



شركة البدرى للأعمال الكهروميكانيكية

إحدى شركات مجموعة البدرى للتنمية والاستثمار

BADRY Electro-Mechanical Works Co.

MEP CONTRACTOR

GEOHERMAL GHP HVAC SOLUTION

ORANA Food Plant HVAC Systems Upgrade @ Badr City

FACILITY GHP / HVAC SYTEMS 300 TONs

Quotation # 16230-00-010-1434, Rev 00 – Feb. 2020



BADRY MEP

Electro-Mechanical Works Co.

6B, Sixth October St., Manshiet Al Sad Al Aaly,
Al-Salam, Cairo, Egypt.

P.O Box 1527 Alf Maskan, Cairo, Egypt.

Tel: +202 219 06 401, +202 219 06 362

Fax: +202 219 06 823 - Cell: +20 100 57 43 852

E-mail: mep@badrygroup.com

Web : www.Badrygroup.com

BADRY
Group

P.O.Box 1527 Alf Maskan
Cairo 11777, Egypt
Phone 21906401 Fax 21906823

DATE 25/02/2020
Quotation # 16230 (Rev 0)
Customer ID 1434

Quotation For:

Project Geothermal GHP HVAC Solution for Badr Plant
Name Mr. Mahendra Dhote
Company/Auth. ORANA
Address Plot 145, Area 250 Yard, Robeyky - Badr City
Tel / Fax 02 23 10 82 23 / 23 10 82 27
Cel / Mob +2 0109 532 2552
E-Mail msd@orana.com.eg

Quotation valid until: 30/04/2020

Prepared by: Gehad Salah

Geothermal GHP Solution

Facility HVAC Systems - 300 Ton

Terms or Special Cond.: 20% In Advance (A.P), R.T (Raise To) 50% Material, R.T 95% Install Invoices, 05% RET. / Delivery
Delivery 10 Working Months (W.M) From W.O & A.P, Design, Approved WSDs (2 W.M) Design Receipt

SALES PERSON	QUOTE NUMBER	DELIVERY	SHIP VIA	SITE	TERMS
Gehad Salah	16230-0 / 010 / 1434	12 Months (10 + 2) W.M	LAND - DTD	Badr City	Due on Order

CODE	DESCRIPTION	BOQ	ADD / ENG	AMOUNT USD)
VENT	GEOHERMAL SYSTEM FOR AREA VENTILATION Acc. To. Table D-1: BOQ - Geothermal Ground Coupled System for the Ventilation of Production Area	660,000	40,000	USD 700,000
ACND	GEOHERMAL SYSTEM FOR AIR CONDITIONING Acc. To. Table D-2: BOQ - Geothermal Ground Coupled System for the Air Conditioning of the Adminstrative Area	960,000	40,000	USD 1,000,000
HEAT	GEOHERMAL SYSTEM FOR WATER / STEAM HEATING Acc. To. Table D-3: BOQ - Geothermal Ground Coupled System for the Heating Steam of Food Production Area	760,000	40,000	USD 800,000

A. Client is Required to Provide at Site (Our Prices Exclude Any of);

1- Site Facilities; Power, Lighting, Water, Drainage - Sources

2- Storage Area, Site Office, Lisences, Permits from Any /others Entrance & Exist Fees

B. Quote Prices based on RE-MEASURE SUB-CONTRACT, FIRST Perurity is BOQ

C. ADD / ENG express Engineering, Work-Shop-Drawings & AS-Builts Drawings

D. Others is a non refund cost values express Mobilization, Accomodation

SUBTOTAL USD 2,500,000

VAT TAX USD 350,000

SOC. INSUR USD 100,000

OTHERs USD 50,000

TOTAL USD 3,000,000

If you have any questions concerning this quotation contact Ms. Gehad Salah

Tel +20 2 219 06 401, Fax +20 2 219 06 823, hasoegypt@gmail.com, mep@badrygroup.com

THANK YOU FOR YOUR BUSINESS!



Table C - Air Equipments Calculation

Ventilation for Production Area Project - Quote 16231-00

Table C-1: Air Equipment Calculation for the Ventilation for Production Area Project

Production Area Ventilation - Water To Air "a" - GHP/ AHU (s) Calculation												
S.N	Area Description	Class	ISO	Area (m ²)	Area (ft ²)	Height (ft)	Volume (ft ³)	ACPH	CFM Steady	Add CFM Fresh Air	Add CFM Heat Load	CFM SUM
1	Production Area	N/A	N/A	308	3315	33	109395	15	27,349	0	2,000	29,349
2	Corridors Area	N/A	N/A	105	1130	33	37290	12	7,458	746	400	8603.80
3	Services Area	N/A	N/A	37	398	10	3980	20	1,327	199	522	2047.67
a	AHU(s) / G.H.P(s)	8,000	40,000	CFM	20	100	TR	5	36,133	945	2,922	40,000

