Trisymbiotic Intellectual Property Portfolio

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INVENTOR

"trying to escape energy return on energy investment is like trying to escape gravity or the speed of light"

Front image: Courtesy of NASA
Graphic: Matteo B. Gravina

Trisymbiotic Patents 1

Patent Portfolio

The Trisymbiotic Patent Collection is a set of three patents in the fields of Data Center and High-Performance Computing. Each patent can operate independently of one another or, depending on the setup, could work together. Either way, the aim of the portfolio is to increase the efficiency of both fields by creating temporal *negative power usage effectiveness* in data centers, while delivering a force multiplier for high-performance computing centers. In high-performance computing, the force multiplier is the *floating-points operations per second* (FLOPS), and the deliverance of *floating-points operation per second per unit of one watt*.

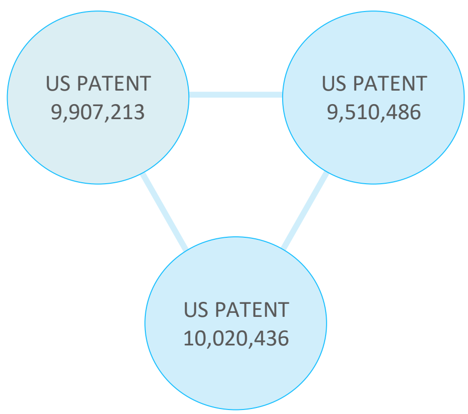


Fig. 1 Patent portfolio **Source:** Gravina, Matteo B.

US Patent 9,510,486 B1 allows information center facilities to create power from the heat coming from the servers. In permitting the temperature to flow up as heated air does naturally, the warmed air once arriving at the pinnacle of its control elevation it then falls downward with force as the thicker air moves, rotating downward. At the latter end, a thermal energy converter therefore producing electrical power, which when applied back into the facilities increasing the efficiency, lowing the number of the power usage effectiveness. US Patent 9,907,213 B1 is a step forward by adding a heat energy conveyor. The thermal energy conveyor promotes the transfer of air inside the cyclical system, encouraging movement of air whereby using the heat exchanger to chill the air organically. When using a combination of the thermal energy conveyor and the thermal energy converter, we could use the design for both data centers and high-performance computing facilities. Using the invention at a percentage of full capacity allows the prior data centers and high-performance computing predecessors. The ratio of power applied to the cyclical system regarding the amount of cross power input to the power exported to the power extrapolated is many times over, therefore creating a force multiplier.

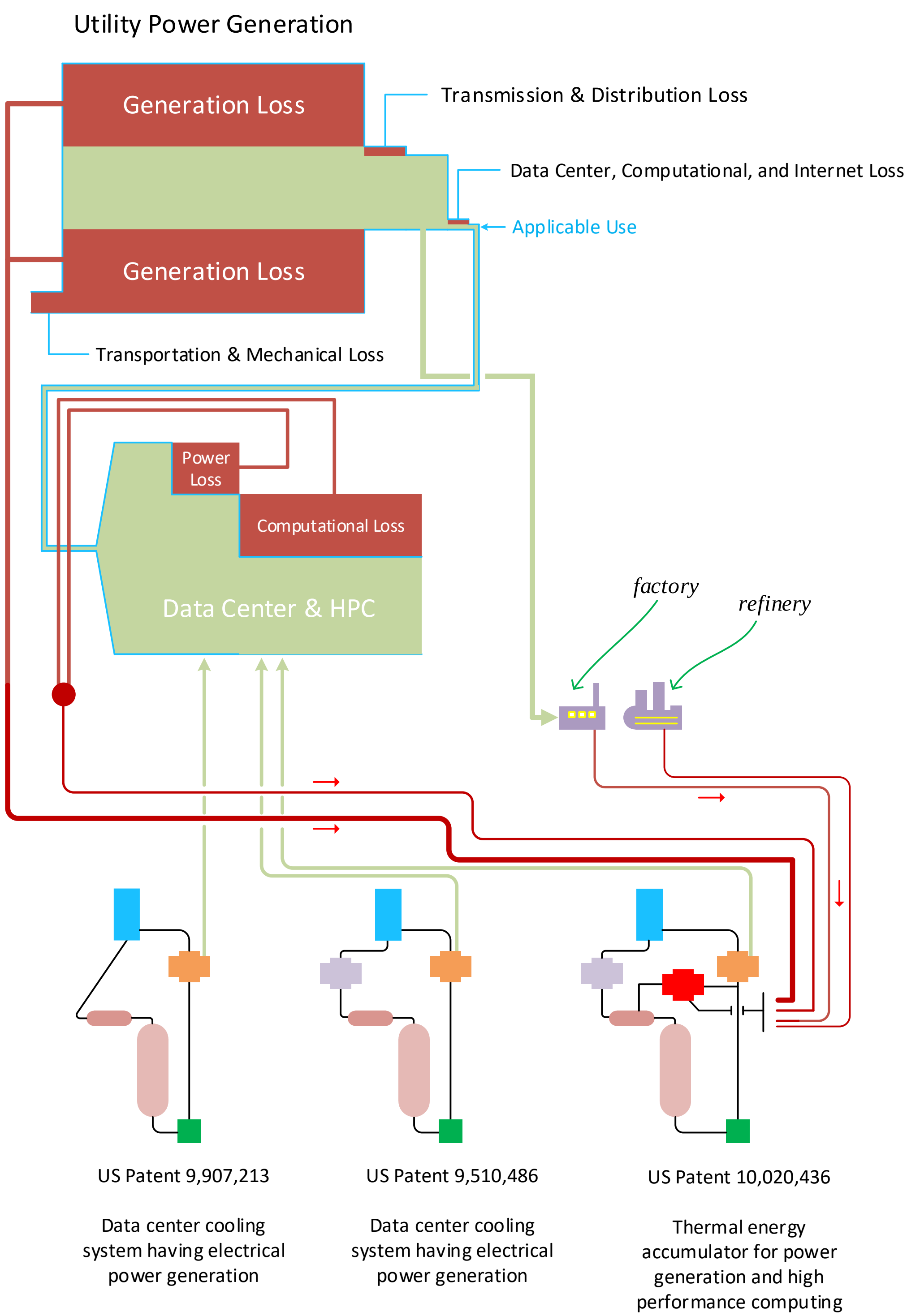


Fig. 2 Engineering Source: Gravina, Matteo B.

US Patent 10,020,436 B1 is a combination of both US Patent 9,510,486 B1 and US Patent 9,907,213 B1. US Patent 10,020,436 B1 extends their capabilities by using external waste heat. Taking in external waste heat, the thermal content of the mass of air use is for use as additional waste energy onto its thermal line. The thermal line is a receiver of convection, conduction and radiation waste energy. Working together to amplify the energy already present. Using both inner and outer thermal energy in a regulated climate elevates the center's effectiveness. The bigger the extremes in temperature between air mass existing in higher elevations to waste heat use to move back cold air spiraling downward back into the facilities basement is suffice to say it becomes a thousand-fold power amplifier. Using parallel thermoelectric generators further amplifies the multiplication force factor. The vast differences in temperature between high elevation's to waste energy make use of thermoelectric generators to produce even more electrical power.

