

QUESTIONNAIRE REPORT SHEET

iPQ1CEM.V1.1

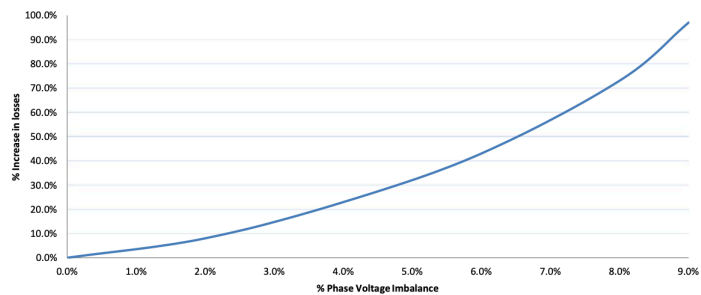
iPQ.No	Correct Answer	Points	Explanation
1CEM001	2	19.1	<p>Answer = 2</p> <p>$A (P/A, 10\%, 10) - P$ $NPV = \\$15,000 (6.1446) - \\$100,000 = -\\$7,831.00$</p>
1CEM002	3	19.1	<p>Answer = 3</p> <p>$A = P (A/P, 15\%, 10)$ Find Savings "A" = $\\$15,000 (0.1993) = \\$2,989.50$</p>
1CEM003	4	19.1	<p>Answer = 4</p> <p>First, cost/savings gives the factor $(P/A, i\%, n)$.</p> <p>$\\$223,650 / \\$57,200 = 3.9099$; go to the interest tables and look for this value dropping down 17 years until the factor is found. The table that it is found on is the IRR.</p>
1CEM004	1	19.1	<p>Answer = 1</p> <p>$P = A (P/A, 14\%, 8)$ Cost of "P" = $\\$17,500 (4.6389) = \\$81,180.75$</p>
1CEM005	4	19.1	<p>Answer = 4</p> <p>$A (P/A, 12\%, 10) - P$ LCC (Standard) = $\\$10,500 (5.650) + \\$25,000 = \\$84,325$</p> <p>$A (P/A, 12\%, 10) - P$ LCC (Energy Eff): $\\$7,000 (5.650) + \\$30,000 = \\$69,550$</p> <p>(Note : The question asked for the answer in terms of costs, so the answers are given in terms of the costs' absolute value. Our solution calculation keeps the "-" sign for costs because that's how cash flow works.)</p>
1CEM006	2	6	<p>Answer = 2</p> <p>Pressure gauges, flow metres, torque metres, and tachometers</p>
1CEM007	3	6	<p>Answer = 3</p> <p>Electrical power meter, torque meter, tachometer</p>
1CEM008	1	6	<p>Answer = 1</p> <p>Combustion analyser</p>
1CEM009	1	6	<p>Answer = 1</p> <p>Illumination level</p>
1CEM010	3	6	<p>Answer = 3</p> <p>Pitot tube</p>
1CEM011	2	6	<p>Answer = 2</p> <p>Energy management</p>
1CEM012	4	6	<p>Answer = 4</p> <p>All of the above</p>

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1CEM013	2	6	Answer = 2 Production factor
1CEM014	3	6	Answer = 3 Energy substitution
1CEM015	2	6	Answer = 2 860 k Cal
1CEM016	4	6	Answer = 4 All of the above
1CEM017	4	6	Answer = 4 All of the above
1CEM018	4	6	Answer = 4 All of the above
1CEM019	4	6	All of the above
1CEM020	3	6	Answer = 3 Both
1CEM021	3	6	Answer = 3 Both option 1 and 2
1CEM022	1	19.1	<p>Answer = 1</p> <p>Because the projects have different lifespans, it is natural to believe that Annual Value could be used to compare economics. However, the problem specifies that the planning horizon is only 25 years, so NPV should be utilised in this instance. The annual savings from the solar system would amount to \$3,800.</p> <p>PV of Annual Solar System Savings = \$3,800/year (P/AIN Factor) = \$3,800/year (7.8431) = \$29,803</p> <p>NPV of the Solar System = \$29,803 - \$20,000 = \$9,803</p> <p>PV of Annual Savings from Ground Source HP: = \$3,500 per year (P/AIN Factor) = \$3,500 per year (7.8431) = \$27,451</p> <p>= \$27,451 - \$25,000 = \$2,451</p> <p>The Solar System would therefore have the highest NPV.</p>
1CEM023	2	19.1	<p>Answer = 2</p> <p>In this problem, A is given and P must be determined. The P (from the positive cash flows) must be at least equal to the Cost for this project to have a positive NPV. Therefore, let's determine P, which is the maximum amount we can pay for the installed cost.</p> <p>PV of \$1,000,000 Annual Savings: = \$1,000,000/year (P/AIN Factor) = \$1,000,000/year (2,8021) = \$2,802,100</p> <p>Thus, we can purchase the Waste Heat Exchanger for \$2,802,100 while maintaining a positive NPV.</p>