CFM
A.H.U

Ton
G.H.P

ALL
Geothermal Heat Pumps

QTY
G.H.P

CFM_{Total}



Table C - Air Equipments Calculation

Air Condition for Adminstrative Area Project - Quote 16232-00

Table C-2: Air Equipment Calculation for the Air Condition for Adminstrative Area Project

Production Area Ventilation - Water To Water "b" - GHP/ AHU (s) Calculation

S.N	Area Description	Class	ISO	Area (m ²)	Area (ft ²)	Height (ft)	Volume (ft ³)	ACPH	CFM Steady	Add CFM Fresh Air	Add CFM Heat Load	CFM SUM
1	Ground Floor Area	N/A	N/A	182	1960	10	19600	30	9,800	1,960	2,000	13,760
2	First Floor Area	N/A	N/A	173	1862	10	18620	30	9,310	1,862	2,000	13,172
3	Services Area	N/A	N/A	145	1560	10	15600	36	9,360	1,872	1,836	13,068
b	AHU(s) / G.H.P(s)	10,000	40,000	CFM	25	100	TR	4	28,470	5,694	5,836	40,000

CFM
A.H.U

ALL

Ton
G.H.P

ALL

Geothermal Heat Pumps

QTY
G.H.P

CFM_{Total}



Geothermal System Air Equipment Calculation

Table C – Air Equipment's Calculation

Heating Steam for Food Production Project - Quote 16233-00

Table C-3: Air Equipment Calculation for Heating Steam for Food Production Project

Heating Water with Steam Heat Exchangers - Shell and Tube Exchanger		
Steam is on the Shell side		
Product to heat is on the Tube Side		
Temperature in	68	F
Temperature out	320	F
Delta T	252	F
Gallons to Heat	5.00	US GPM
Gallons to Heat	4	IMP Gall / Minutes
Gallons to Heat	250	Imp Gallons / Hour
Based on S.Gravity	2498	Lbs / Hour
Heating	19	Litres / Minutes
Specific Heat of Liquid (Cp)	1	BTU / LB F
Specific Gravity	1	
Steam Pressure	150	psig
Latent Heat at Steam Pressure	880	BTU / LB
Safety Factor (Eff. H. Exch)	85	% Efficiency
	740,586	BTU / Hour Required
	186,628	Kcal / Hr to Exchanger
Load of Heat Exchanger	842	LBS / Hour of Steam Required
BHP - Using Heat Exchanger	24.4	BHP ☆
Direct Injection of Steam into Water	630.0	LBS / Hour of Steam Required
BHP - Direct injection of Steam into water	18.3	BHP ☆

Geothermal / Ground Source Coupled Heat Pump – Water To Water G.H.P:

Total Heat Load =

$$\begin{aligned}
 & 186,628 \text{ K.Cal/Hr (Heat Steam for Production)} \\
 & + 113,372 \text{ K.Cal/Hr (Hot Water for Cooking)} \\
 & \text{-----}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total Heat Load} &= 300,000 \text{ K.Cal/Hr} \\
 &= 1,200,000 \text{ BTU/Hr}
 \end{aligned}$$

Total Heat Load = 100 Ton

Using: # 3 G.H.P (2+1); 2 Operation + 1 Backup / Standby
Each of 50 Ton, Water To Water Heat Pump (Ground Coupled)
With Dedicated Control System (DDC)



Geothermal System Costing Calculation

Table A – Per TON's Cost Calculation - 2020

Overall Geothermal System Project – Per Ton Calculations

Table A : Geothermal HVAC Systems Construction Cost & Per Ton Calculation :-

S.N	Area	HVAC System	Load (Ton)	Notes	Total COST (USD)	Per Ton (USD)
1	Production Area	Ventilation	100	Cool Only	700,000	7,000
2	Adminstration Area	Air Condtion	100	Cooling + Hydronic Warming	1,000,000	10,000
3	Production Area	Heating	100	Heating (Water / Steam)	800,000	8,000
S	Facility HVAC	SUM	300	Exclude TAXs	2,500,000	8,333
				Taxes & Social Insur.	450,000	1,500
				Others, Mobilization	50,000	167
P	Facility HVAC	Total	300	Enclude TAXs	3,000,000	10,000
			TON		Total HVAC COST	Per Ton Cost

Geothermal Facility HVAC Systems Construction Cost:

- Total Facility HVAC Systems Load = 300 Ton
- Total Facility HVAC Systems Cost = 3,000,000 USD
- Per Ton HVAC Systems Cost = 10,000 USD

Notes of Pricing:

- 1) Above HVAC Facility Systems are Economical Solution (60% Energy Reduction) with 5Y Warranty from 25Y Lifetime, of (3,000,000 USD), China GHPs total price = 1,110,000 USD (37% of Total System Price) and Per Ton Price (10,000 USD) based on China Origin GHPs via brands same as AMRTA, NE and Mango.
- 2) Hi-Level Solution (70% Energy Reduction) with 10Y Warranty from 30Y Lifetime for HVAC Facility Systems will be of (5,250,000 USD), US GHPs total price = 3,360,000 USD (64% of Total System Price) and Per Ton Price (17,500 USD) based on US Origin GHPs via brands same as Northern, Bard and Thermal-Air.



