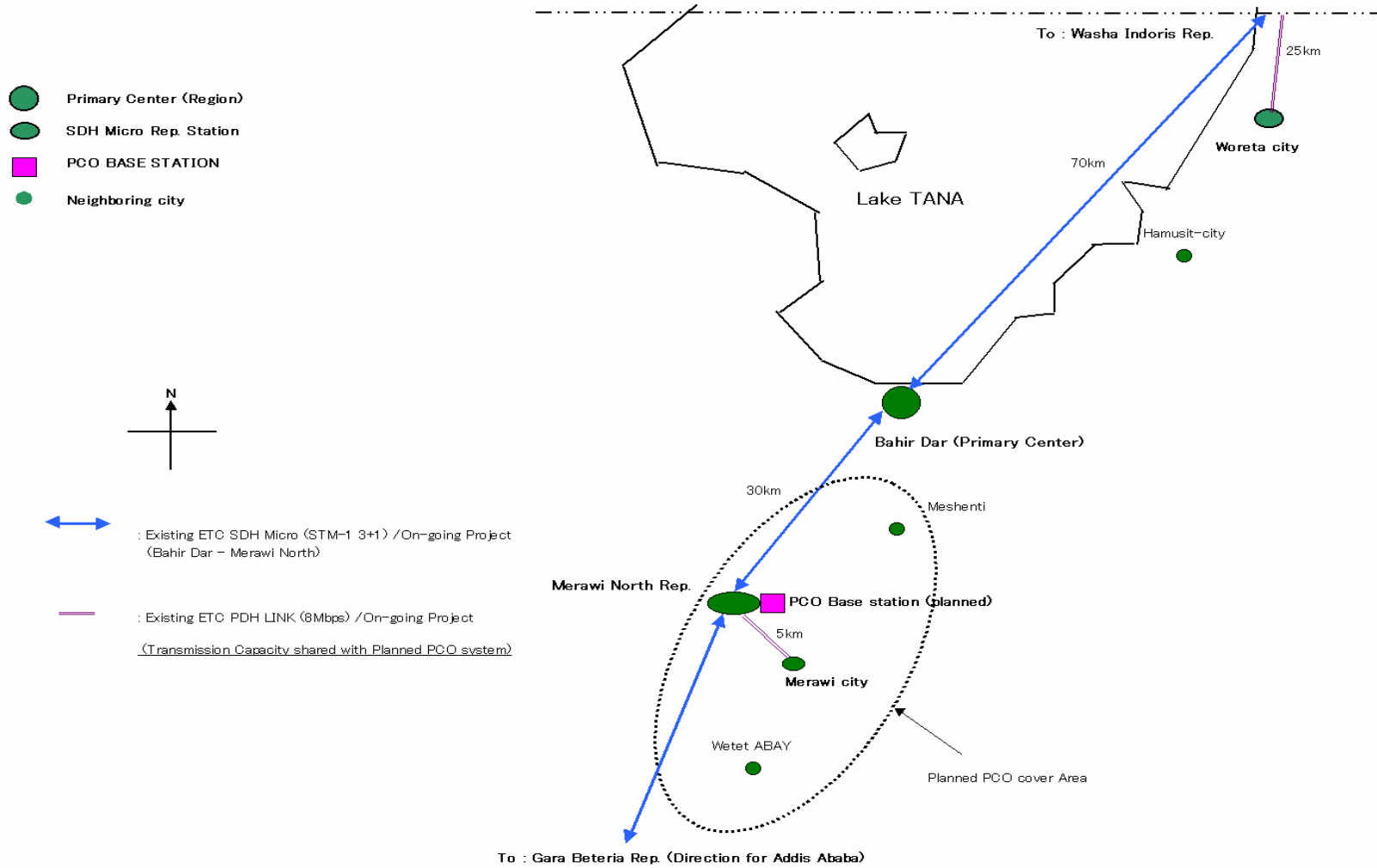


Figure 1.3-2 Transmission system configuration for Merawi PCO Station

Specifications for Solar Power System for PCO Network (Bahir Dar)

1. Solar Modules

General

This specification covers for solar power System for PCO network in rural areas. The equipment and materials to be supplied shall be in conformity with the technical specifications described hereunder.

Type of Solar Modules

- (1) The solar cell efficiency shall be as follows;

Cell efficiency: at least 14%

Module efficiency: better than 12%

- (2) Each solar module shall be constructed on the basis of normal 12V DC output and easy for series – parallel connection that can fulfill the load requirement of the transmission equipment.
- (3) Solar module shall have by-pass diodes for each or string of solar cells in order to avoid energy loss due to partial shading and bird dropping.
- (4) Junction boxes at the back of each solar module shall be resistant to water and atmospheric condition.

