NC SUSTAINABLE ENERGY ASSOCIATION

Geothermal in North Carolina

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North Carolina Energy Policy Council
November 18, 2019

What is NCSEA?

NC SUSTAINABLE ENERGY ASSOCIATION

Our Mission

Drive policy and market development to create clean energy jobs, economic opportunities and affordable energy to benefit all of North Carolina.

The NC Sustainable Energy Association is a 501(c)(3) nonprofit membership organization of **consumers, businesses, government, utilities and nonprofits** interested in North Carolina's sustainable energy future.

What is Geothermal?

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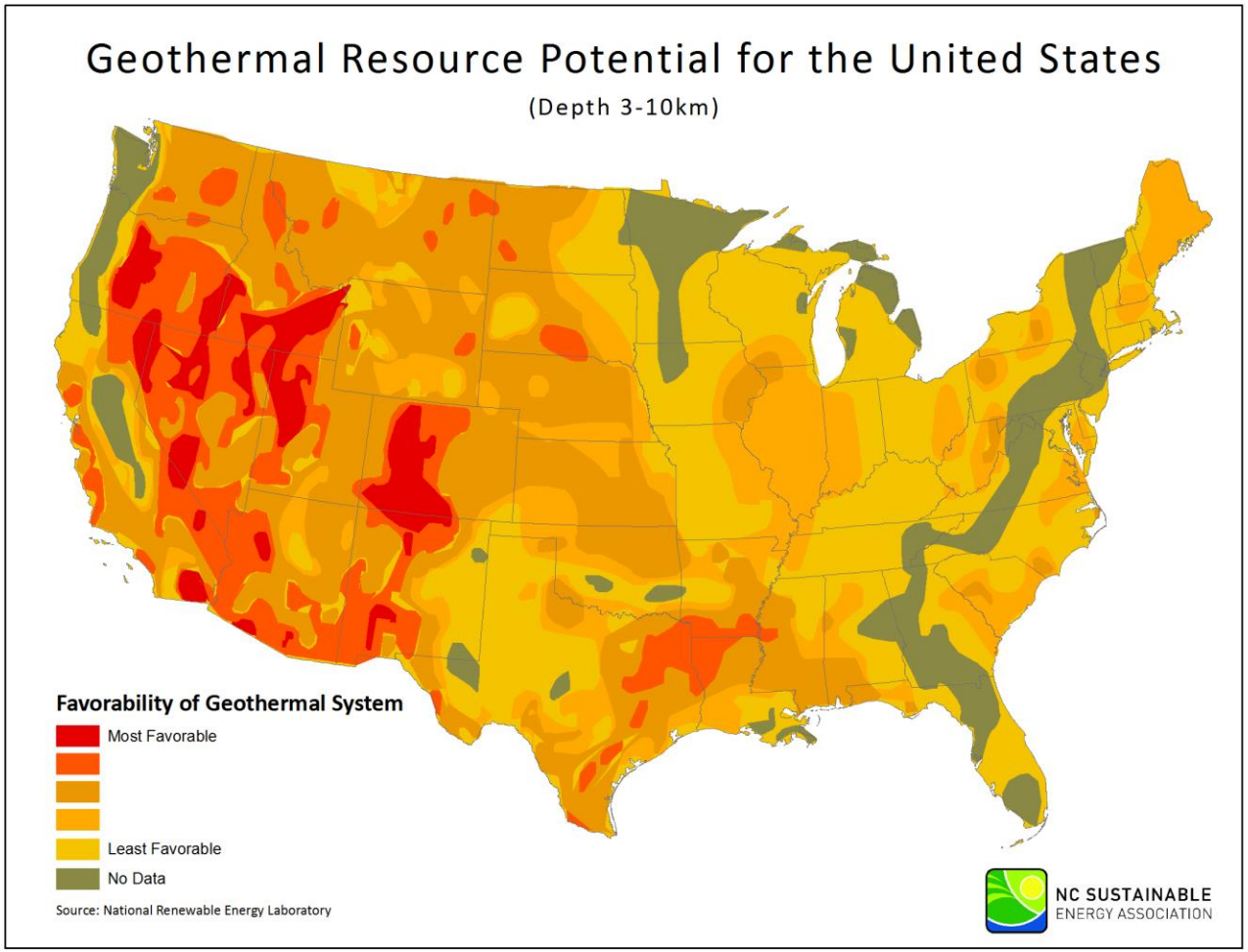
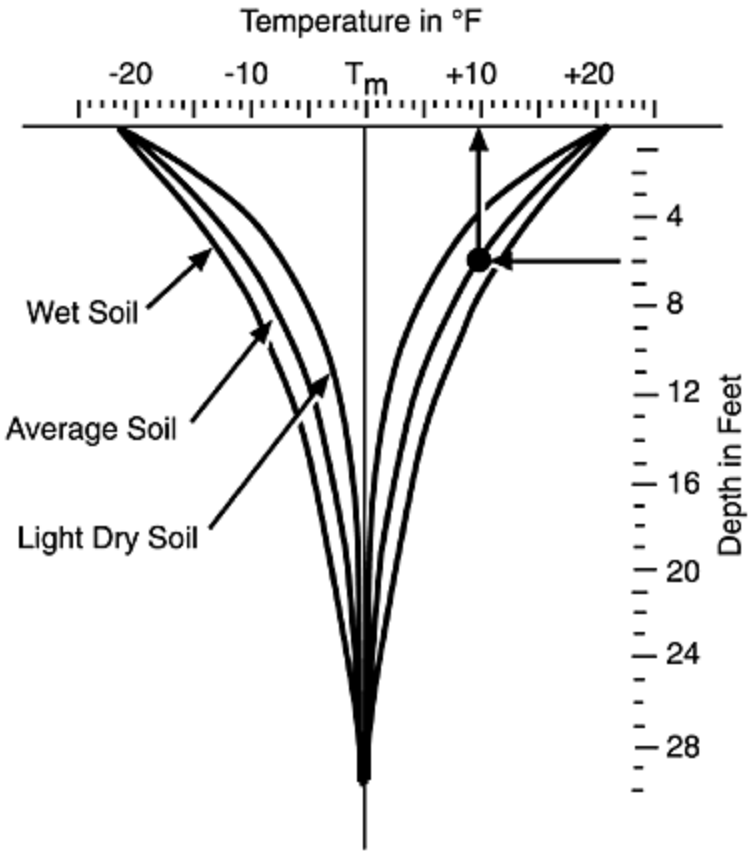
- Includes both Geothermal Energy and Ground Source Heat Pump (GSHP) technologies:
  - Geothermal energy technologies utilize the thermal energy stored in the Earth to generate electricity
  - GSHPs are central heating and cooling systems that increase efficiency by transferring heat to or from the ground