Geothermal HVAC System Savings Calculation

Table B – Comparison of Energy Sources Cost Calculation - 2020

Geothermal HVAC System Project – SAVINGS Calculations

Table B : Geothermal HVAC Systems Compared Energy Cost & Savings :-

Traditional Electric Resistant HVAC Systems -- Annual Costs										
S.N	Area	HVAC System	Load (Ton)	Annual Operational Energy Used (QTY / COST)				SUM Annual Energy COST (USD)	SUM Annual Maintenance COST (USD)	TOTAL Annual T. HVAC COST (USD)
				Electricity		Natural Gas				
				KWH (s)	Cost / USD	MMBTU (s)	Cost / USD			
1	Production Area	Ventilation	100	150,000	15,000	0.00	0.00	15,000	20,000	35,000
2	Adminstration Area	Air Condtion	100	650,000	65,000	0.00	0.00	65,000	50,000	115,000
3	Production Area	Heating	100	200,000	20,000	16,667	100,000	120,000	30,000	150,000
S_T	Facility HVAC	SUM	300	1,000,000	100,000	16,667	100,000	200,000	100,000	300,000

Geothermal GHP Heat Pump HVAC Systems -- Annual Costs										
S.N	Area	HVAC System	Load (Ton)	Annual Operational Energy Used (QTY / COST)				SUM Annual Energy COST (USD)	SUM Annual Maintenance COST (USD)	TOTAL Annual G. HVAC COST (USD)
				Electricity		Natural Gas				
				KWH (s)	Cost / USD	MMBTU (s)	Cost / USD			
1	Production Area	Ventilation	100	50,000	5,000	400	2,400	7,400	6,667	14,067
2	Adminstration Area	Air Condtion	100	200,000	20,000	700	4,200	24,200	6,667	30,867
3	Production Area	Heating	100	50,000	5,000	3,067	18,400	23,400	6,667	30,067
S_G	Facility HVAC	SUM	300	300,000	30,000	4,167	25,000	55,000	20,000	75,000

Geothermal Facility HVAC Systems Savings:

- Applied GHP HVAC Systems is 25% of existing Electric Resistant Systems for same load of 300 Tons
- Applied GHP HVAC Systems has the Lowest Operating Cost more over Lowest CO2 Emissions and so Lowest Sound Ratings
- Estimated Annual Savings for HVAC Operations & Maintenance = 225,000 USD "Per Year"

Notes of Savings:

- 1) Estimated Energy costs based on industrial applications tariff @ EGY - 2020 via 6 USD for MMBTU Natural Gas and 10 Cent for KWH, and within given data that operation through 8-10 working hours a day at facility.
- 2) Higher Energy (Qty & Cost) Savings due to the existing Air Condition system based on Mini Split AC Units and Electric Heaters and Boilers for Administrative heating and air conditions in which all will be replaced by economical GHP Centralized HVAC Systems.
- 3) GHP HVAC Systems all will be higher efficiency, comfort and eco friendly plus lowest cost compared to existing traditional Electric Resistant HVAC System – especially the Ventilation System for the production area – it will be humidity leveling and rating being controlled and with colder fresh air rather than founded ventilated air with hotter air and higher humidity containing.



Geothermal HVAC System Payback Calculation

Table E – Geothermal HVAC System PAY-BACK Calculation - 2020

Geothermal HVAC System Project – PAY-BACK Calculations

Table E : Geothermal HVAC Systems PAY-BACK :-

G	Facility HVAC Systems	300	3,000,000	10,000	75,000
	Geothermal GHP Heat Pumps	TON	First Base COSTs	Per Ton First Base Cost	Energy + Maintenance Annual COSTs
E	Facility HVAC Systems	300	1,650,000	5,500	300,000
	Traditional Electric Resistant	TON	First Base COSTs	Per Ton First Base Cost	Energy + Maintenance Annual COSTs
S	SAVINGS	300	1,350,000	4,500	225,000
		TON	First Base SAVINGS	Per Ton First Base Saving	Energy + Maintenance Annual SAVINGS
P	PAY-BACK	300	1,350,000	225,000	6
		TON	First Base SAVINGS	Energy + Maintenance Annual SAVINGS	YEARS

Geothermal Facility HVAC Systems Payback year's calculation:

- Estimated Payback years for Submitted Geothermal GHP HVAC Systems of 300 Tons is 6 Years.
- Successful Geothermal HVAC System Paybacks are within 5 – 10 Years.
- Noting the Life-Time of existing Air Condition (Split AC Units) is around 5 – 7 Years, compared to Geothermal HVAC System of 30 Years Life-Time – Thus makes additional added value for GHP savings and Payback years.
- HVAC System Economics lead to its Bottom Line equals the sum of First Base Costs (Initial Construction and building Costs) and the Energy Costs (for Operation) and the Maintenance Cost (Preventive & Services Repair).
- First Base Cost is greatly influenced by effective design.
- Geothermal HVAC System have the Higher Economic Benefits of Performance, Energy Efficient, Comfortable Operation, Reduction of Energy Costs, Payback rates and generally Best Life Cycle Costs.