Solar Array and Supporting Structure

- (1) The 12V modules shall be assembled into array of convenient dimensions using rigid frames incorporated into the principal supporting structure.
- (2) When supporting structure mounted on the ground-based foundation, the lower edge of the solar array shall be at least 1.5 meters above ground level.
- (3) Array supporting structure shall resist a wind speed up to 150 km/h.
- (4) Array supporting structure shall have a fixed 10 degree tilt design.

System Sizing

The system sizing shall be done based on the average insolation level of 465 Langley.

2. Charge Regulator

- (1) Charge regulator shall be designed for nominal voltage of,
 - a) -48V DC for PCO Base station equipment and for the point to point microwave radio equipment in Woreta Base station.
 - b) -24V DC for PCO Subscriber station equipment.
- (2) The voltage to the load terminals shall be isolated in case of battery reverse polarity connection.

Regulator Facilities

- (1) The regulator shall incorporate an automatic boost charging facility.
- (2) The regulator shall have a built-in measuring instrument that is used to measure array current, load current, battery and load voltage each having manually operated push button and switch to disconnect them when not in use.
- (3) The regulator shall have necessary protection facilities to protect from damages.

3. Storage Battery for Solar Power System

Type of Battery

- (1) Storage batteries shall be of an enclosed lead-acid and dry-charged type.
- (2) The battery container shall be preferably see-through transparent type.

Operating Condition

The battery cells will be operated under float and boost charge modes and shall be able to supply the load for three (3) days in case of failure or bad weather condition.

4. Power Distribution Board (PDB)

- (1) The DC power distribution board shall have built-in automatic circuit breakers, which are sized on the load requirement of different transmission equipment with at least one (1) extra breaker for an expansion.
- (2) The DC power distribution board shall be designed for in-door use and to be fixed on the wall.

5. System Requirement

Equipment to be supplied for solar power system is as follows:

1. Woreta PCO Power System Requirement (Tentative)

No.	Station Name	Power Consumption	Solar Module		Storage Battery	
			Cap. (W)	Q'ty	Cap.(Ah)	Q'ty (Bank)
1	Woreta PCO(BASE)	N/A	N/A*	N/A	N/A	N/A
2	PCO Repeater (Rep No.1)	140 W	60	7 (24V)	500	1
3	PCO Repeater (Rep No.2)Mt. Tizba	140 W	60	7 (24V)	500	1
4	Gala Minder (PCO No.1)	70 W	60	7 (24V)	500	1
5	Wore Meda (PCO No.2)	70 W	60	7 (24V)	500	1
6	Arbaba(PCO No.3) WEJI	70 W	60	7 (24V)	500	1
7	Sheleko Medhane(PCO No.4)	70 W	60	7 (24V)	500	1
8	Anguko (No.5)	70 W	60	7 (24V)	500	1
9	Mobil gas Station (No.6)	70 W	60	7 (24V)	500	1
10	Woreta ATVET College(No.7)	70 W	60	7 (24V)	500	1
11	Bawabat (Road Side) (No.8)	70 W	60	7 (24V)	500	1
12	Shiga Maryam (No.9)	70 W	60	7 (24V)	500	1
13	Shena Tekele Haymanot (No.10)	70 W	60	7 (24V)	500	1
14	Hod GEBEYA (No.11)	70 W	60	7 (24V)	500	1
15	Kidiste Hana (No.12)	70 W	60	7 (24V)	500	1
16	Rice Farm Reserch (No.13)	70 W	60	7 (24V)	500	1
17	SEFATRA (No.14)	70 W	60	7 (24V)	500	1

* Commercial power supply will be available at Woreta.