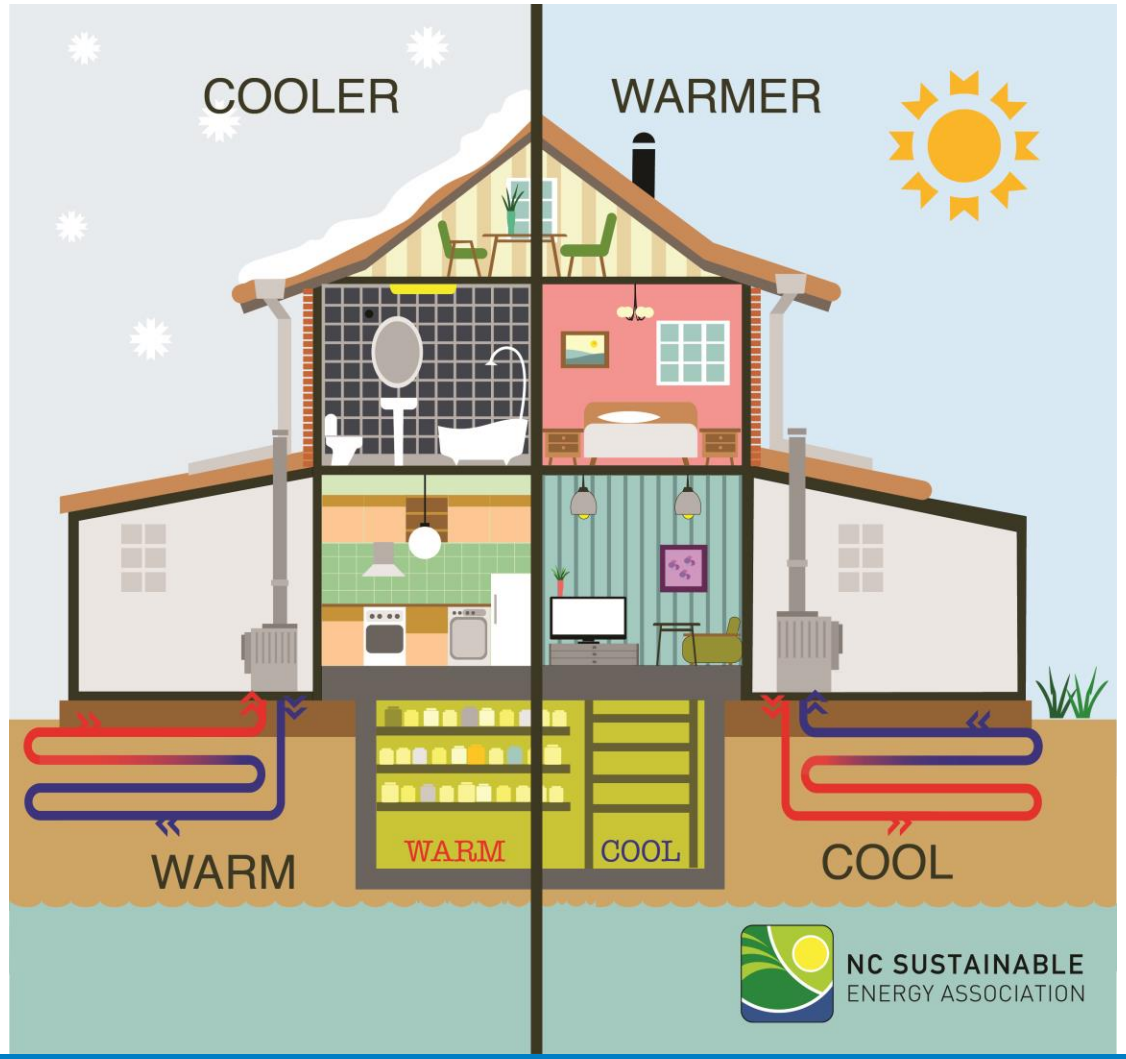
Geothermal Energy Potential



Earth Sub-Surface Temperature



What is a GSHP?