GEOHERMAL SYSTEM FOR AREA VENTILATION -- Project Quote 16231-00

Table D-1: BOQ - Geothermal Ground Coupled System for the Ventilation of Production Area

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
1	Geothermal System Design & Ground Testing								
	Ground Geothermal Sytem Testing & Designing, provides the designer with accurate information on the thermal conductivity, loop design can be optimized and the path of of piping and Bore-Holes. Tests with Field Testing Appartus will be conducted by drilling borehole and adding loop with hot water from a portable electric heater is circulated. Data log is run over 48 hours and energy absorbed by the ground is measured so that the conductivity and diffusivity could be calculated. Then, Submitting of Trenched Horizontal / Vertical Loop Design, c/w Bore-Hole Layout using Software Design for Ground Loops, Piping								
1-a	Ground Testing for Geothermal of the Ventilation Area	LS	1	BADRY	0	0	20000	20,000	20,000
1-b	Ground Loop Design for Geothermal of the Ventilation Area	LS	1	BADRY	0	0	20000	20,000	20,000



GEOHERMAL SYSTEM FOR AREA VENTILATION -- Project Quote 16231-00

Table D-1: BOQ - Geothermal Ground Coupled System for the Ventilation of Production Area

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
2	Ground Closed Loop Hydrulic Piping Works								
	Under Ground Geothermal closed loop; Trenched Horizontal / Drilled Vertical, Loop Piping works via HDPE System, c/w Bore-Hole Layout using Software Design for Ground Loops, Piping of HDPE material c/w all required fittings to act as a heat exchanger same to cooling coil. Item complete with Backfill & Grouts for the piping jacket avoiding Air Gaps or separations via grouting with Thermal Grouts of 60% Quartezil and 20% Cement, 10% Fly Ash, 10% Sand. Hydraulic Fluid of Antifreeze Water Based Solution as a water source refrigrant for Heat Pump to be supplied and equiped.								
2-a	Trenched horizontal HRZ Loop with 10 ft depth, Bore-hole 4 Inch	Ton	50	BADRY	600	30,000	900	45,000	75,000
2-b	Drilled Vertical VER Loop with 200 ft depth, Bore-hole 6 Inch	Ton	50	BADRY	800	40,000	1200	60,000	100,000



GEOHERMAL SYSTEM FOR AREA VENTILATION -- Project Quote 16231-00

Table D-1: BOQ - Geothermal Ground Coupled System for the Ventilation of Production Area

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
3	Geothermal System Equipments (GHP Equipments)								
	Supply, installation, testing and commissioning of Geothermal water source Heat Pump with R-410a Refrigerant with wider fluid operating range and additional insulation of internal co-axial coils, thermal expansion TX Valves and heat exchangers optimized for geothermal operating conditions. GHP to be designed and supplied with Variable Flow System c/w two-way isolating valves at each heat pump that shut off the flow when the compressors is not runing. Heat Pump to be modulated and equieped with variable frequency drive (VFD)								
3-a	GHP c/w VFD for Variable Flow, 20 Ton (Cool Only)	No	5	AMRTA	28000	140,000	4000	20,000	160,000
3-b	GHP c/w VFD for Variable Flow, 25 Ton (Cool + Warm)	No	0	AMRTA	53000	0	7000	0	0
3-c	GHP c/w VFD for Variable Flow, 50 Ton (Heating / Child)	No	0	AMRTA	67000	0	8000	0	0
3-d	Rooftop Unit with Enthalpy Wheel	No	1	Mc-Quay	49000	49,000	6000	6,000	55,000
3-e	Templifier Water to Water Heat Recovery	No	1	Mc-Quay	41000	41,000	4000	4,000	45,000



GEOHERMAL SYSTEM FOR AREA VENTILATION -- Project Quote 16231-00

Table D-1: BOQ - Geothermal Ground Coupled System for the Ventilation of Production Area

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
4	Pumping & Mechanical Room Works								
	Supply, installation, testing and commissioning of Geothermal system redundant pump package system to meet the design flow and to be connected and controlled with VFD of GHP. System to be complete with Supply & Return Headers @ Mechanical Rooms c/w pipes, fittings, taps and valves for supply / return lines and expansion tanks and air separators to act the whole system operation more over system flushing; air removing from ground loop into piping								
4-a	Pumping System for Flow (1-Operation +1-Standby)	Pkg	1	Grundfos	28000	28,000	4000	4,000	32,000
4-b	Mechanical Room Works c/w Headers, Valves, Accessories	LS	1	BADRY	12000	12,000	6000	6,000	18,000



GEOHERMAL SYATEM BOQ

Table D - BOQ for Geothermal System



GEOHERMAL SYSTEM FOR AREA VENTILATION -- Project Quote 16231-00

Table D-1: BOQ - Geothermal Ground Coupled System for the Ventilation of Production Area