In figure 2 power production at the electric power plant yields power with an efficiency of 33% while 66% is conversion loss. Primarily, fuels come from fossil sources, while most of the fuel is coal. Natural gas and nuclear make little difference in converting from fuel to mechanical to power. Producing electrical power requires immense towers to cool down water that is recycled for cooling so that it can be converted to steam once more. For over one hundred years the same system of heating steam which spins a turbine that spins a generator, is the only way to generate electricity. Energy is wasted as 66% of the heat energy send to the air and river environment. In figure 2 this wasted energy is harnessed back e.g. US Patent 10,020,436, thermal energy accumulator, which utilizes this surplus heat to transfer to data centers.

Large masses of cold air which cool the electronic components in the data centers or high-performance computing centers. The movement of this mass of cold condense air inside the system produces electrical power. In parallel to the movement of the air, two thermoelectric generators use the cold air moving and the opposing waste heat thermal energy moves on the other side of the thermoelectric generators. Using the energy differences between the two moving masses allows the thermoelectric generators to produce more electrical power.

Thermal energy coming from industry also applies, as the waste heat coming from factories or refineries applies for consumption by the intellectual portfolio. The electrical utility shortens the distance factor of extraction to the interconnections, as they consume a continual flow of thermal energy. The amount of Therms and rate allows a negotiable economic rate for each Therm consume, being set at 100,000 Btu, the amount consume by the data centers or high-performance computing centers is beneficial as an addition source of income to utilities, factories and refineries.

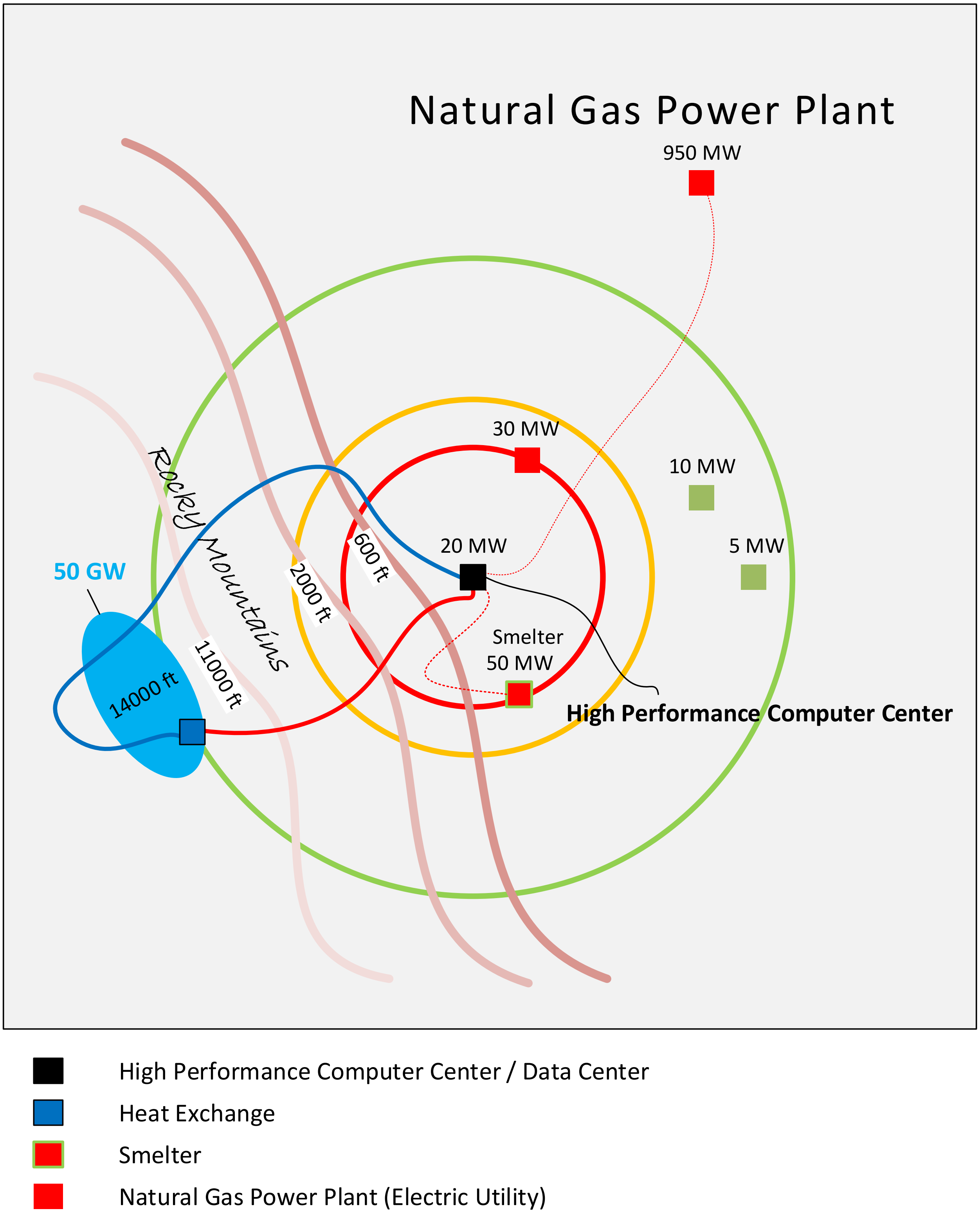


Fig. 3 Inverse energy Source: Gravina, Matteo B.

As explained in the previous paragraph on how the intellectual property patents work, in FIG. 3, an example of the processes is a facility with a total power of 20 megawatts next to the

US Rocky Mountains. The facility [black square], total power is 20 megawatts, has a thermal line [red line], forwards by a natural lift of hot air to progress upward onto the heat exchanger [blue square]. Now the natural occurrence of cold air to filling at high elevations brings about the force multiplication of the amount of power extracted many times the amount the waste heat produced by the facility. Therefore, at certain times, the amount of potential power arises depending on the time of season and the elevation's lack of heat energy. Once the condense air changes temperature, also by natural occurrence tumbles downward with force, it is therefore this downward force which is used to 1) cool the equipment at the facility's silos, but also to 2) produce electricity back to the facility. Within a proximity ring [red] thermal waste heat produced by, per se example, Smelter. The facility uses the waste heat to introduce thermal energy to the, per se example, High Performance Computer Center. In addition, a natural gas power plant, of which two-thirds is waste heat, although outside a distance ring [green ring] produces about twenty times the power of waste heat that of the Smelter, it is a large amount that the quantity suffices to aggregate the use of thermal energy into the processes. In these conditions, when thermal energy suffices outside sources of waste heat that is larger than the amount produce by the facilities, and the invert thermal power of the high elevations, that the facilities will produce far more power than introduce, culminating in time-based *negative power usage effectiveness*.