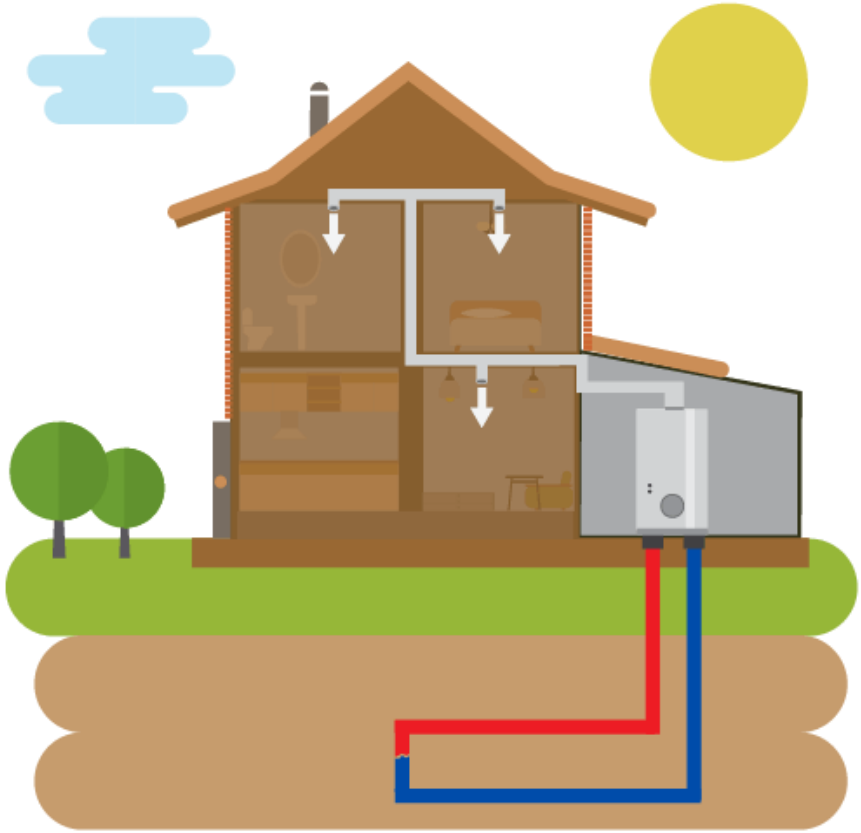


What is a GSHP?

- 2 main types:
  - Open loop
  - Closed loop

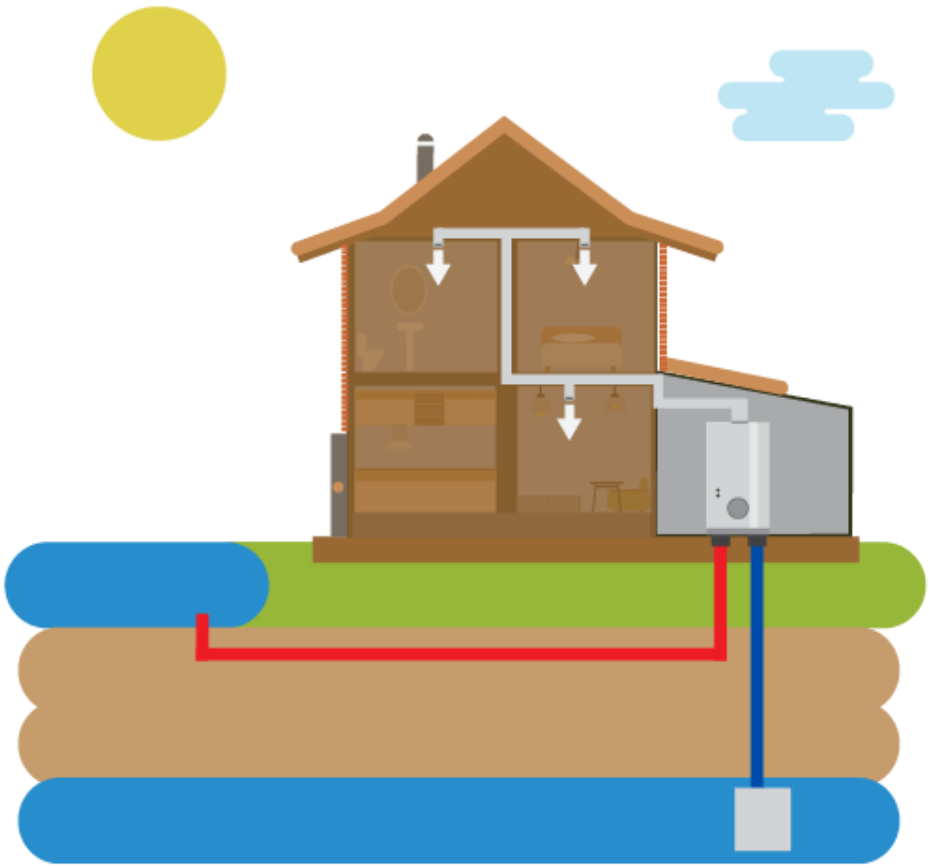
- 2 main subcategories:
  - Vertical
  - Horizontal

What is a GSHP?