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
5	Delivery / Distribution System								
5-1	SITC Water Transfer / Piping System c/w Valves & Fittings	LS	0	BADRY	75000	0	25000	0	0
5-2	SITC Air Transfer / Ducting System c/w Registers & Dampers	LS	1	BADRY	55000	55,000	20000	20,000	75,000
5-3	SITC Radiant Floor Warming System c/w Outlets	LS	0	BADRY	85000	0	25000	0	0
5-5	Civil / Arch. Ancilaary Works to furnish Distribution System	LS	1	BADRY	0	0	35000	35,000	35,000
6	Control & Management System								
6-1	DDC Control System	LS	1	Rockwell	19000	19,000	4000	4,000	23,000
6-2	BMS / HDMI Operation System with PLC	LS	1	Rockwell	22000	22,000	5000	5,000	27,000
7	Testing & Balance								
7-1	Testing & Ballancing of HVAC / Ducting / Piping Systems of Each Area Acc. To ASHARE / SMACNA / ISO Classification	LS	1	BADRY	0	0	15000	15,000	15,000
S1	GEOHERMAL - SUM / VENTILATION WORKS	Seven Hundred Thousands USD					700,000		



GEOHERMAL SYSTEM FOR AIR CONDITIONING -- Project Quote 16232-00

Table D-2: BOQ - Geothermal Ground Coupled System for the Air Conditioning of the Adminstrative Area Project

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
1	Geothermal System Design & Ground Testing								
	Ground Geothermal Sytem Testing & Designing, provides the designer with accurate information on the thermal conductivity, loop design can be optimized and the path of of piping and Bore-Holes. Tests with Field Testing Appartus will be conducted by drilling borehole and adding loop with hot water from a portable electric heater is circulated. Data log is run over 48 hours and energy absorbed by the ground is measured so that the conductivity and diffusivity could been calculated. Then, Submitting of Trenched Horizontal / Vertical Loop Design, c/w Bore-Hole Layout using Software Design for Ground Loops, Piping								
1-a	Ground Testing for Geothermal of the Ventilation Area	LS	1	BADRY	0	0	20000	20,000	20,000
1-b	Ground Loop Design for Geothermal of the Ventilation Area	LS	1	BADRY	0	0	20000	20,000	20,000



GEOHERMAL SYSTEM FOR AIR CONDITIONING -- Project Quote 16232-00

Table D-2: BOQ - Geothermal Ground Coupled System for the Air Conditioning of the Adminstrative Area Project

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
2	Ground Closed Loop Hydrulic Piping Works								
	Under Ground Geothermal closed loop; Trenched Horizontal / Drilled Vertical, Loop Piping works via HDPE System, c/w Bore-Hole Layout using Software Design for Ground Loops, Piping of HDPE material c/w all required fittings to act as a heat exchanger same to cooling coil. Item complete with Backfill & Grouts for the piping jacket avoiding Air Gaps or seprations via grouting with Thermal Grouts of 60% Quartezil and 20% Cement, 10% Fly Ash, 10% Sand. Hydraulic Fluid of Antifreeze Water Based Solution as a water source refrigrant for Heat Pump to be supplied and equiped.								
2-a	Trenched horizontal HRZ Loop with 10 ft depth, Bore-hole 4 Inch	Ton	30	BADRY	600	18,000	900	27,000	45,000
2-b	Drilled Vertical VER Loop with 200 ft depth, Bore-hole 6 Inch	Ton	70	BADRY	800	56,000	1200	84,000	140,000



GEOHERMAL SYSTEM FOR AIR CONDITIONING -- Project Quote 16232-00

Table D-2: BOQ - Geothermal Ground Coupled System for the Air Conditioning of the Adminstrative Area Project

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
3	Geothermal System Equipments (GHP Equipments)								
	Supply, installation, testing and commissioning of Geothermal water source Heat Pump with R-410a Refrigerant with wider fluid operating range and additional insulation of internal co-axial coils, thermal expansion TX Valves and heat exchangers optimized for geothermal operating conditions. GHP to be designed and supplied with Variable Flow System c/w two-way isolating valves at each heat pump that shut off the flow when the compressors is not runing. Heat Pump to be modulated and equieped with variable frequency drive (VFD)								
3-a	GHP c/w VFD for Variable Flow, 20 Ton (Cool Only)	No	0	AMRTA	28000	0	4000	0	0
3-b	GHP c/w VFD for Variable Flow, 25 Ton (Cool + Warm)	No	4	AMRTA	53000	212,000	7000	28,000	240,000
3-c	GHP c/w VFD for Variable Flow, 50 Ton (Heating / Child)	No	0	AMRTA	67000	0	8000	0	0
3-d	Rooftop Unit with Enthalpy Wheel	No	1	Mc-Quay	49000	49,000	6000	6,000	55,000
3-e	Templifier Water to Water Heat Recovery	No	1	Mc-Quay	41000	41,000	4000	4,000	45,000



