Geothermal Systems

The Good, The Bad, and The Ugly

Presentation by

John Bender, P.E.

MWSK Geothermal Inc.

Geothermal Systems

- Growing market for MEP firms
- Equipment vendors
- Used on my LEED projects
  - Energy Savings
  - Sustainability
  - Reduces Carbon Footprint
    - Wind
    - Nuclear
    - Hydroelectric
    - Solar

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- High Risk for MEP firms
- Problematic for Equipment vendors new to the market
- Used on my LEED projects
  - Energy Savings are over estimated in many cases due to improper system design by MEP firms
  - Are not sustainable when improperly designed

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QUESTION

How can one MEP firm have a “Good Job”…

While others have “BAD Jobs” and/or “UGLY Jobs”?

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What Defines

A “Good Job”?

A “Bad Job”?

An “UGLY Job”?

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Good Jobs

- Work properly in all seasons
- Meets or exceeds Energy Model presented to client (end user)
- Does not cause adverse effects to the Earth
- Can be used by MEP firms as sales tools to get more work of the same type

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Bad Jobs

- Work – but not properly
- Use substantially more energy than the energy model
- Cause adverse effects on the Earth
- Can’t be used by MEP firms as sales tools to get more work of the same type

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UGLY Jobs

- Don’t Work
- The original energy model is not even looked at because the system doesn’t function
- Cause adverse effects on the Earth
- MEP is sued by client
- MEP might never do another GEO job

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Standard Job Scenarios

- 3 Different Hypothetical Engineers
  - Engineer “A” – UGLY Jobs
  - Engineer “B” – BAD Jobs
  - Engineer “C” – GOOD Jobs
- 2 Different Systems
  - High End Manhattan Residential
  - Public School on Long Island

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“JOB 1” Manhattan Residential

1. Wealthy Client – $10 to $30 million home
2. No true interest in being GREEN – doesn’t want to see a cooling tower
3. Special Architecture..

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Job “1” Manhattan Residential

IMPORTANT DESIGN CRITERIA

1. System has to work
2. Owner wants max comfort
3. System must be “SILENT”
4. Doesn’t have to be GREEN but owner could like the idea
5. Architect spending large amounts on interiors

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"JOB 1" Manhattan Residential