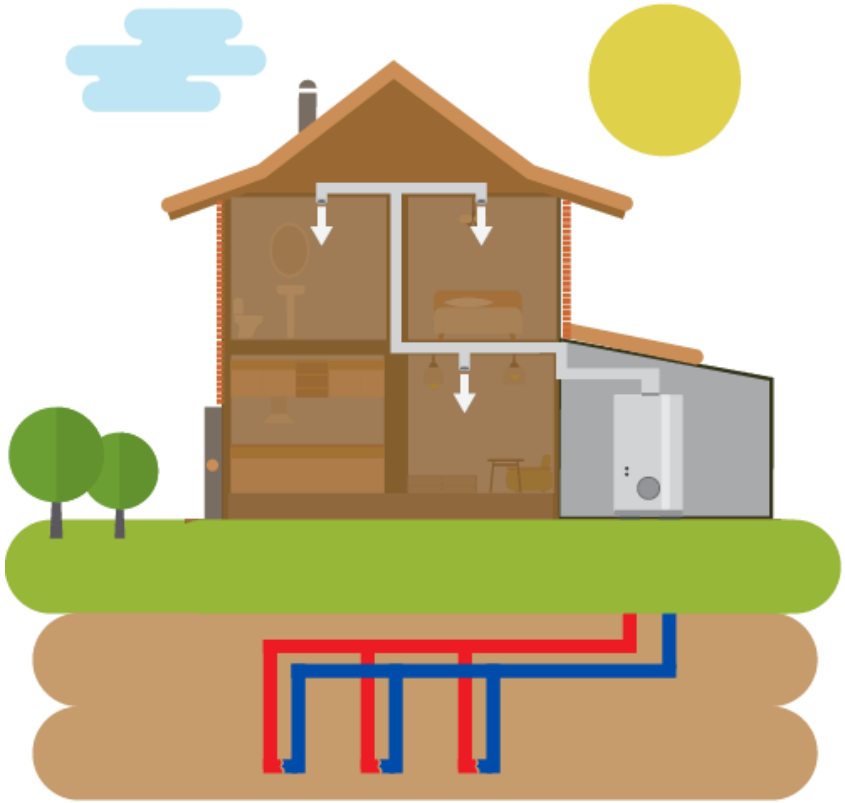
Closed Horizontal Loop

What is a GSHP?



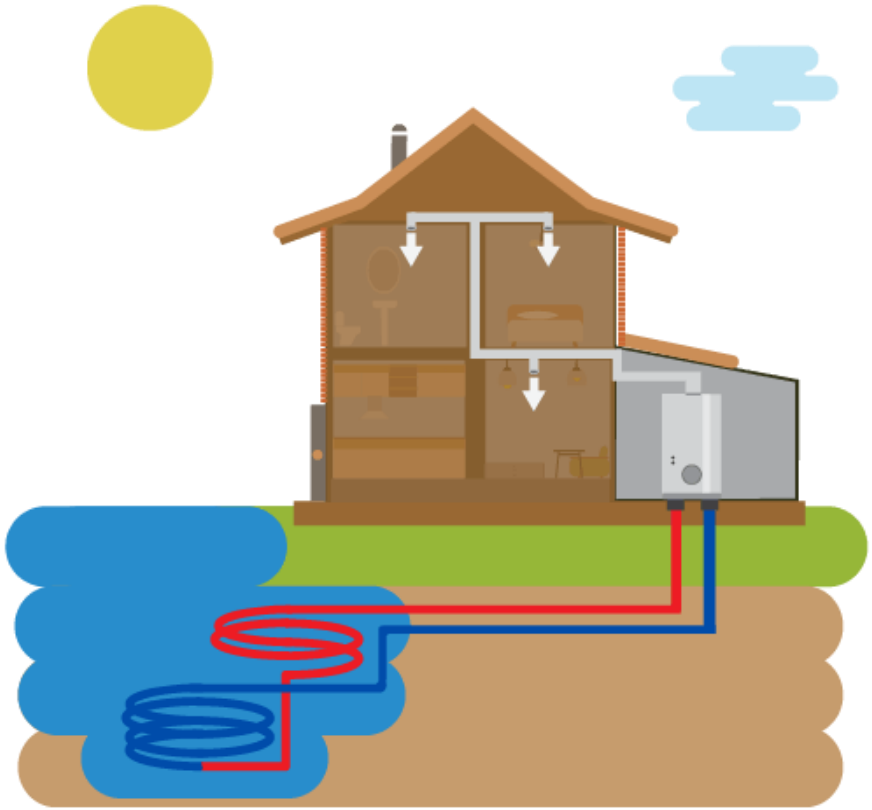
Open Loop Well Water

What is a GSHP?



Closed Vertical Loop

What is a GSHP?



Lake or Pond System

How Efficient is a GSHP?

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- According to the International Ground Source Heat Pump Association, GSHPs are:
  - 50-70% more efficient than comparable heating systems
  - 20-40% more efficient than comparable cooling systems

How is a GSHP Installed?

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How is a GSHP Installed?

What are the Costs Associated with Installing a GSHP?

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Item	Cost Ratio (%)	Unit Cost for Installation ($/RT)	Repair Period (Year)	Replacement Period (Year)
Heat pump	10.74	404.63	7	20
Drilling & Trench	45.42	1711.19	-	-
Terminal unit	6.41	241.50	6	15
Pump	2.15	81.00	3	20
Pipe	15.37	579.06	10	20
Controller	0.89	33.53	5	20
Duct	19.02	716.58	8	15

Development of a Multi-Objective Sizing Method for Borehole Heat Exchangers during the Early Design Phase, 2017

How Much is an Average GSHP?