GEOHERMAL SYSTEM FOR AIR CONDITIONING -- Project Quote 16232-00

Table D-2: BOQ - Geothermal Ground Coupled System for the Air Conditioning of the Adminstrative Area Project

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
4	Pumping & Mechanical Room Works								
	Supply, installation, testing and commissioning of Geothermal system redundant pump package system to meet the design flow and to be connected and controlled with VFD of GHP. System to be complete with Supply & Return Headers @ Mechanical Rooms c/w pipes, fittings, taps and valves for supply / return lines and expansion tanks and air seprators to act the whole system operation more over system flushing; air removing from ground loop into piping								
4-a	Pumping System for Flow (1-Operation +1-Standby)	Pkg	1	Grundfos	28000	28,000	4000	4,000	32,000
4-b	Mechanical Room Works c/w Headers, Valves, Accessories	LS	1	BADRY	12000	12,000	6000	6,000	18,000



GEOHERMAL SYATEM BOQ

Table D - BOQ for Geothermal System



GEOHERMAL SYSTEM FOR AIR CONDITIONING -- Project Quote 16232-00

Table D-2: BOQ - Geothermal Ground Coupled System for the Air Conditioning of the Adminstrative Area Project

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
5	Delivery / Distribution System								
5-1	SITC Water Transfer / Piping System c/w Valves & Fittings	LS	1	BADRY	75000	75,000	25000	25,000	100,000
5-2	SITC Air Transfer / Ducting System c/w Registers & Dampers	LS	1	BADRY	55000	55,000	20000	20,000	75,000
5-3	SITC Radiant Floor Warming System c/w Outlets	LS	1	BADRY	85000	85,000	25000	25,000	110,000
5-5	Civil / Arch. Ancilaary Works to furnish Distribution System	LS	1	BADRY	0	0	35000	35,000	35,000
6	Control & Management System								
6-1	DDC Control System	LS	1	Rockwell	19000	19,000	4000	4,000	23,000
6-2	BMS / HDMI Operation System with PLC	LS	1	Rockwell	22000	22,000	5000	5,000	27,000
7	Testing & Balance								
7-1	Testing & Ballancing of HVAC / Ducting / Piping Systems of Each Area Acc. To ASHARE / SMACNA / ISO Classification	LS	1	BADRY	0	0	15000	15,000	15,000
S2	GEOHERMAL - SUM / AIR CONDITIONING WORKS	One Milion USD					1,000,000		



GEOHERMAL SYSTEM FOR WATER / STEAM HEATING -- Project Quote 16233-00

Table D-3: BOQ - Geothermal Ground Coupled System for the Heating Steam of Food Production Area Project

S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
1	Geothermal System Design & Ground Testing								
	Ground Geothermal Sytem Testing & Designing, provides the designer with accurate information on the thermal conductivity, loop design can be optimized and the path of of piping and Bore-Holes. Tests with Field Testing Appartus will be conducted by drilling borehole and adding loop with hot water from a portable electric heater is circulated. Data log is run over 48 hours and energy absorbed by the ground is measured so that the conductivity and diffusivity could been calculated. Then, Submitting of Trenched Horizontal / Vertical Loop Design, c/w Bore-Hole Layout using Software Design for Ground Loops, Piping								
1-a	Ground Testing for Geothermal of the Ventilation Area	LS	1	BADRY	0	0	20000	20,000	20,000
1-b	Ground Loop Design for Geothermal of the Ventilation Area	LS	1	BADRY	0	0	20000	20,000	20,000



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					Unit Rate	Amount	Unit Rate	Amount	
2	Ground Closed Loop Hydrulic Piping Works								
	Under Ground Geothermal closed loop; Trenched Horizontal / Drilled Vertical, Loop Piping works via HDPE System, c/w Bore-Hole Layout using Software Design for Ground Loops, Piping of HDPE material c/w all required fittings to act as a heat exchanger same to cooling coil. Item complete with Backfill & Grouts for the piping jacket avoiding Air Gaps or separations via grouting with Thermal Grouts of 60% Quartezil and 20% Cement, 10% Fly Ash, 10% Sand. Hydraulic Fluid of Antifreeze Water Based Solution as a water source refrigrant for Heat Pump to be supplied and equiped.								
2-a	Trenched horizontal HRZ Loop with 10 ft depth, Bore-hole 4 Inch	Ton	30	BADRY	600	18,000	900	27,000	45,000
2-b	Drilled Vertical VER Loop with 200 ft depth, Bore-hole 6 Inch	Ton	70	BADRY	800	56,000	1200	84,000	140,000