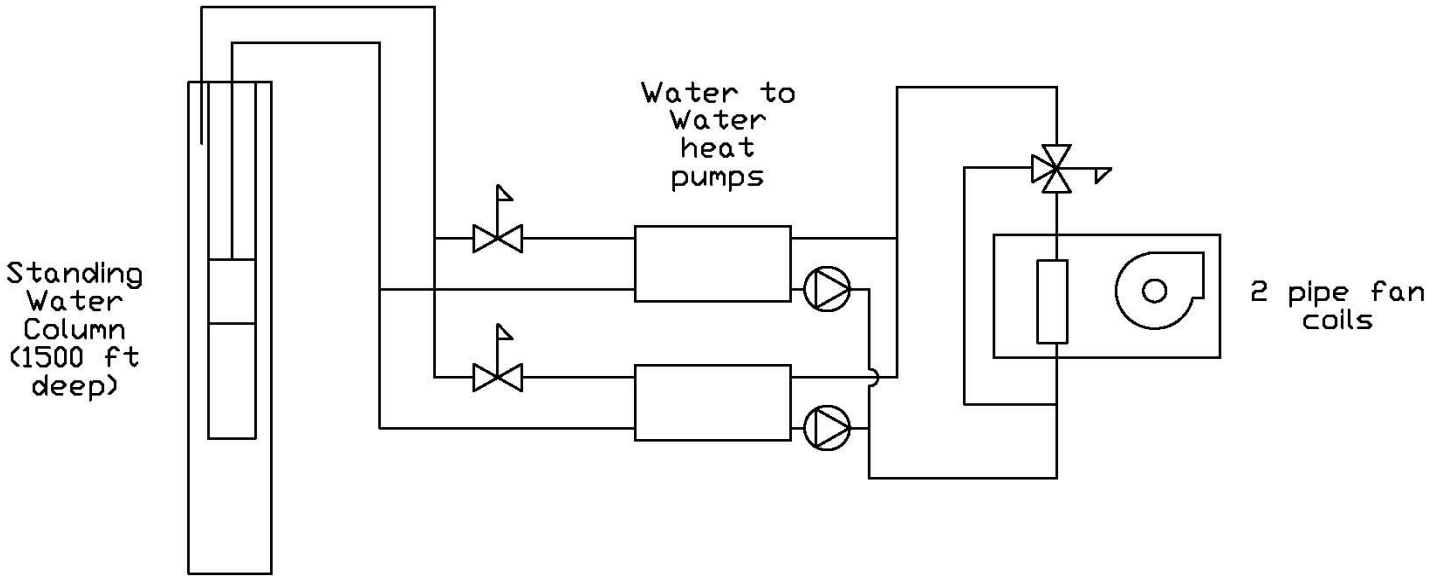
Engineer "A" – UGLY JOB

1. Standing Water Column – single hole
2. No heat exchanger
3. 2 pipe system with storage tank
4. Fan coils with PSC blowers

Engineer "A" - High End Manhattan Residential Job

UGLY JOB

Standing Water Column
No Heat Exchanger
Water to Water Heat Pumps
2 Pipe System with Fan Coils



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“JOB 1” Manhattan Residential

Engineer “A” – UGLY JOB

Standing Water Column – single hole with no heat exchanger

Hole has brackish water (salt) and corrodes heat pumps and piping

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“JOB 1” Manhattan Residential

Engineer “A” – UGLY JOB

2 Pipe System with Storage Tank requires several hours for change over

Very Loud - PSC blower in fan coil slams on and off when thermostat calls

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"JOB 1" Manhattan Residential

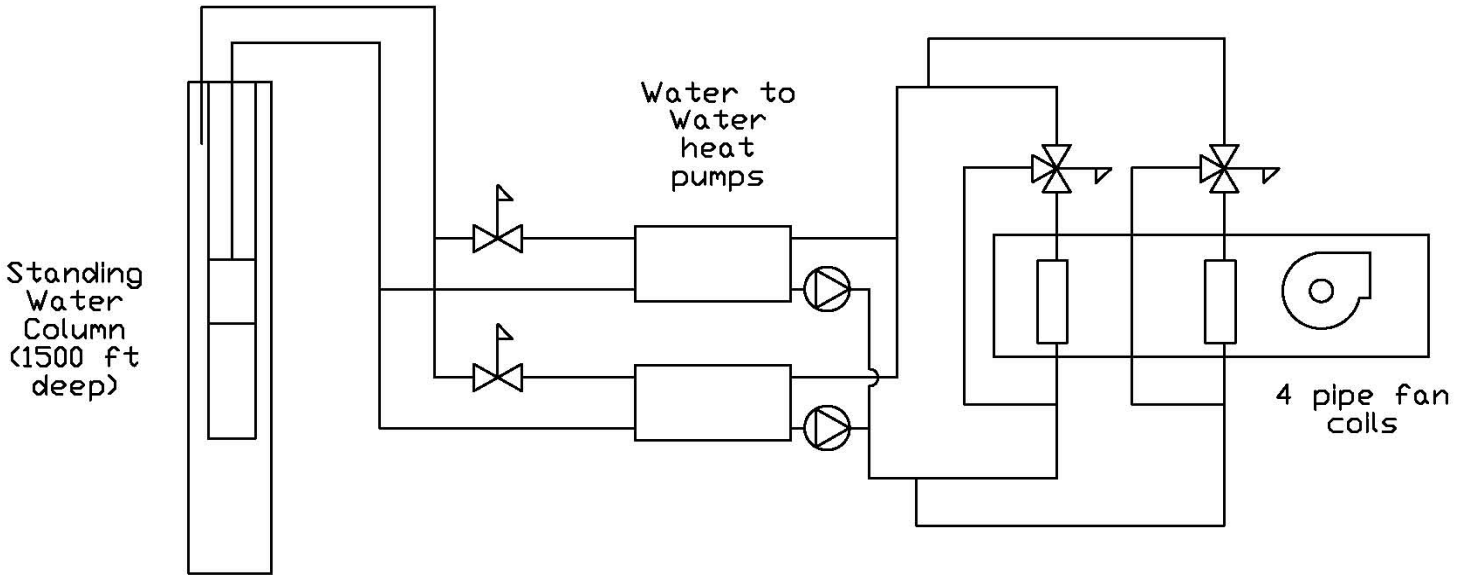
Engineer "B" – BAD JOB

1. Standing Water Column – single hole
2. No heat exchanger
3. 4 pipe system with storage tank
4. Fan coils with PSC blowers
5. Cupronickel heat exchangers in HP's

Engineer "B" - High End Manhattan Residential Job

BAD J□B

Standing Water Column
No Heat Exchanger
Water to Water Heat Pumps with CN Coax
4 Pipe System with Fan Coils