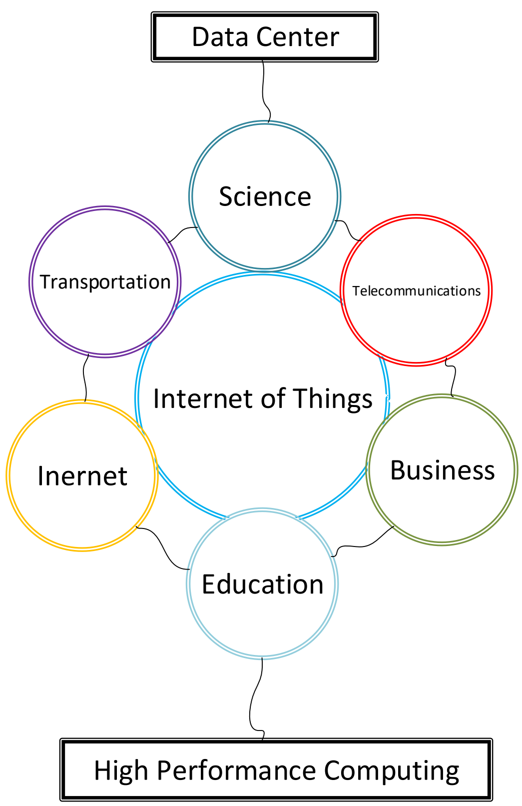


FIG. 4 IOT **Source:** Gravina, Matteo B.

Internet of Things (IoT) is the interconnection of devices using the internet. Upcoming technological engineering devices allow for the interconnection of as well as logarithmic growth use of them. The intellectual property portfolio allows the increase in using data and information transportation through fixed and wireless interconnectivity between node centers with much higher energy efficiency rates than currently use in the marketplace. With artificial intelligence becoming prevalent, the data centers and high-performance computing centers will become IOT Node Centers of high-capacity communications and data links.

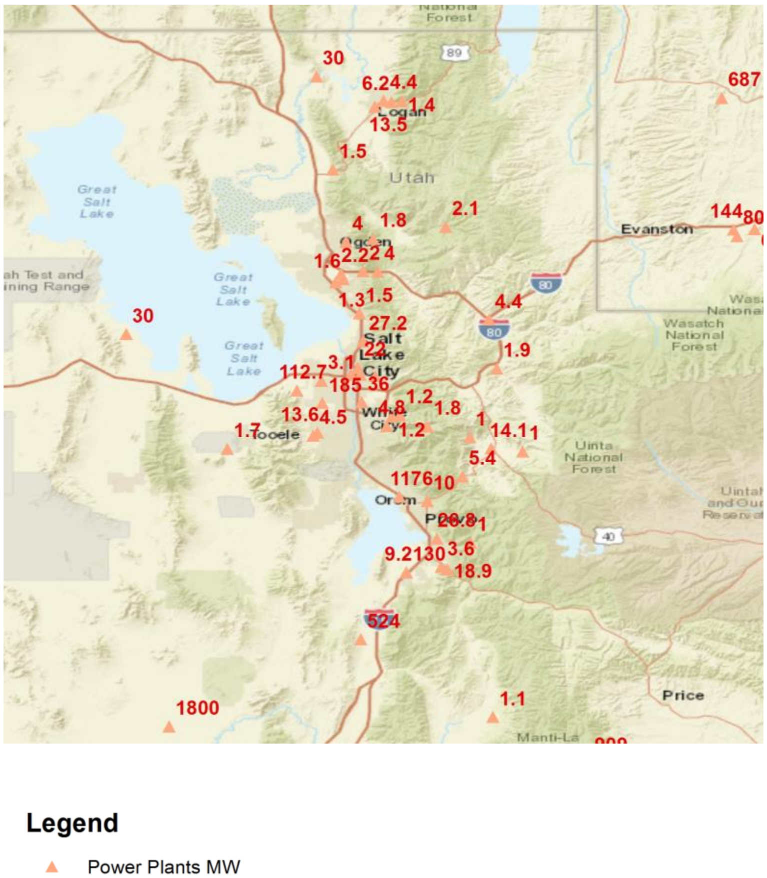


Fig. 5 Salt Lake City Source: USGS National Map and Energy Information Administration.

In Fig. Fig. 5 shows the surrounding areas of Salt Lake City, Utah with power generation structures. The larger structures are utility plants, while others are industrial and commercial complexes. With about 8 GW of power production with a rate of two-thirds of the power plant lost conversion to waste heat. Therewith, a two-thirds heat rate loss, that equals around 5.33 gigawatts amount of heat energy not use productive. This waste heat energy is useable for integrating onto the intellectual property portfolio. With a deliverance efficiency of even 1 gigawatt, which is around 21 percent to the thermal line at the facility, the ratio of even $1/60^{th}$ in accordance to Fig. 5, this would surmount to over 320 exaFLOPS for distribution around the surrounding private and public institutions.