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1CEM024	1	19.1	<p>Answer = 1</p> <p>To make a fair comparison, we must convert the fuel prices to dollars per unit. We select \$/MMBTU, knowing that 1 kWh equals 3,412 BTU, and then incorporate the efficiency data.</p> <p>\$/MMBTUelectric:</p> <p>Using 1 kWh would result in 3,412 BTUs. The fuel cost per MMBTU would be calculated as follows: = $(\\$0.095/3,412 \text{ BTU}) \times (1,000,000 \text{ BTU}/1 \text{ MMBTU}) \times (1/.97) = \\$28.7/\text{MMBTU}$</p> <p>\$/MMBTUgas:</p> <p>We are aware that 1 Therm is equal to 100,000 BTUs. The fuel cost per MMBTU would be equal to: = $(\\$0.92/\text{Therm}) \times (1 \text{ Therm}/100,000 \text{ BTU}) \times (1,000,000 \text{ BTU}/1 \text{ MMBTU}) \times (1/.75) = \\$12.27/\text{MMBTU}$.</p> <p>The gasoline option has the lowest unit cost.</p>
1CEM025	1	6	<p>Answer = 1</p> <p>True (or "Operating") Lease is essentially "renting," and at the end of the lease, you (the Lessee) do not own the equipment.</p>
1CEM026	3	19.1	<p>Answer = 3</p> <p>IPMVP Option D is applicable because there are no energy performance data available for the new building section. Option D permits a simulation to be conducted in order to estimate the baseline and "avoided costs" of implementing energy improvements.</p>
1CEM027	2	6	<p>Answer = 2</p> <p>False. CCT indicates the "colour" of the light, not the capacity to differentiate between colours.</p>
1CEM028	4	6	<p>Answer = 4</p> <p>Because occupancy sensors will reduce kWh, but cannot be guaranteed to reduce demand (the lights may come on during a peak period). If the lights are "on" less hours per day, they should last longer (assuming the lights are not turned "off" and "on" rapidly).</p>
1CEM029	4	6	<p>Answer = 4</p> <p>Return air carbon dioxide (CO2) level</p>
1CEM030	1	19.1	<p>Answer = 1</p> <p>ECI = $(\\$65,000 + \\$9,900)/4,000 \text{ m}^2 = \\$18.73/\text{m}^2/\text{yr}$. which is greater than the average building.</p>
1CEM031	4	6	<p>Answer = 4</p> <p>Time-based energy consumption profiles per end-use</p>
1CEM032	2	6	<p>Answer = 2</p> <p>Improve system efficiency</p>
1CEM033	2	6	<p>Answer = 4</p> <p>Check the running times of the air handling plant and set them to match building occupancy.</p>
1CEM034	2	19.1	<p>Answer = 2</p> <p>$(150000 \times 0.08) + (420 \times 45) = €30900/\text{m}$, Intensity of cost = $30900/2050 = € 15.07$</p>

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1CEM035	1	6	Answer = 1 The utility has to deliver more current for the same kW billed.
1CEM036	2	19.1	Answer = 2 $LF = 190000 / (400 \times 31 \times 24) = 0.6384 = 63.84\%$
1CEM037	2	6	Answer = 2 Detailed information on the building's configuration, including the total floor area
1CEM038	3	6	Answer = 3 Rate of fuel used
1CEM039	2	19.1	Answer = 2 $4 \times 0.42 = 1.68 \text{ MW}$. The table factor from 0.62 to 0.92 is 0.839. $1.68 \text{ MW} \times 0.839 = 1.4095 \text{ MVA} \times 1000 = 1409.5 \text{ KVA}$
1CEM040	2	19.1	Answer = 2 $P = VI, I = V/R$ so $P = V^2/R$, Therefore, $R = 230 \times 230 / 60 = 881.6666$ ohms. If this lamp is now turned on at 220V, The current will again be $(V/R) = 220 / 881.666 = 0.249 \text{ A}$.
1CEM041	3	19.1	Answer = 3 Below 3%
1CEM042	2	6	Answer = 2 13th Harmonic
1CEM043	2	6	Answer = 2 No, With a high load factor this generally indicates little opportunities for this type of opportunity
1CEM044	1	19.1	Answer = 1 $\text{Average} = (236 + 231 + 227) / 3 = 231.33 \text{ V}$ Largest voltage difference is 4.67V. Phase imbalance is $4.67 / 231.33 = 2.02\%$
1CEM045	2	6	Answer = 2 False. Power is expressed as kW and Energy is expressed as kWh. Power is a “rate of flow”.
1CEM046	2	6	Answer = 2 False. A Flue Gas Analyzer will tell you the efficiency of combustion, but will not tell you the volume of steam or really any information about what is happening downstream within the steam system.