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“JOB 1” Manhattan Residential

Engineer “B” – BAD JOB

Standing Water Column – single hole with no heat exchanger

Hole has brackish water (salt) and corrodes piping

Heat Pumps are Protected

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“JOB 1” Manhattan Residential

Engineer “B” – BAD JOB

4 Pipe System gives better control

Very Loud - PSC blower in fan coil slams on and off when thermostat calls

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"JOB 1" Manhattan Residential

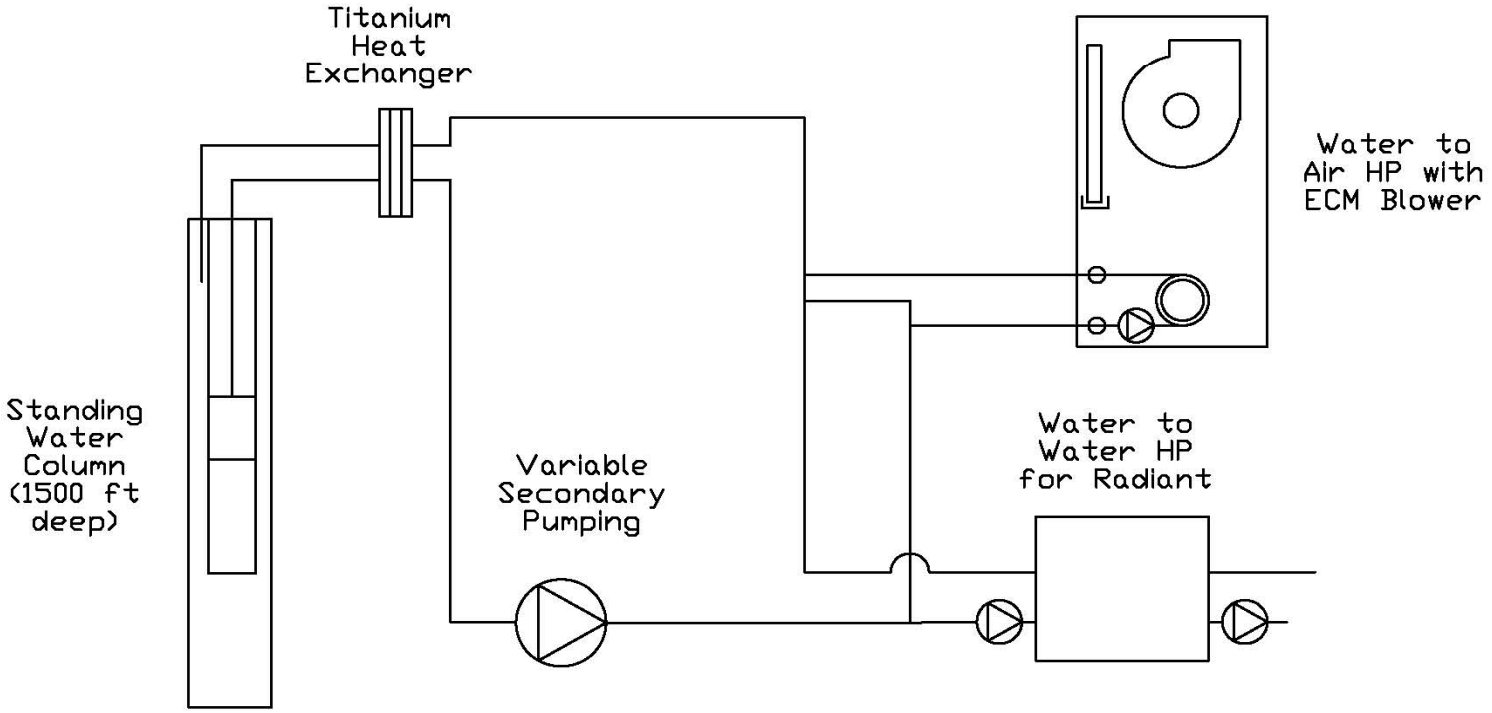
Engineer "C" – GOOD JOB

1. Standing Water Column – single hole
2. Titanium Heat Exchanger
3. Water to air and water to water HP's
4. ECM Blowers

Engineer "C" - High End Manhattan Residential Job

GOOD JOB

Standing Water Column
Titanium Heat Exchanger
Water to Water Heat Pumps for Radiant Floor
Water to Air Heat Pumps with ECM Blowers



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“JOB 1” Manhattan Residential