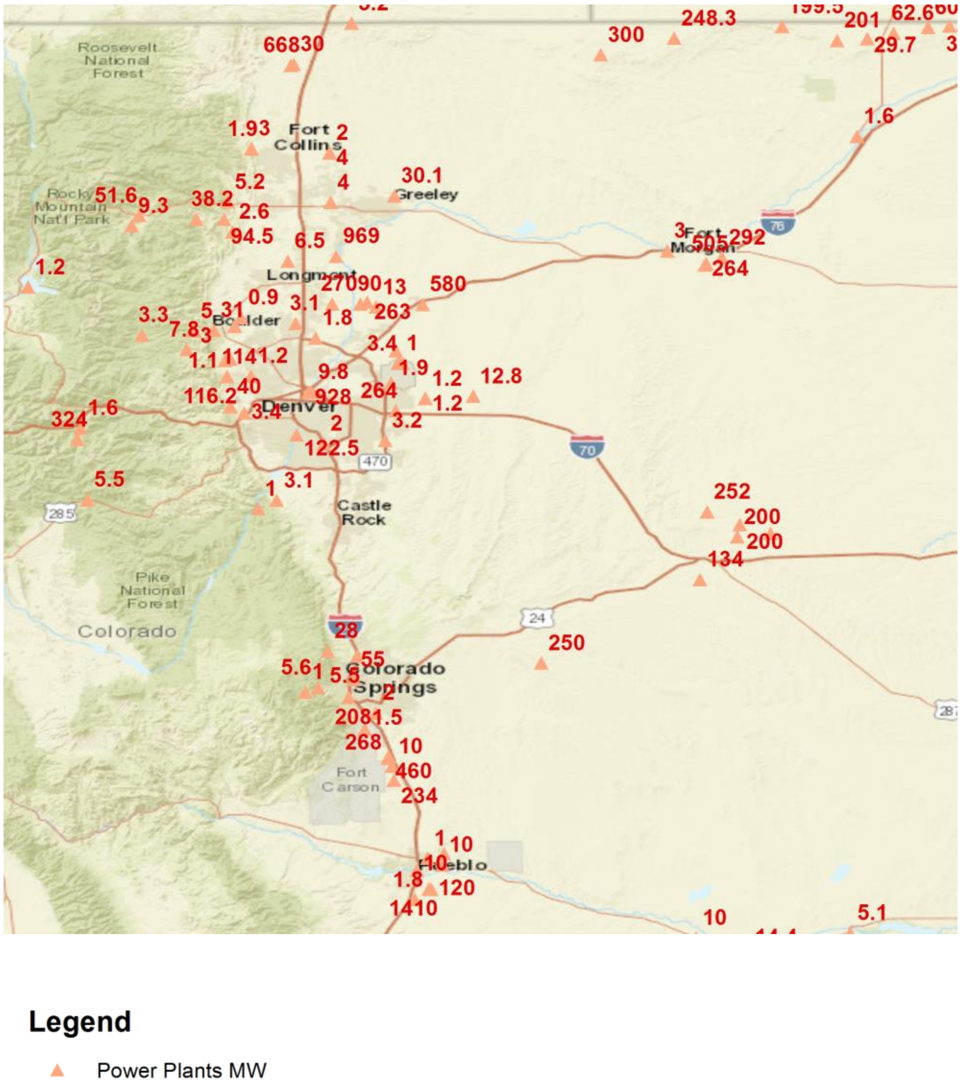


Fig. 6 Denver Source: [USGS National Map]() and [Energy Information Administration]().

In Fig. 6, the surround areas of Denver, Colorado have around 10.7 gigawatts of power production. As with its neighbor to the west, Salt Lake City, Utah, the Denver communities employ several methods to produce power. Although, some of the productive complexes use renewable energy of which is distributed structures in comparison where a utility plant filling with its cooling towers nearby. The Denver communities have the highest available potential inverse energy reserves. This allows for the highest potential of large complexes for the employment of IOT Node Centers. At about 7.1 gigawatts of heat rate efficiency, the probable available, probable deliverance of thermal energy to the IOT Node Center's thermal line of twenty-one percent, the potential of 1.3 zetaFLOPS, exists. This estimate employs the same method as the 1/60th floating-points to watt ratio. This estimate is conservative in nature, of which a plethora of variables coexist.

Patent Factsheet

United States Patents

	9,510,486	9,907,213	10,020,436
Title	Data center cooling system having electrical power generation	Data center cooling system having electrical power generation	Thermal energy accumulator for power generation and high performance computing center
Inventor	Matteo B. Gravina	Matteo B. Gravina	Matteo B. Gravina
ABSTRACT	A data center cooling system having electrical power generation, which utilizes heat generated by servers to simultaneously cool the data center and generate electrical power. Taking into account the design of the data center and cooling allows heat to dissipate naturally, which by design permits a turbine to rotate thereby generating electrical power from a generator. Using the fundamental phenomena of compressed hot air rising and cool air sinking in a cyclical approach is a force multiplier using the heat energy of the data center against the natural use of elevation temperatures. Variations between the differences in energy amount in the looping cycle of the close loop system allows for a negative power usage effectiveness.	A high performance computer cooling system having electrical power generation, which utilizes heat generated by servers to simultaneously cool the high performance computer, and generate electrical power. Taking into account the design of the high performance computer and cooling allows heat to dissipate actively or passively, which by design permits a turbine to rotate thereby generating electrical power from a generator. Using the fundamental phenomena of compressed hot air rising and cool air sinking in a cyclical approach is a force multiplier using the heat energy of the high performance computer against the natural use of elevation temperatures.	A thermal energy accumulator for power generation and high performance computing center utilizes heat generated by at least one of a transformer, a parking lot, a roof structure, an air conditioner, a generator, an uninterruptible power supply, a thermal energy conveyer and a thermal energy converter; a source of cold condensed compressed air; and at least one of a thermoelectric generator and a thermoelectric gradient inducer to generate electrical power for a performance computing center.
Status	Patent In Force	Patent In Force	Patent In Force
Filed	13-Jul-16	12-Dec-16	15-Jun-17
Published	29-Nov-16	27-Feb-18	10-Jul-18
Filing to Patent (Days)	136	442	388
Family ID	57352114	1000002358435	1000002722223
Application Number	15/209,176	15/375,217	15/623,473
Independent Claims	3	3	3
Dependent Claims	15	14	9
Figures	11	14	26

Fig. 7 Patent portfolio **Source:** Gravina, Matteo B.

The United States Patents portfolio, that makes up three patents that either work independently or in combination. Depending on user facilities, we intended them for the next generation of data centers, and supercomputers.

Scientific

Planetary & Celestial Mechanics

The principles behind the intellectual property family originate with celestial mechanics. It is the mechanics set a few billion years ago that have allowed the current movement within our solar system, our planet-moon duo, to allow us seasons.