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1CEM047	3	19.1	<p>Answer = 3</p> <p>Answer: 3. To determine the savings, we need to compare the fuel consumed before and after the retrofit. Before the retrofit, if the boiler is only 50% efficient, then the fuel supplied to the boiler will be more than the 10,000 MMBtu needed for the process. Thus, the fuel input will be $10,000 / .5 = 20,000$ MMBtu per year. After the retrofit, the new boiler is 80% efficient, and the fuel input will be $10,000 / .8 = 12,500$ MMBtu per year. The savings would be: 20,000 MMBtu minus 12,500 MMBtu equals 7,500 MMBtu per year.</p>
1CEM048	1	6	<p>Answer = 1</p> <p>Use the Saturated Steam tables to find Enthalpy in the gaseous state (hg), which is: 1201 Btu/lb.</p>
1CEM049	2	6	<p>Answer = 2</p> <p>Colder air is more dense and dry, which reduces the work required by the compressor, thereby increasing the efficiency.</p>
1CEM050	2	6	<p>Answer = 2</p> <p>When the flue gases temperatures are reduced below the dew point, they will condense... (lets hope that you have a condensing boiler).</p>
1CEM051	1	6	<p>Answer = 1</p> <p>True. The “phase change” energy allows more Btu to be stored (or liberated) in energy storage applications.</p>
1CEM052	1	19.1	<p>Answer = 1</p> <p>Annual Energy Wastage = $(1 - \text{ILER}) \times \text{Watts} \times \text{no. of operating hours} = (1 - 0.7) \times 990 \times 8 \text{ hours/day} \times 300 \text{ days} = 712 \text{ kWh/ annum}$</p>
1CEM053	1	19.1	<p>Answer = 1</p> <p>Answer = 1.37 Room index = $L \times W / Hm$ $(L+R) = 10 \times 7 / 3 \times (10+7) = 1.37$</p>
1CEM054	1	19.1	<p>Answer = 1</p> <p>Actual lux/watt/m² = $500 / 14.3 = 34.9$ Target lux/W/m² (from table in the book for the above RI) = 38 ILER = $34.9 / 38 = 0.92$ (satisfactory to good)</p>
1CEM055	1	19.1	<p>Answer = 1</p> <p>Stator resistance at 100 °C = $R_1 \times [(235 + t_1) / (235 + t_2)] = 0.264 \times [(235 + 100) / (235 + 30)] = 0.334 \text{ ohms per phase}$</p>
1CEM056	3	6	<p>Answer = 3</p> <p>Two of the main advantages are (i) High operating power factor (ii) Energy savings during part load operation for longer duration of time.</p>