Engineer “C” – GOOD JOB

Standing Water Column – single hole with Titanium Heat Exchanger

Hole has brackish water (salt) and corrodes very little

City Water Connection in building loop if pump in water column goes down

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“JOB 1” Manhattan Residential

Engineer “C” – GOOD JOB

Heating or Cooling at any time

Very Quiet - ECM blower slowly ramps up

Heat pumps located in insulated closet or insulated ceiling spaces to cut down on compressor enable/disable “HUM”

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Job “2” LEED School – Long Island

IMPORTANT DESIGN CRITERIA

1. System has to work
2. Owner wants to be GREEN and SUSTAINABLE
3. Job will have separate LEED commissioning agent and rebates from LIPA
4. MEP sells extra cost of field based on energy model

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"JOB 2" LEED School Long Island

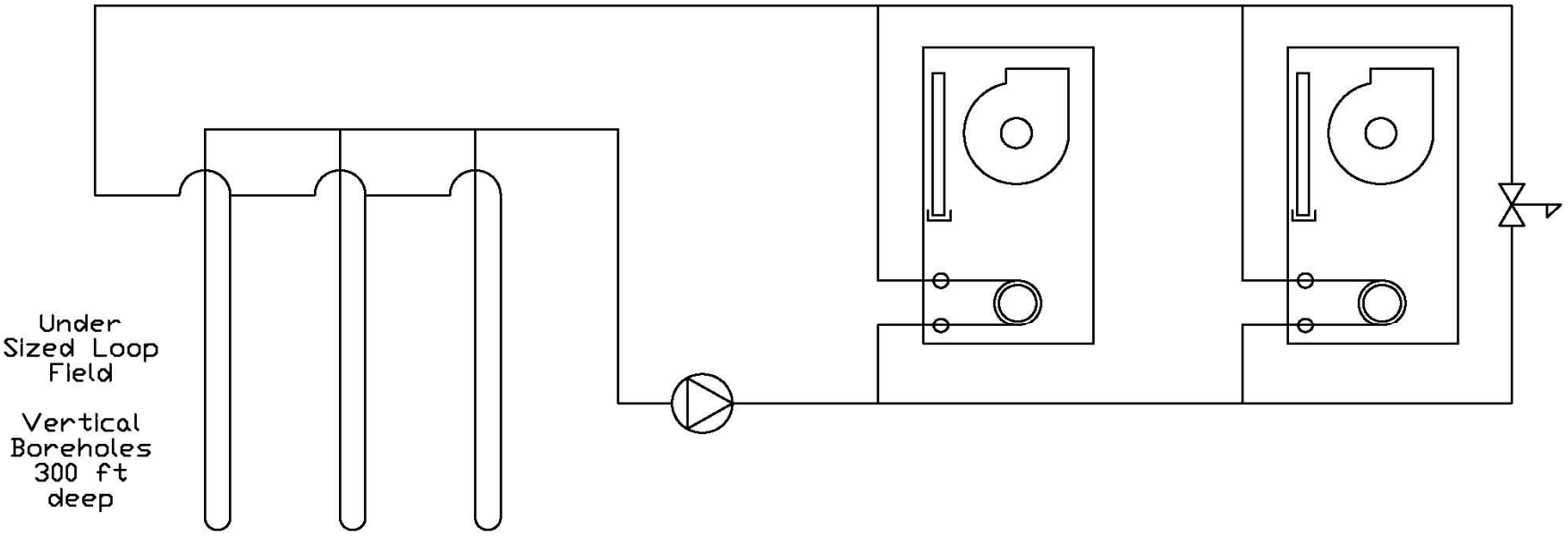
Engineer "A" – UGLY JOB

1. Closed Loop Geothermal
2. Short Looped
3. Low efficiency heat pumps
4. No air side heat recovery

Engineer "A" - School Long Island - Closed Loop Geo

UGLY JOB

Hires Loop Consultant for Field
Doesn't review loop calculations
Low Efficiency Water to Air Heat Pumps
No Air Side Heat Recovery
Variable Primary Pumping with DP control



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"JOB 2" LEED School Long Island

Engineer "A" – UGLY JOB

Loop Field is too small

- Summer Operation hits 110F supply from field – high pressure trips
- Winter Operation hits 32F supply from field – low pressure/freeze trips

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"JOB 2" LEED School Long Island

Engineer "A" – UGLY JOB

Engineer's Insurance Company pays for Cooling Tower to be installed

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"JOB 2" LEED School Long Island