2. Merawi PCO Power System Requirement

No.	Station Name	Power Consumption	Solar Module		Storage Battery	
			Cap. (W)	Q'ty	Cap.(Ah)	Q'ty (Bank)
1	Mearwi/North PCO (BASE)	700 W	120	36 (24V)	1,500	1
2	PCO Inguti Rep. (Rep No.1)	140 W	60	7 (24V)	500	1
3	Meshenti No.1 (PCO No.1)	70 W	60	7 (24V)	500	1
4	Meshenti No.2 (PCO No.2)	70 W	60	7 (24V)	500	1
5	Bachuma (PCO No.3)	70 W	60	7 (24V)	500	1
6	INAMRT Farmer Office (PCO No.4)	70 W	60	7 (24V)	500	1
7	Anbo Mask School (PCO No.5)	70 W	60	7 (24V)	500	1
8	Anbo Mask Farmer Office (PCO No.6)	70 W	60	7 (24V)	500	1
9	Kudimi School (PCO No.7)	70 W	60	7 (24V)	500	1
10	Inguti School (No.8)	70 W	60	7 (24V)	500	1
11	Inguti (Road side) (No.9)	70 W	60	7 (24V)	500	1
12	Wetet ABAY (No.10)	70 W	60	7 (24V)	500	1
13	KURT BAHIR (No.11)	70 W	60	7 (24V)	500	1
14	RIM (No.12)	70 W	60	7 (24V)	500	1
15	Kurkurit Giyorgis (No.13)	70 W	60	7 (24V)	500	1

Remarks: The capacities of solar modules and batteries in the above table show preliminary values for the references.

Technical Specifications for VoIP

1. VoIP (Voice over Internet Protocol)

1.1 General

This specification covers for main specification of VoIP network to be applied in Ethiopia. The equipment and materials to be supplied shall be in conformity with the technical specifications described hereunder.

1.2 Voice CODEC

VoIP shall have the voice compression facility which is adopted ITU-T Recommendation G.711 (~16kb/s) and shall have the facility to automatically select the compression method according to the communication status.

1.3 AGC (Automatic Gain Control)

VoIP shall have AGC facility to automatically control voice level to the most suitable extent.

1.4 T.38 Real Time FAX communication

T.38 FAX communication system shall be adopted to reduce jitter of the network.

1.5 Support for TOS Field

Voice shall be controlled with the priority by TOS (Type of Service) of IP header.

VoIP shall have the facility to cope with priority routing such as Multi-protocol Label Switching for router facility.

1.5 First Connect

1.5.1 The facility shall be provided for rapid call connection by simplifying call control process with H.245.

2. Interface

2.1 VoIP Gateway – Subscriber : Analog interface,

Power Supply at Subscriber Side : -24V ~ -48VDC (applicable to analog Telephone)

2.2 VoIP Gateway – Soft Switch : H.323 or SIP (Session Initiation Protocol)

2.3 Media Gateway – VoIP Gateway: RTP (Real Transport Protocol) Packet

2.4 Media Gateway – Existing Exchange: E1 Digital interface (Capacity: more than 4 E1), and 10/100 Base T (Ethernet) for LAN (Local Area Network) and E1, STM-1 for WAN (Wide Area Network)

2.5 VoIP Gateway

Interface: 10/100 Base-T (Ethernet)

Protocol: H.323 or SIP

Capacity: 30 or more (16 for PCO networks)

2.6 Soft Switch

Interface Protocol: H.323 and SIP

Signaling System: SS 7 over IP

Facility: SCCP (Signaling Control Channel Protocol)/TCAP (Traffic Control Address Protocol), G733.

2.7 Charging Facility

Real time CDR (Call Detail Record) shall be installed in Addis Ababa PC (Primary Center), has interchangeability with the existing system and be programmable format.

The charging information shall be connected to the existing computer of ITCD in ETC.

2.8 Call Control Facility

Following facilities shall be provided.

- a) Hunting
- b) Call Screening
- c) Three-way Calling
- d) Call Hold
- e) Call Forwarding

2.9 Gateway in Addis Ababa Primary Center shall have the capacity of 10,000 BHCA (Busy Hour Call Attempt) or more with a capability of up-grade.

2.10 Exchange Facility (VoIP system)

- a) Calling Rate: 0.05 Erl.
- b) Packet Length of Voice: G.729 / G.729a
- c) Packet Length: 16 kb/s or more
- d) Interval of Packet: within 40 msec.

3. General Information

3.1 Power Supply for VoIP

- a) PC and Exchange: 230 V AC, 50 Hz, nominal and UPS (4 hours or more) shall be provided.
- b) PCO: -24 V DC

3.2 Equipment Composition

- a) PC: Indoor Type

- b) Exchange: Outdoor Cabinet Type
- c) PCO: Indoor Type

3.3 Numbering

- a) Special numbering facility shall be provided.
- b) Calling number shall be displayed in case of call to police and fire station.

3.4 Network supervision for VoIP shall be carried out at any station.

3.5 Applicable Standards

- a) Relevant IEEE Standards
- b) Relevant ITU-R and ITU-T Recommendations
- c) The manufacturing facilities for the proposed equipment shall be certified to the ISO 9000 series quality standard.