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- Residential:
  - $2,500/ton for the system itself
  - 5-10 year payback

Guide to Geothermal Heat Pumps, 2011

How Does a GSHP Compare to Traditional HVAC Systems?

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Table 7.4. Summary of inputs and outputs from BLCC for the four HVAC systems

Costs	Baseline: GHP	Option 1: ACC/VAV	Option 2: WCC/CV	Option 3: WCC/VAV
Initial cost	$1,021,257	$1,129,286	$835,916	$1,164,268
First year maintenance cost	$7,383	$7,824	$13,651	$7,928
First year electric cost	$22,138	$23,037	$34,152	$19,448
rst year gas cost	$3,533	$10,963	$23,944	$11,034
Water cost	—	—	$385	$385
Total annual O&M costs	$33,054	$41,824	$73,826	$38,795
Life cycle cost	$1,498,835	$1,734,327	$1,912,297	$1,728,736

Geothermal Heat Pumps in K-12 Schools: A Case Study of the Lincoln, Nebraska, Schools (Shonder, Martin, and Hughes; 2000)

GSHPs in NC

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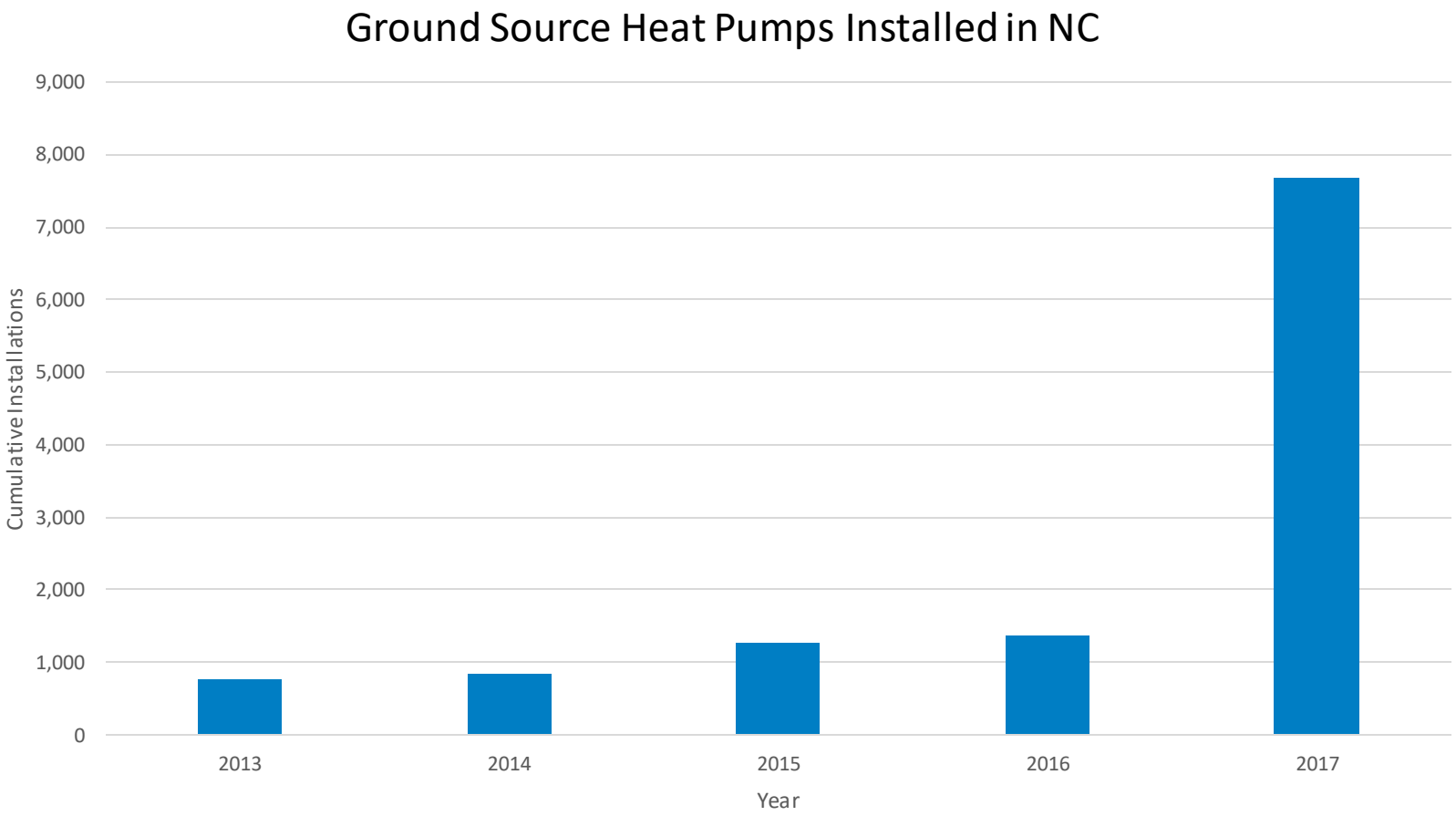
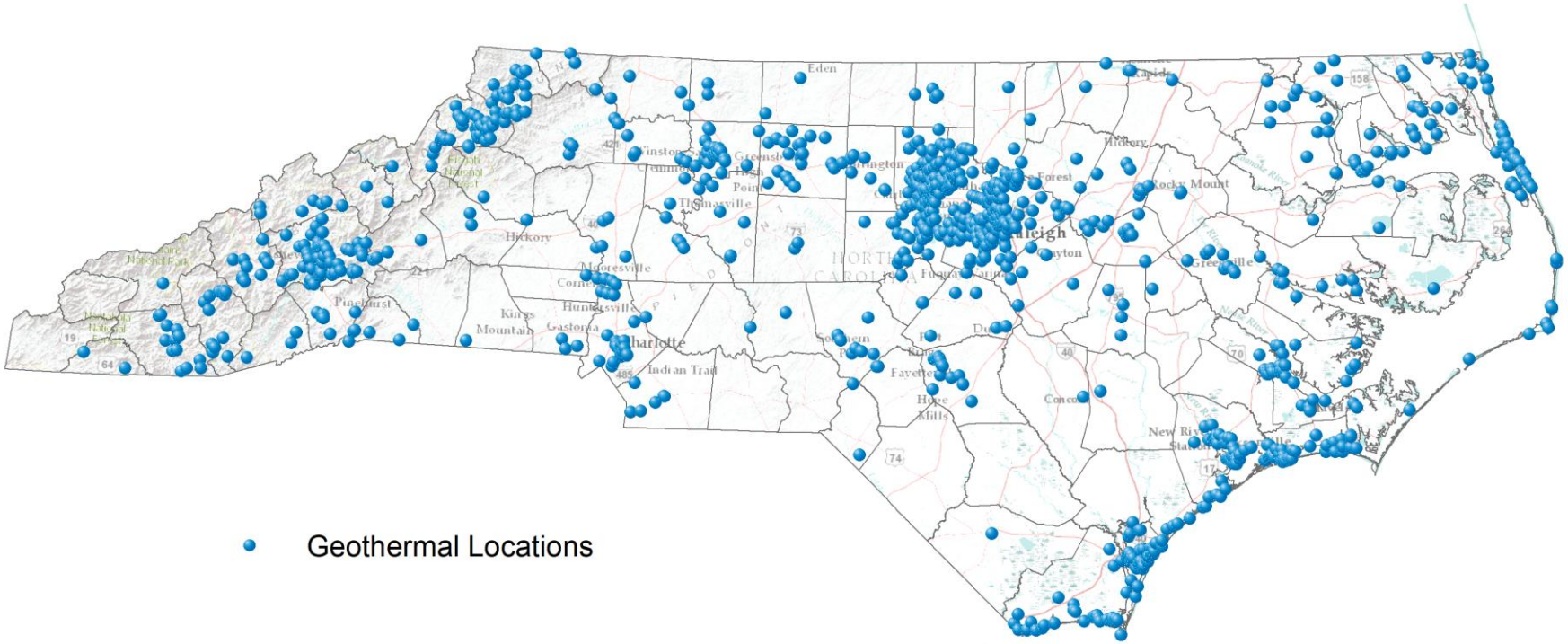
- From 2007-2018, over $30 million has been invested in Geothermal systems in the state
  - 0.2% of direct spending in clean energy development by technology
- Over 7,600 geothermal systems were installed in NC from 2007-2018
  - 49.8% of renewable energy systems installed over that period