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					Unit Rate	Amount	Unit Rate	Amount	
3	Geothermal System Equipments (GHP Equipments)								
	Supply, installation, testing and commissioning of Geothermal water source Heat Pump with R-410a Refrigerant with wider fluid operating range and additional insulation of internal co-axial coils, thermal expansion TX Valves and heat exchangers optimized for geothermal operating conditions. GHP to be designed and supplied with Variable Flow System c/w two-way isolating valves at each heat pump that shut off the flow when the compressors is not runing. Heat Pump to be modulated and equieped with variable frequency drive (VFD)								
3-a	GHP c/w VFD for Variable Flow, 20 Ton (Cool Only)	No	0	AMRTA	28000	0	4000	0	0
3-b	GHP c/w VFD for Variable Flow, 25 Ton (Cool + Warm)	No	0	AMRTA	53000	0	7000	0	0
3-c	GHP c/w VFD for Variable Flow, 50 Ton (Heating / Child)	No	3	AMRTA	67000	201,000	8000	24,000	225,000
3-d	Rooftop Unit with Enthalpy Wheel	No	1	Mc-Quay	49000	49,000	6000	6,000	55,000
3-e	Templifier Water to Water Heat Recovery	No	1	Mc-Quay	41000	41,000	4000	4,000	45,000



GEOTHERMAL SYATEM BOQ

Table D - BOQ for Geothermal System



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S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
4	Pumping & Mechanical Room Works								
	Supply, installation, testing and commissioning of Geothermal system redundant pump package system to meet the design flow and to be connected and controlled with VFD of GHP. System to be complete with Supply & Return Headers @ Mechanical Rooms c/w pipes, fittings, taps and valves for supply / return lines and expansion tanks and air separators to act the whole system operation more over system flushing; air removing from ground loop into piping								
4-a	Pumping System for Flow (1-Operation +1-Standby)	Pkg	1	Grundfos	28000	28,000	4000	4,000	32,000
4-b	Mechanical Room Works c/w Headers, Valves, Accessories	LS	1	BADRY	12000	12,000	6000	6,000	18,000



GEOHERMAL SYATEM BOQ

Table D - BOQ for Geothermal System



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S.N	Item Description	Unit	QTY	Offered Makes	Supply (USD)		Erection (USD)		Total Supply & Erection (USD)
					Unit Rate	Amount	Unit Rate	Amount	
5	Delivery / Distribution System								
5-1	SITC Water Transfer / Piping System c/w Valves & Fittings	LS	1	BADRY	75000	75,000	25000	25,000	100,000
5-2	SITC Air Transfer / Ducting System c/w Registers & Dampers	LS	0	BADRY	55000	0	20000	0	0
5-3	SITC Radiant Floor Warming System c/w Outlets	LS	0	BADRY	85000	0	25000	0	0
5-5	Civil / Arch. Ancilaary Works to furnish Distribution System	LS	1	BADRY	0	0	35000	35,000	35,000
6	Control & Management System								
6-1	DDC Control System	LS	1	Rockwell	19000	19,000	4000	4,000	23,000
6-2	BMS / HDMI Operation System with PLC	LS	1	Rockwell	22000	22,000	5000	5,000	27,000
7	Testing & Balance								
7-1	Testing & Ballancing of HVAC / Ducting / Piping Systems of Each Area Acc. To ASHARE / SMACNA / ISO Classification	LS	1	BADRY	0	0	15000	15,000	15,000
S3	GEOHERMAL - SUM / HEATING WORKS				Eight Hundred Thousands USD			800,000	



Water Source Heat Pump Unit

Cooling capacity from 10 to 133 kW

Heating capacity from 12.1 to 156.2 kW

Functions



Cooling



C&H



Heat Recovery



Characteristics

Structure

Panels and frame are made from galvanized steel protected with polyester powder painting to ensure total resistance to atmospheric agents

Hermetic compressor

Single phase (mod. 10, 12,15) and 3-phase (mod.17 to 130) scroll type compressors, with built-in thermal overload cut-out and crankcase heater, mounted on rubber vibration dampers

Evaporator

High efficiency plate type heat exchanger, factory insulated with flexible close cell material

Condenser

High efficiency plate type heat exchanger, factory insulated with flexible close cell material

Desuperheater

High efficiency stainless steel brazed plate heat exchanger, factory insulated with flexible close cell material

Refrigerant circuit

Copper tube connection with charge valves, filter drier, thermostatic expansion valve (capillary for mod.10 to 15), gas-liquid separator, high pressure switch and low pressure switch

The heat pump units are complete also with 4-way valve and one way valve

Hydraulic circuit

Built with user side and source side water inlet/outlet connectors, water discharge connectors, air vent valve (mod.10 to 30 the user side is complete also with expansion vessel, water pump and flow switch.)