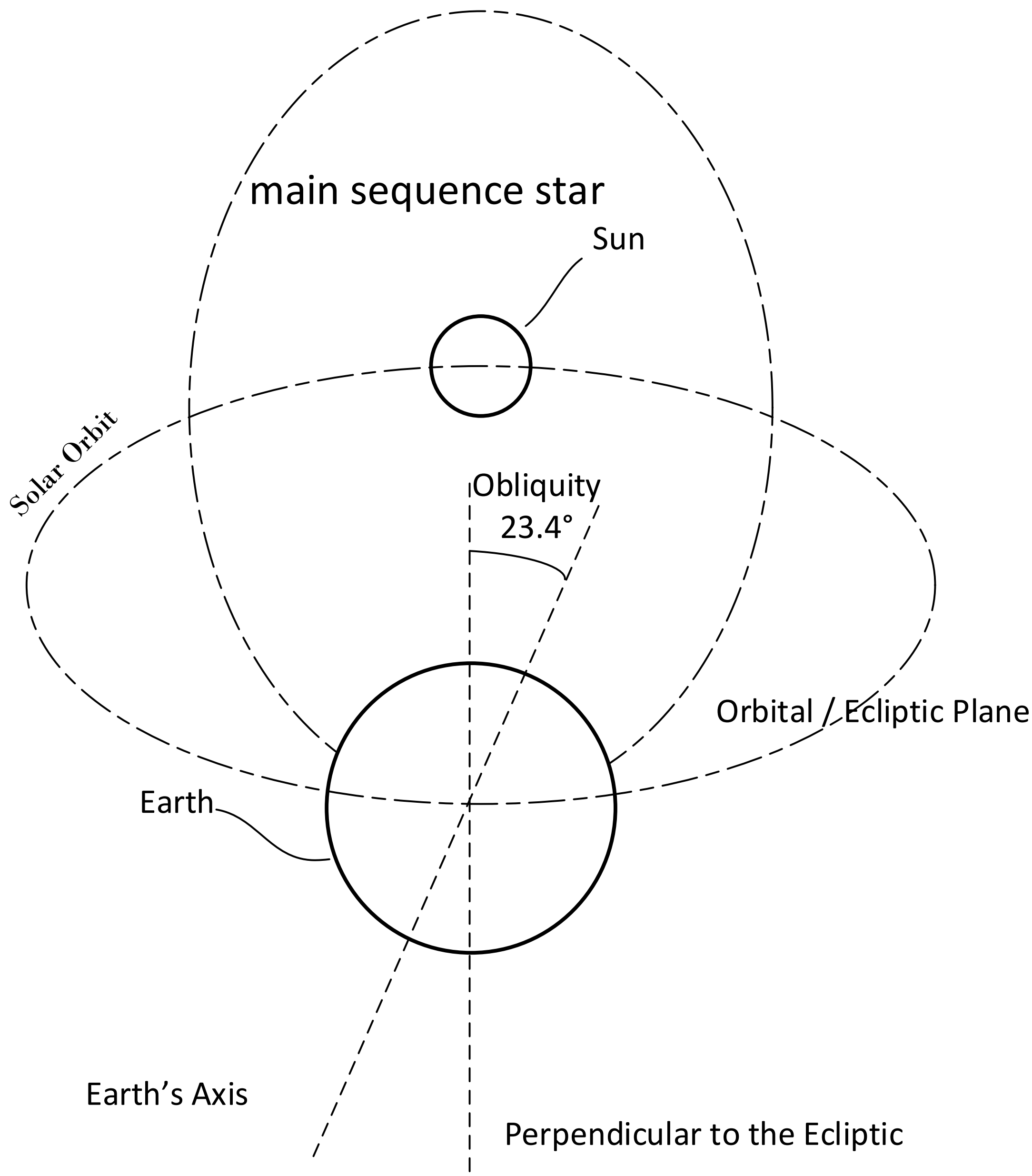


Fig. 8 Celestial mechanics **Source:** Gravina, Matteo B.

Atmospheric Principles

At several intervals of time, our planet has seasons which permit seasonal changes to accrue on both the Northern and Southern Hemisphere of the planet. In our reference Northern Hemisphere, North America, during the season of winter, experiences the coldest days accrue on surface land. It is therefore that the highest available potential energy happens in Winter. This is due to using the inverse potential contrasting thermal temperatures between the amount of artificial energy created by humans and use this wide range in temperatures for use at the IOT Node Centers.

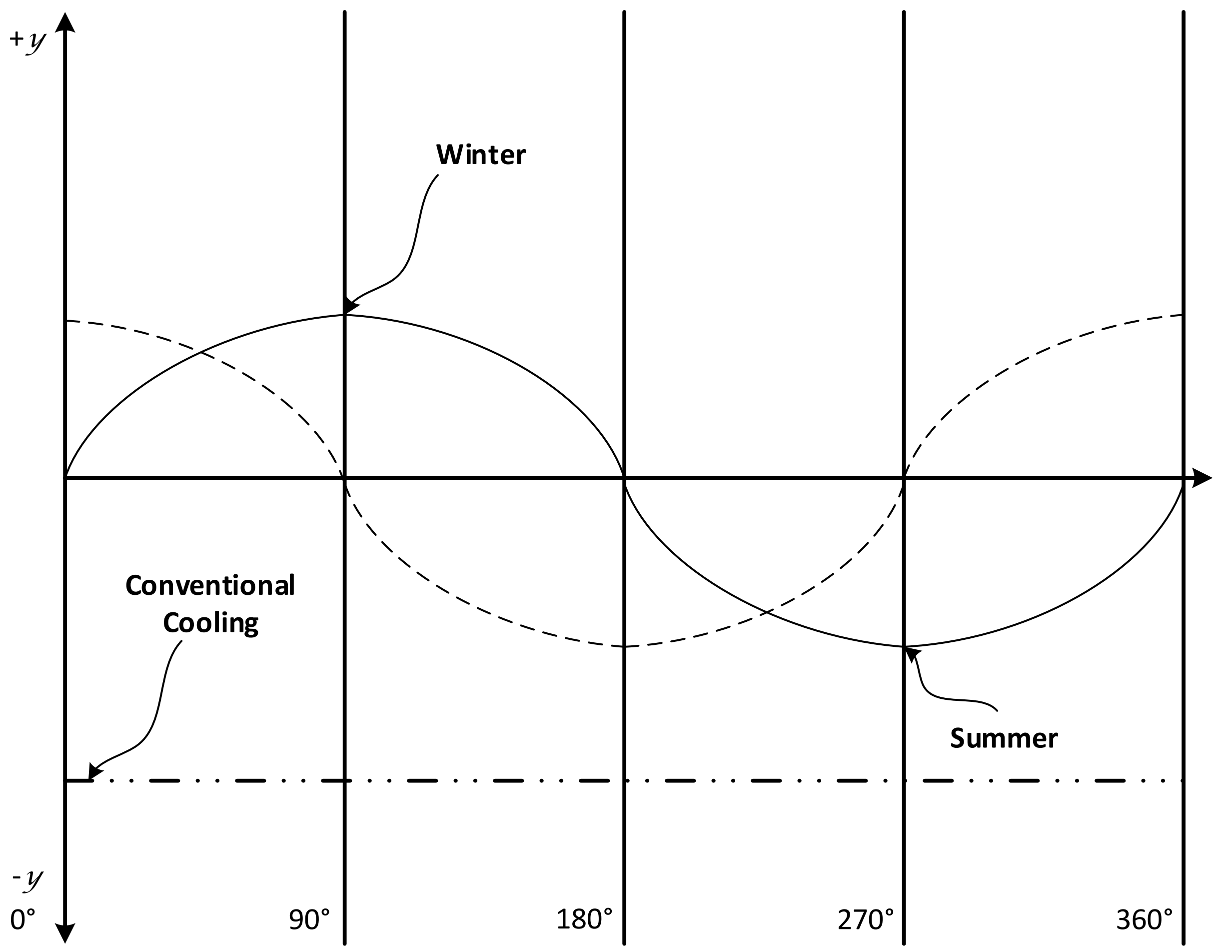


Fig. 9 Seasons **Source:** Gravina, Matteo B.