GSHPs in NC


Ground Source Heat Pumps Installed in NC
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Cumulative Installations
2013
2014
2015
2016
2017
Year

GSHPs in NC


Eden
Hickory
Pinehurst
Kings Mountain
Gastonia
Charlotte
Indian Trail
Fayetteville
Rocky Mount
Greenville
Geothermal Locations

Geothermal Industry in NC

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- According to NCSEA's 2018 Clean Energy Industry Census:
  - 225 companies active in the sector (7% of the clean energy industry)
  - 1,075 jobs (4%)
  - $252 million in revenue (2%)

Geothermal Industry in NC

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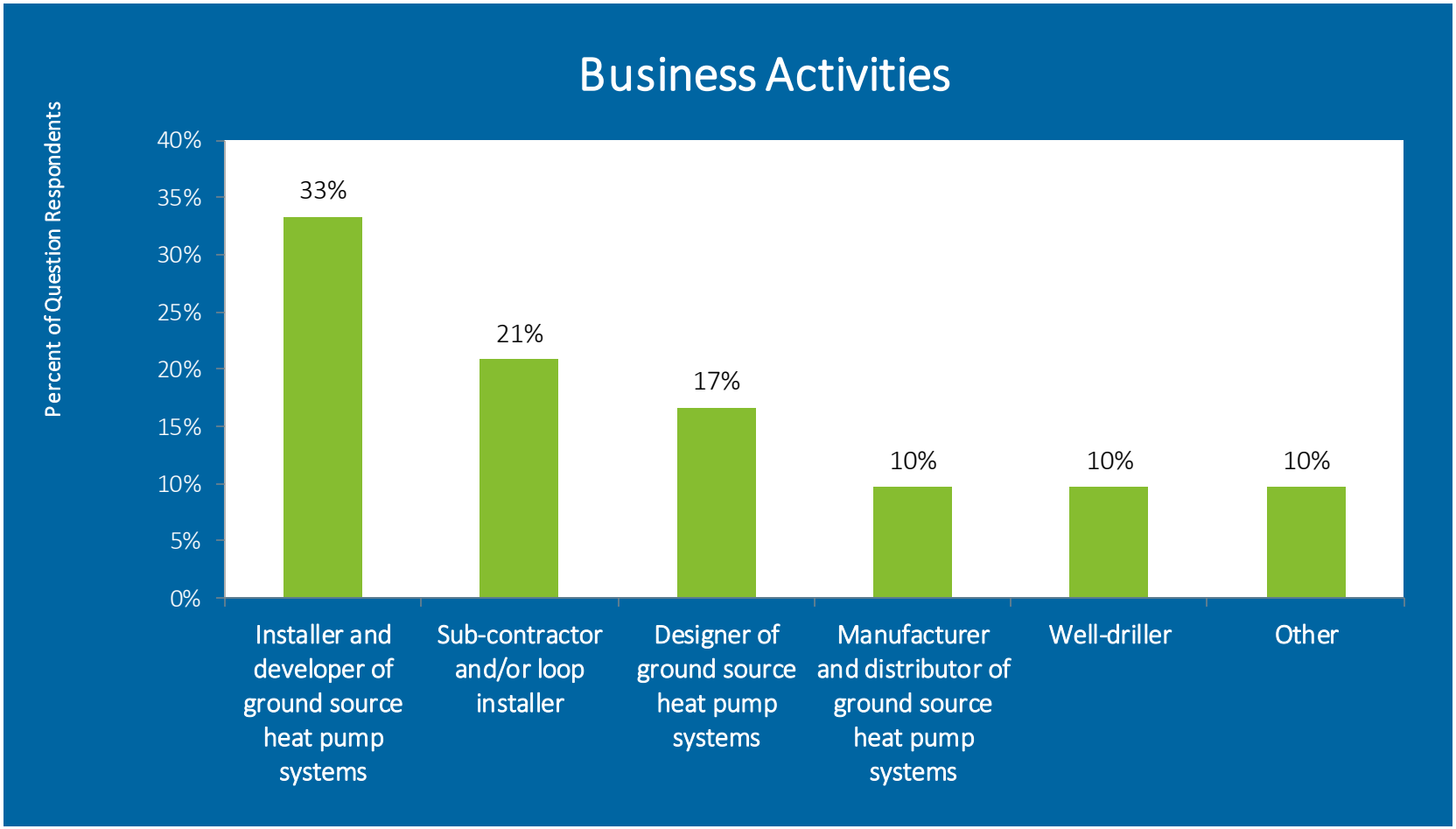