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1CEM057	1	19.1	Answer = 1 Input power at full rated power in kW, $P_i = 22/0.91 = 24.2$ kW Percentage loading = $13/24.2 = 53.77\%$																						
1CEM058	1	19.1	Answer = 1 Additional heat inside the space = $3 \times 860 = 2580$ kcal/h Equivalent refrigeration load (TR) = $2580/3024 = 0.85$ TR																						
1CEM059	3	6	Answer = 3 For assessment of the refrigeration load, the basic parameters required are: water flow rate through the evaporator. b) the temperature difference between entering and leaving water.																						
1CEM060	4	6	Answer = 4 All of the above																						
1CEM061	2	6	Answer = 2 Strongly disagree with the recommendation																						
1CEM062	1	19.1	Answer = 1 Old load = $57 \times .8/ .83 = 54.94$ kW New load = $57 \times .8/ 0.94 = 48.52$ kW delta kW = 6.42 kW Power (demand) savings = $6.42 \times \text{€}10 \times 12 = \text{€ } 770.40$ Energy savings = $6.42 \times 6500 \times .15 = \text{€}6,259.5$ Total = €7029.90																						
1CEM063	3	6	Answer = 3 Both																						
1CEM064	2	6	Answer = 2 All of the above																						
1CEM065	1	19.1	Answer = 1 Average = $(236 + 231 + 227)/3 = 231.33\text{V}$ Largest voltage difference is 4.67V. Phase imbalance is $4.67/ 231.33 = 2.02\%$, Graph then shows increase in losses by approx 7% <h3>Voltage Imbalance Impact</h3> <p style="text-align: center;">% increase in losses in an electric motor when the phases are imbalanced</p>  <table border="1"><caption>Data points estimated from the Voltage Imbalance Impact graph</caption><thead><tr><th>% Phase Voltage Imbalance</th><th>% Increase in losses</th></tr></thead><tbody><tr><td>0.0%</td><td>0.0%</td></tr><tr><td>1.0%</td><td>~2.0%</td></tr><tr><td>2.0%</td><td>~4.0%</td></tr><tr><td>3.0%</td><td>~7.0%</td></tr><tr><td>4.0%</td><td>~11.0%</td></tr><tr><td>5.0%</td><td>~16.0%</td></tr><tr><td>6.0%</td><td>~22.0%</td></tr><tr><td>7.0%</td><td>~30.0%</td></tr><tr><td>8.0%</td><td>~40.0%</td></tr><tr><td>9.0%</td><td>~95.0%</td></tr></tbody></table>	% Phase Voltage Imbalance	% Increase in losses	0.0%	0.0%	1.0%	~2.0%	2.0%	~4.0%	3.0%	~7.0%	4.0%	~11.0%	5.0%	~16.0%	6.0%	~22.0%	7.0%	~30.0%	8.0%	~40.0%	9.0%	~95.0%
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1CEM066	1	19.1	<p>Answer = 1</p> <p>Average = $(236 + 231 + 227)/3 = 231.33V$ Largest voltage difference is 4.67V. Phase imbalance is $4.67/231.33 = 2.02\%$</p>
1CEM067	2	6	<p>Answer = 2</p> <p>It is absorbed at low pressure</p>
1CEM068	4	6	<p>Answer = 4</p> <p>COP=Energy moved/Energy input</p>
1CEM069	2	19.1	<p>Answer = 2</p> <p>$dQ = 250 \times 2200 \times (1.2 - 0.4) = 440,000 \text{ W} = 440 \text{ kWh}$</p>
1CEM070	2	6	<p>Answer = 2</p> <p>Remain constant</p>
1CEM071	2	19.1	<p>Answer = 2</p> <p>Old P = 17.3 kW, new P = $0.75 \times 0.75 \times 0.75 \times 17.3 \text{ kW} = 7.298 \text{ kW}$ meaning reduction in power demand is $17.3 - 7.3 = 10 \text{ kW}$</p>
1CEM072	4	19.1	<p>Answer = 4</p> <p>$R = L/k = 0.07/0.028 = 2.5$</p>
1CEM073	3	6	<p>Answer = 3</p> <p>Emissivity and solar reflectance</p>
1CEM074	4	6	<p>Answer = 4</p> <p>Analog Input, Closed Loop Control</p>
1CEM075	3	6	<p>Answer = 17</p> <p>Overshoot</p>
1CEM076	1	6	<p>Answer = 1</p> <p>Derivative Gain</p>
1CEM077	1	19.1	<p>Answer = 1</p> <p>a) $Dh = (hf \text{ at } 90^\circ\text{C}, 101.3 \text{ kPa}) - (hf \text{ at } 15^\circ\text{C}, 101.3 \text{ kPa})$ (use temperature steam stable) = $376.97 \text{ kJ/kg} - 62.98 \text{ kJ/kg} = 314.0 \text{ kJ/kg}$ b) $Dh = CP \Delta T = 4.2 \text{ kJ/kg}^\circ\text{C} \times (90 - 15)^\circ\text{C} = 315.0 \text{ kJ/kg}$</p>
1CEM078	3	19.1	<p>Answer = 3</p> <p>a) $Q = 15 \text{ L/min} \times 10 \text{ min/shower} \times 4 \text{ shower/d} \times 350 \text{ d/yr} \times 1.00 \text{ kg/L} \times 4.2 \text{ kJ/kg}^\circ\text{C} \times 21^\circ\text{C}$ $Q = 18,522,000 \text{ kJ/yr}$ $Q = 18.522 \text{ GJ/yr}$ b) $18.522 \text{ GJ/yr} / 0.80 = 23.15 \text{ GJ/yr}$ input (final) energy 23.15 GJ/yr * €8/GJ = €185/yr</p>