Another principle that permits the intellectual property family to excel and become a force multiplier is the absence of temperature. The snow line plays an important role in providing the dividing line between elevation low temperatures and low-lying geographic areas. The greater the absence, the better as the distance between the disparity in temperature between the accumulative sources of heat and the lowest temperature got at time becomes a force multiplier ratio. Therefore, the greater the cold, the more energy expediter the intellectual property family works. The closer the snowline temperatures and surrounding temperature are to the amount of heat energy coming from the data center or the high-performance computing center, the higher the level of extracted power they get. The closer we are to the snow line, the better we can employ temperature differences, although ideally, at high latitudes the lower elevation the snow line is, the locations are not where most of the human populations exist, besides variables in play, such as fiber lines, and utility-industry.

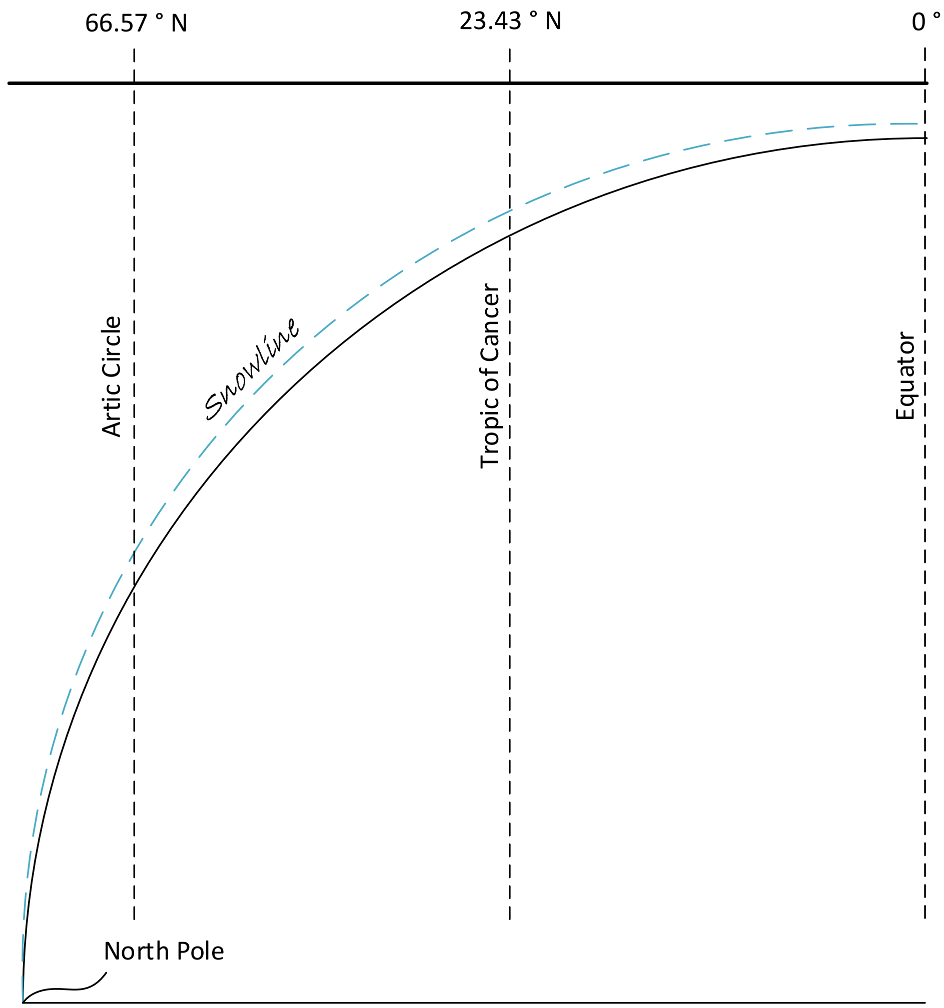


Fig. 10 Snow line Source: Gravina, Matteo B.

Thermodynamic Laws

The laws of thermodynamics are paramount in how the intellectual property portfolio works. The thermodynamic laws: *The First Law of Thermodynamics*, *The Second Law of Thermodynamics*, *The Third Law of Thermodynamics*, *Zeroth Law of Thermodynamics*. Although, the laws and principles stated below play roles such as ***Newton's Law of Universal Gravitation,*** such as the force of gravity of the heavier condense air subsiding downward. ***Bernoulli's Principle*** vivid appearance is in the acceleration of air as it moves upward as it is a release from the thermal line as the hot air aggregates coming from the silos. ***Carnot's Theorem*** exemplifies the silos as reservoirs between the heat exchange as the two counter each other. ***Faxén's laws*** are another example as condense air as a fluid flow through the thermal energy conveyor and the thermal energy converter. The inner designs and the overall designs contemplate the movement of the condense air, whether cold or hot. The chemistry rules also apply as the ***Arrhenius Equation***, ***Charles's Law***, and ***Avogrado's Law*** come into play as the amount of air which comprises a composition of elements and molecules is increase or decrease in the cyclical system, as far as to change the composition.

Law's & Principles

The following are Laws and Principles that either govern the three patented inventions. The scientific laws have small, while others have major roles on how each of the patent's work. Without them, they would not work, with them working in unison allow for breakthroughs which result in multiplication factor compare to previous art.

Carnot's Theorem
Charles Law
Boltzmann Equation
Avogrado's Law
Arrhenius Equation
Bernoulli's' Principle
Boyle's Law
D' Alembert's Paradox
Dalton's Law
Darcy's Law
Dermott's Law
Faxén's laws
Fick's Law of Diffusion
Fourier's Law
Gay-Lussac's Law
Gibbs-Helmholtz Equation
Graham's Law
Henry's Law
Hess's Law
Helmholtz Theorem
Kopps Law
Maxwell Relations
Newton's Law of Cooling
Newton's Law of Universal Gravitation
Newton's Law of Motion
Pascal's Law
Poiseuille's Law
Stroke's Law
Young-Laplace Equation

Ratio’s

The intellectual property portfolio is at best measured by ratios. Several of these measurements underline specific locations and intervals on how the force multiplication of using minimal amounts of energy return higher orders of output than input, therefore increase marginal returns. Locations inside the silos specifically at the rack level show below and how space volume frees server space inside silos. The virtual amounts of energy used to control larger quantities are deviced to keep the process ongoing. They adjust during seasonal times of the year and time of day to extenuate capacities, elongate processing times and increase order of magnitude. We show comparable metrics and how each of the patents accords to the 60:1, 250:1, and 500:1 ratio of using the intellectual property portfolio. In defining the ratios, we measured exaFLOPS by the power input to floating-points of operation per second equivalent.