Electric panel

Consists of:

- ◆ Compressor contactor
- ◆ Compressor protection breaker
- ◆ User side water pump contactor (for mod.10 to 30)
- ◆ User side water pump breaker (for mod.10 to 30)
- ◆ Microprocessor with function display

Optional

- ◆ Sight glass which must be installed in factory
- ◆ Source side flow switch
- ◆ Source side water pump
- ◆ Anti-vibration rubber
- ◆ Metallic filter for the water circuit
- ◆ Heat recovery exchanger
- ◆ Tube in tube heat exchanger

Technical Data R410a

Model WW	Unit	10	12	15	20	25	30	40	45	50	
Nominal cooling capacity*	kW	10	12	15	20	25	30	40	45	50	
Nominal heating capacity**	kW	11.6	14	17.5	21	27.3	34.6	41.7	47	55.9	
Power supply	V/PH/Hz	220/1/50				380/3/50					
Hermetic compressors											
Qty	Nr.	1	1	1	1	2	2	2	2	2	
Cooling power input*	kW	2.77	3.22	3.89	4.21	5.63	7.09	8.24	10.4	11.04	
Cooling current*	A	13.8	16.2	19.1	7.8	10.6	12.8	14.9	18.8	20.1	
Heating power input**	kW	3.51	4.15	5.05	5.76	7.63	9.69	11.34	13.97	14.77	
Heating current*	A	17.1	20.3	24.5	10.2	13.6	16.8	19.7	24.3	25.8	
User side heat exchanger											
Pressure drop	kPa	33	33	36	38	38	38	40	40	42	
Water flow	m³/h	1.7	2.1	2.6	3.4	4.3	5.2	6.9	8.1	8.6	
Water pipe	DN	25	25	25	25	40	40	40	40	40	
Source side heat exchanger											
Pressure drop	kPa	33	33	36	38	38	38	40	40	42	
Water flow	m³/h	0.7	0.8	1	1.2	1.6	2	2.5	2.5	3.3	
Water pipe	DN	25	25	25	25	40	40	40	40	40	
Water pump											
power input	kW	0.4	0.49	0.49	0.55	0.75	0.75	0.92	1.05	1.05	
current	A	2.2	2.4	2.4	1.1	1.2	1.2	1.5	2	2	
Water head	m	17	20	18	16	19	16	17	18	17	
Dimension(mm)	L	820	820	820	820	1400	1400	1400	1400	1400	
	W	575	575	575	575	850	850	850	850	850	
	H	910	910	910	910	1050	1050	1050	1050	1050	
Sound pressure level***	dB(A)	56	58	62	62	62	64	64	66	66	
Net weight	kg	130	140	150	180	265	280	320	340	360	

Model	Unit	55	60	68	75	95	110	130	150	
Nominal cooling capacity*	kW	56	62	69	75	94	113	130	150	
Nominal heating capacity**	kW	62.2	70.1	76.4	83.4	105.1	124.1	140.1	165.4	
Power supply	V/PH/Hz	380/3/50								
Hermetic compressors										
Qty	Nr.	2	2	2	4	3	3	4	4	
Cooling power input*	kW	11.03	12.66	13.7	14.64	18.99	22.11	25.32	29.48	
Cooling current*	A	19.6	22.8	24.3	26.8	34.2	38.7	45.6	51.6	
Heating power input**	kW	15.41	17.02	18.71	20.84	25.53	30.6	34.04	40.8	
Heating current*	A	26.3	29.4	31.9	36.4	44.1	51.6	58.8	68.8	
User side heat exchanger										
Pressure drop	kPa	42	48	48	50	52	52	55	55	
Water flow	m³/h	9.6	10.7	11.9	12.9	16.2	19.4	22.4	25.8	
Water pipe	DN	50	50	50	50	65	65	80	80	
Source side heat exchanger										
Pressure drop	kPa	42	48	48	50	52	52	55	55	
Water flow	m³/h	3.7	4.1	4.5	4.9	6.2	7.3	8.3	9.7	
Water pipe	DN	50	50	50	50	65	65	80	80	
Water pump										
Power input	kW	/	/	/	/	/	/	/	/	
Current	A	/	/	/	/	/	/	/	/	
Water head	m	/	/	/	/	/	/	/	/	
Dimension(mm)	L	1400	1400	1400	1400	1400	1850	1850	1850	
	W	850	850	850	850	850	880	880	880	
	H	1050	1050	1050	1050	1050	1250	1250	1250	
Sound pressure level***	dB(A)	68	72	72	72	73	73	74	74	
Net weight	kg	280	300	340	360	460	500	550	620	

Performance values refer to the following conditions:

* Source side water inlet/outlet temperature 18°C/29°C, user side water inlet/outlet temperature 12°C/7°C.

** Source side water inlet/outlet temperature 15°C/7°C, user side water inlet/outlet temperature 40°C/45°C.

*** Sound pressure measured at a distance of 1 m and a height of 1.5 m above the ground in an open field.

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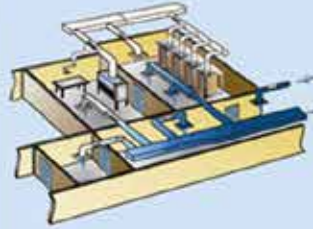
شركة البدرى للأعمال الكهروميكانيكية

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6B, sixth October St. Manshiet Al Sad Al Aaly. Al-salam, Cairo, Egypt.
Tel: +202 2190 6401, +202 2190 6823
Fax: +202 2190 6823 - Cell: +20 100 5743 852
E-mail: mep@badrygroup.com Web: www.badrygroup.com

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