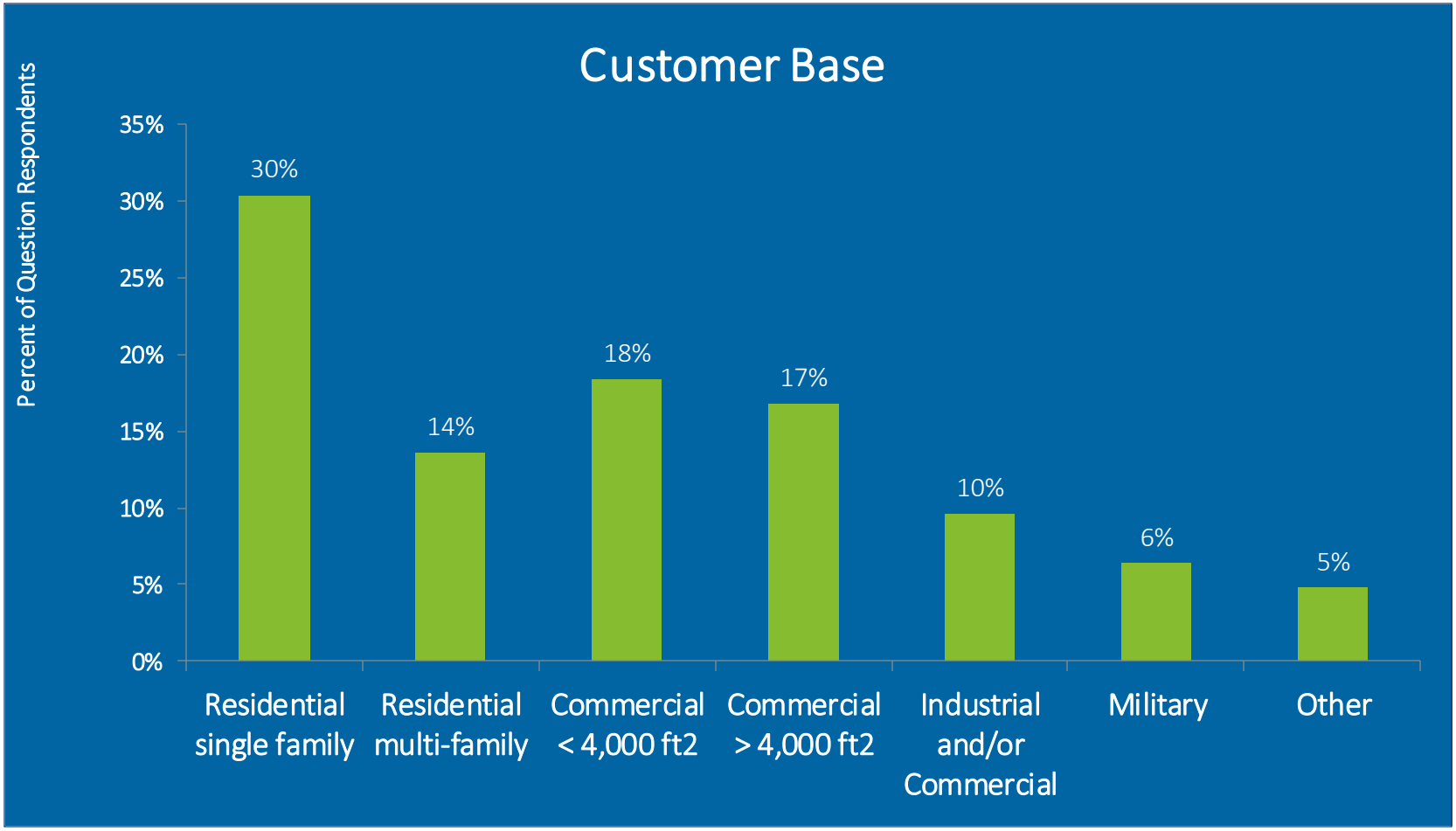
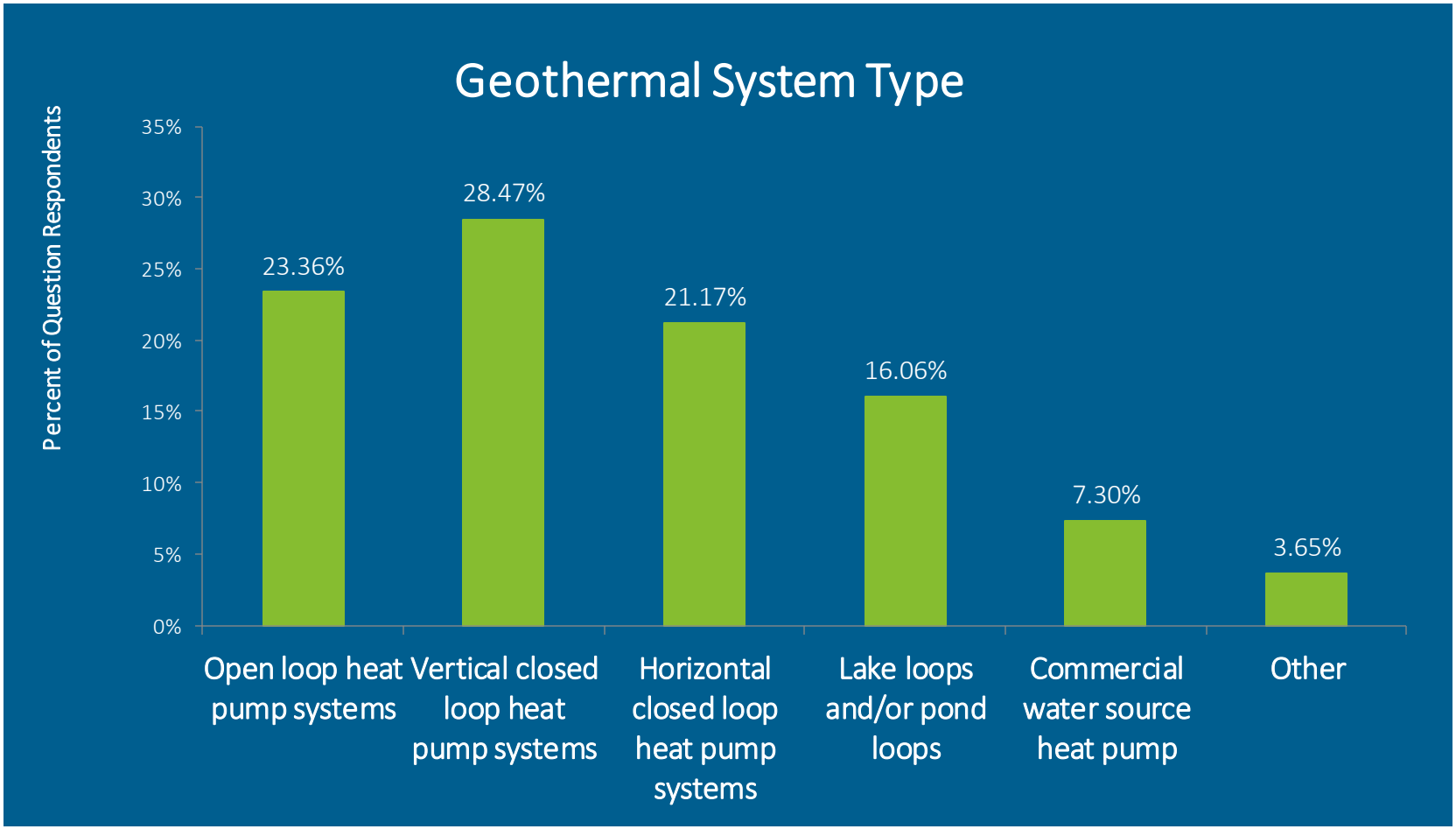


Geothermal Industry in NC



Geothermal Industry in NC



What Contributed to Growth of GSHPs in NC?

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- NC's 35% renewable energy tax credit that expired at the end of 2015 and the federal residential renewable energy 30% tax credit that expired at the end of 2016
  - The federal tax credit was brought back at 30% in 2018, with step downs eventually to 22% in 2022, but has no maximum value limit

Thank You

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