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1CEM079	4	19.1	<p>Answer = 4</p> <p>Option 4 is the only answer where both changes result in improvements in combustion efficiency. To improve efficiency in general: Increase combustion air temperature (e.g., with air preheat) Reduce excess air, which in turn reduces excess O₂ (e.g., fuel and air controls). It is worth noting that lower excess O₂ corresponds to higher CO₂ concentrations because CO₂ in the exhaust is not diluted as much by extra O₂ and N₂. Reduce stack temperature (e.g., by installing an economizer).</p>
1CEM080	1	6	<p>Answer = 1</p> <p>Air power over motor electrical power</p>
1CEM081	3	6	<p>Answer = 3</p> <p>Measurements and monitoring is the most important aspect of predictive maintenance. Nevertheless, reliability-centered maintenance incorporates the other methods, such as predictive. The initiation of scheduled maintenance is not based on any measurements or monitoring.</p>
1CEM082	2	6	<p>Answer = 2</p> <p>Hydrometer</p>
1CEM083	2	6	<p>Answer = 2</p> <p>False</p>
1CEM084	3	6	<p>Answer = 3</p> <p>Lighter oil have lower specific heat</p>
1CEM085	4	6	<p>Answer = 4</p> <p>Zirconium oxide probe</p>
1CEM086	2	6	<p>Answer = 2</p> <p>False</p>
1CEM087	3	6	<p>Answer = 3</p> <p>Temperature</p>
1CEM088	3	6	<p>Answer = 3</p> <p>Maximum fuel input over minimum fuel input</p>
1CEM089	3	6	<p>Answer = 3</p> <p>Coal having excessive fines, need to be blend with the predominantly lumped coal containing lots of excessive fines. Thus coal blending limits the extent of fines in coal being fired. Blending of different qualities of coal may also help to supply a uniform coal feed to the boiler.</p>
1CEM090	4	6	<p>Answer = 4</p> <p>Low excess air</p>
1CEM091	4	6	<p>Answer = 4</p> <p>All of the above</p>
1CEM092	4	6	<p>Answer = 5</p> <p>Economiser</p>

iPQ.No	Correct Answer	Points	Explanation
1CEM093	2	6	Answer = 3 Tangential firing
1CEM094	1	6	Answer = 1 3000 – 3500 ppm
1CEM095	1	6	Answer = 1 Fluidised bed combustion boiler
1CEM096	2	6	Answer = 2 Alkaline solution
1CEM097	4	6	Answer = 4 1%
1CEM098	4	6	Answer = 4 All of the above
1CEM099	3	6	Answer = 3 Both
1CEM100	1	19.1	Answer = 1 Blow down (%) = Feed water TDS x % Make up Permissible TDS in Boiler – Feed water TDS Percentage blow down = $300 \times 10 = 1.11\%$ 3000 – 300 If boiler evaporation rate is 3000 kg/hr then required blow down rate is: $= 3000 \times 1.11 = 3.33$ kg/hr
1CEM101	3	6	Answer = 3 Both
1CEM102	4	6	Answer = 10 High speed & high temperature
1CEM103	4	6	Answer = 4 50-60%
1CEM104	3	6	Answer = 3 Back pressure steam turbine
1CEM105	1	6	Answer = 1 Around 150 °C
1CEM106	4	6	Answer = 4 All of the above
1CEM107	4	6	Answer = 4 Bell-Coleman cycle
1CEM108	3	6	Answer = 3 Test the inter-relationships between systems and subsystems.
1CEM109	1	6	Answer = 1 Review the specification to determine if domestic water systems are included in the test and balance scope.

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1CEM110	4	6	Answer = 4 Optimises life cycle costs
1CEM111	4	6	Answer = 4 All of the above
1CEM112	3	6	Answer = 3 Both
1CEM113	4	6	Answer = 4 All of the above
1CEM114	1	6	Answer = 1 Throughout the construction period
1CEM115	4	6	Answer = 4 All of the above
1CEM116	4	6	Answer = 4 All of the above
1CEM117	3	6	Answer = 3 Decreases with increased thermal conductivity
1CEM118	3	6	Answer = 3 Inner surface of furnace
1CEM119	4	6	Answer = 4 Both 1 and 2
1CEM120	3	6	Answer = 3 Options A, B, or D