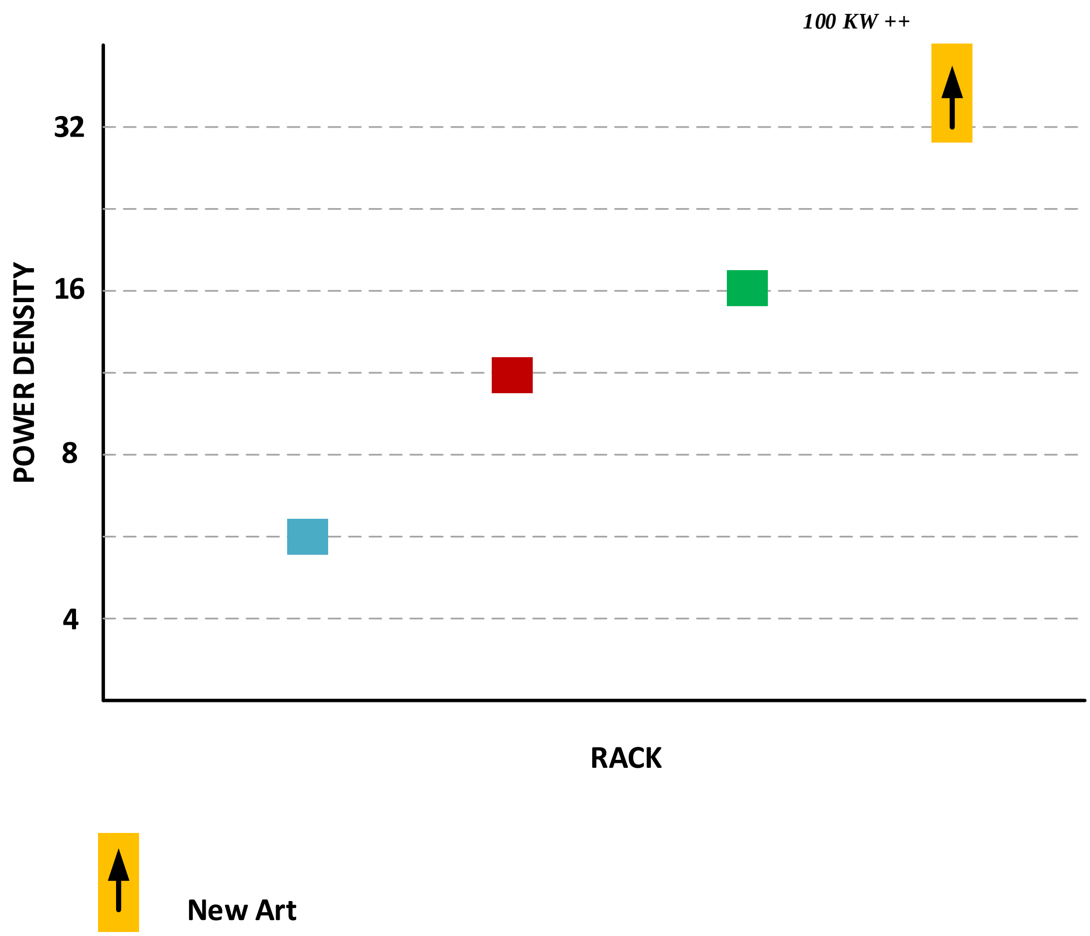


Fig. 11 Rack density Source: Gravina, Matteo B.

On Fig. 11 Rack density, the density per rack unit equivalent is much higher, more rack units allow higher unit density. This increases not only the number of racks per unit of volume processing but also the amount of energy extracted. The design of the silo facilities accordingly carries out the extraction, virtually speeding up the amount of cooling at the same level as heating. By not using server enclosures, cabinets, and similar, a vertical server has more space available, allow at the same time more air to flow.

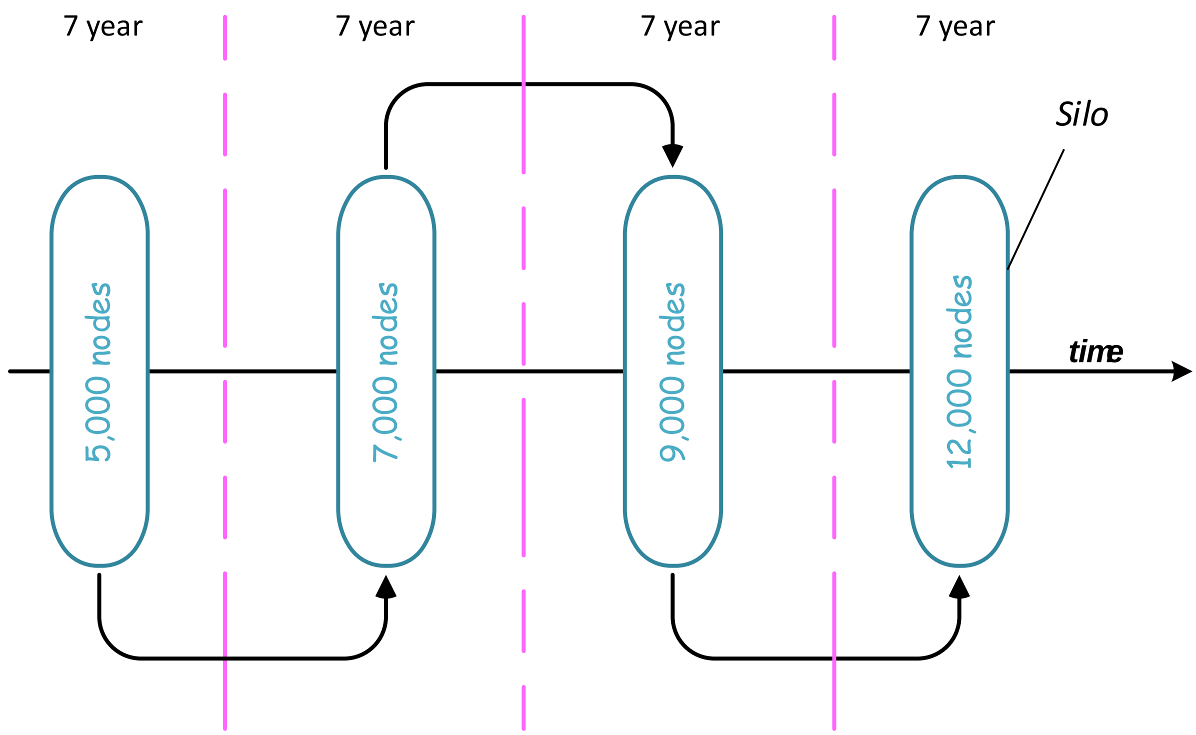


Fig. 12 Silos   **Source:** Gravina, Matteo B.

Therefore, in the Fig. 12 Silos, the number of nodes available through time increase as the size of the server nodes decreases. We expect increases, and more than likely, the heat energy produced per unit of volume at the server location and inside the silos will increase, thus creating more heat energy. Putting into context ample time of eighty-four months for complete recycling of servers and associated computation parts, the number of nodes increases with time.