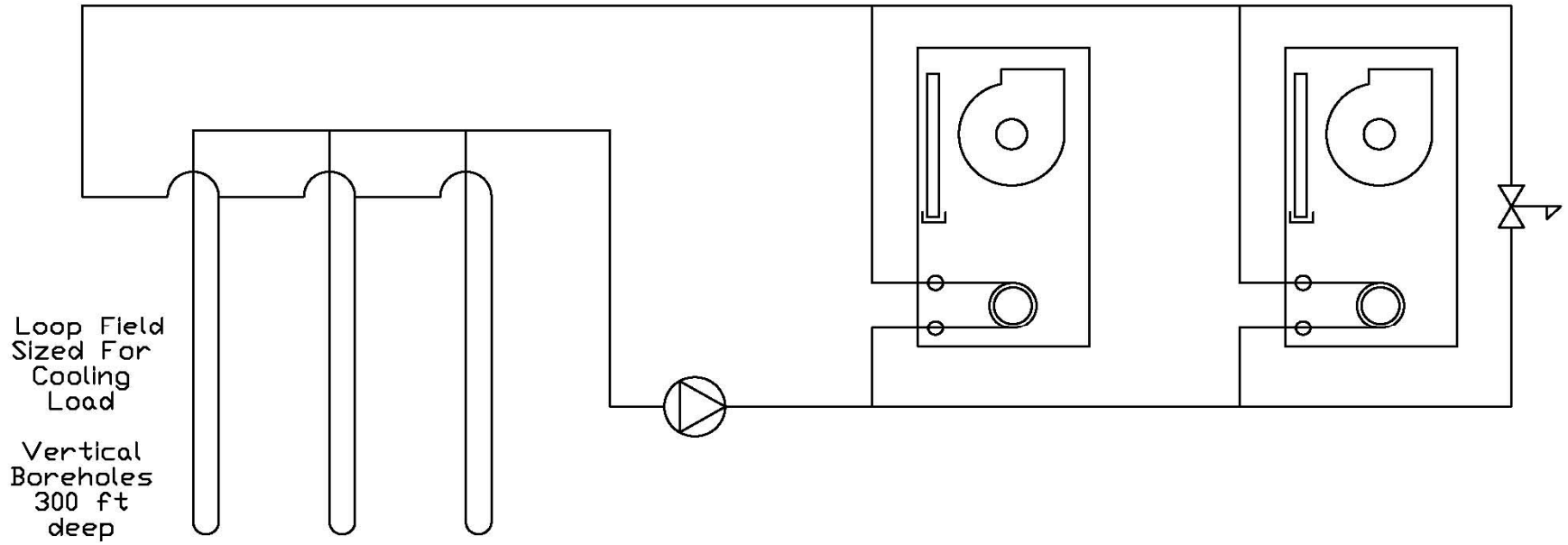
Engineer "B" – BAD JOB

1. Closed Loop Geothermal
2. Cooling Dominant Building
3. Medium efficiency heat pumps
4. Air side heat recovery

Engineer "B" - School Long Island - Closed Loop Geo

BAD J□B

Hires Loop Consultant for Field
Puts in enought pipe for Cooling
Extremely Cooling Dominant Building (unbalanced field)
Medium Efficiency Water to Air Heat Pumps
Air Side Heat Recovery
Variable Primary Pumping with DP control



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"JOB 2" School Long Island

Engineer "B" – BAD JOB

Spends $4000 per ton on a field AND…

Field heats up 15 degrees in 5 years due to high cooling load / low heating load

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“JOB 2” School Long Island

Engineer “A” – UGLY JOB

Payback used to sell the concept to the district is way off.

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"JOB 2" LEED School Long Island

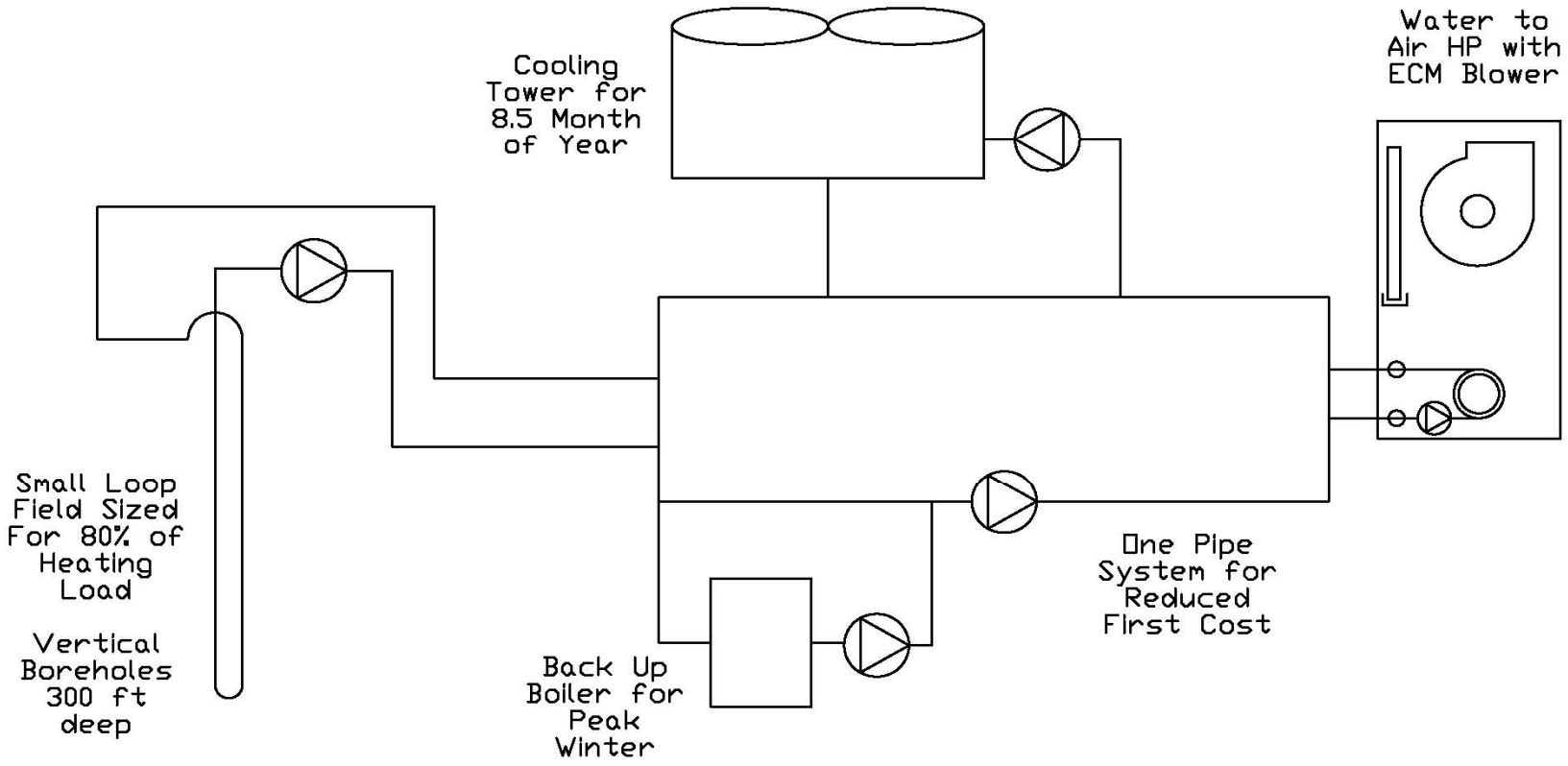
Engineer "C" – GOOD JOB

1. Closed Loop Geothermal HYBRID
2. Sizes field for 80% of heating load
3. Has cooling tower and boiler in system
4. Saves money by using a 1 pipe system
5. Spends money on
    1. Ultra High Efficiency heat pumps
    2. Top of the line ventilation system

Engineer "C" - School Long Island - Closed Loop Geo

GOOD JOB

Hires Loop Consultant for Field
Puts in Hybrid System with Cooling Tower and Boiler
High Efficiency Water to Air Heat Pumps
Air Side Heat Recovery with low dew point discharge
One Pipe System with Primary/Secondary pumping



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“JOB 2” School Long Island

Engineer “C” – GOOD JOB

Small field with tower and boiler is lowest first cost

Tower is drained 4 months out of the year

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"JOB 2" School Long Island

Engineer "C" – GOOD JOB

Designs system with a one pipe distribution system to cut the $/ft2

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"JOB 2" School Long Island

Engineer "C" – GOOD JOB

Engineer uses the best heat pump and ventilation system to cut KW consumption

Reduces KW/ft2

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Key to Good Jobs

- Work properly in all seasons
- Meet or exceed Energy Model presented to client (end user)
- Does not cause adverse effects to the Earth
- Can be used by MEP firms as sales tools to get more work of the same type