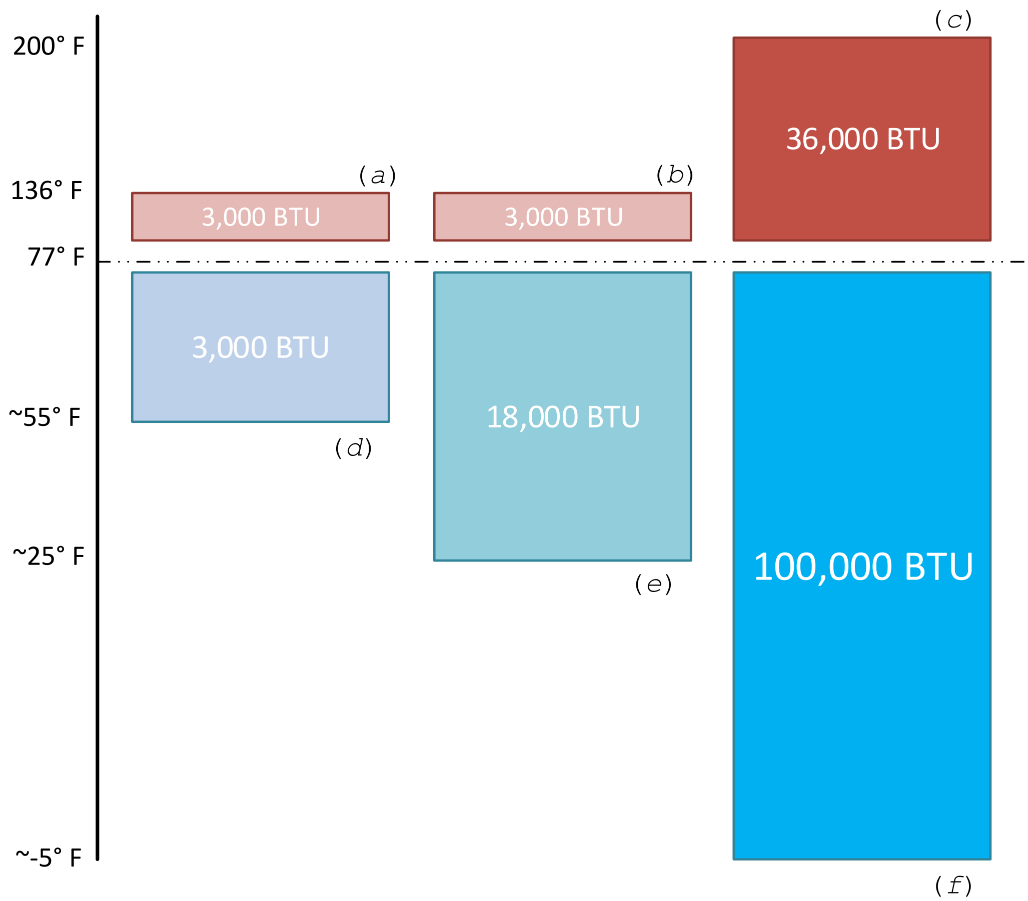
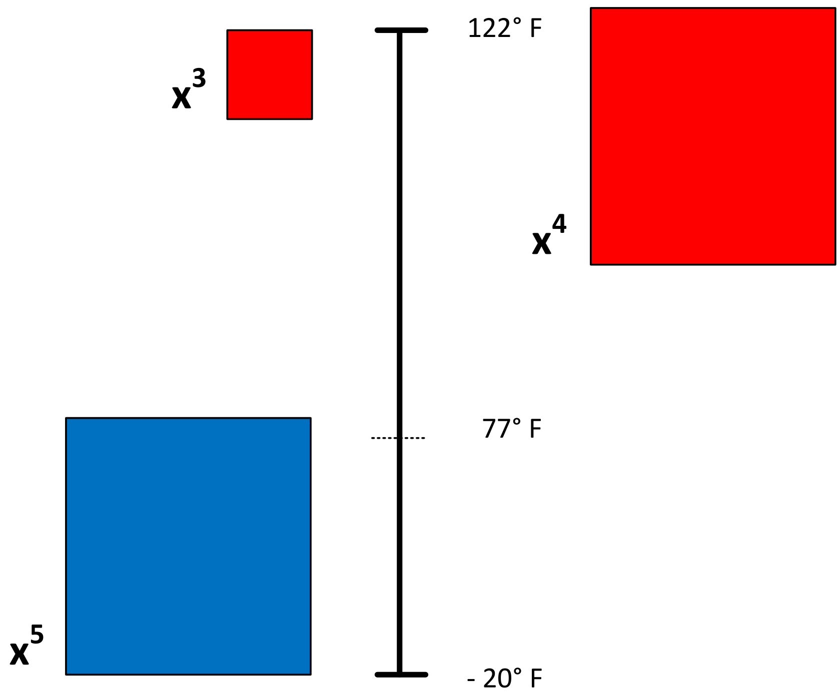


Fig. 13 Enclosure cabinet **Source:** Gravina, Matteo B.

In Fig. 13 Enclosure cabinet, ratios 1 exemplifies how energy quantities and inverse energy amounts allow for the increase in marginal returns. In Fig. 13 Enclosure cabinet, ratios 1, the amount of energy per cubic meter is 3,000 BTU which its inverse energy amount would be a cubic meter with a temperature at an opposing temperature of 3,000 BTU, therefore, 6,000 BTU is the energy amount that force needed to move a higher return than double the 6,000 BTU, 18,000 BTU. The second column has a 3,000 BTU cubic meter against an inverse energy equivalency of 18,000 BTU per cubic meter, using the 3-to-1 ratio, of 3,000+18,000=21,000 BTU would extract around 63,000 BTU of power equivalent. In the second column, the inverse energy per cubic meter at the elevation of the heat exchanger is 18,000 BTU. A cubic meter of condensed air at the rack level with 3,000 BTU thermal energy equivalency would show that the amount of rack servers in cubic a cubic meter of space is producing a small amount of energy. At higher orders of operation, in the third column, the same space is producing 36,000 BTU, although the inverse energy of one cubic meter at the heat exchanger has a 100,000 BTU potential. By adding the two opposing masses, we get 136,000 BTU, but by using the 3-to-1 ratio extraction calculation, we get 408,000 BTU.

Virtual Entropy



x^3 Yearly energy to Data Center or Supercomputer

x^4 Yearly energy from waste heat & internal thermal energy

x^5 Yearly inverse energy

Fig. 14 Virtual entropy **Source:** Gravina, Matteo B.

In Fig. 14, Virtual entropy, the virtual entropy exists, as time variable, temperature variable, and IOT Node Center variable, among many others. The IOT Node Center (**x^3**) amount of heat energy produce at a time in contrast to the waste heat (**x^4**), is far less since the foreign energy source is larger than amount available from the IOT Node Center. Although the inverse energy (**x^5**) is millions of times larger, we will use an equivalent size figure for calculation. In correlation, the use of the use of (x^3+x^4) x5≈P^E. Therefore, the potential energy (P^E) is enormous, contributing to an increase in marginal return.

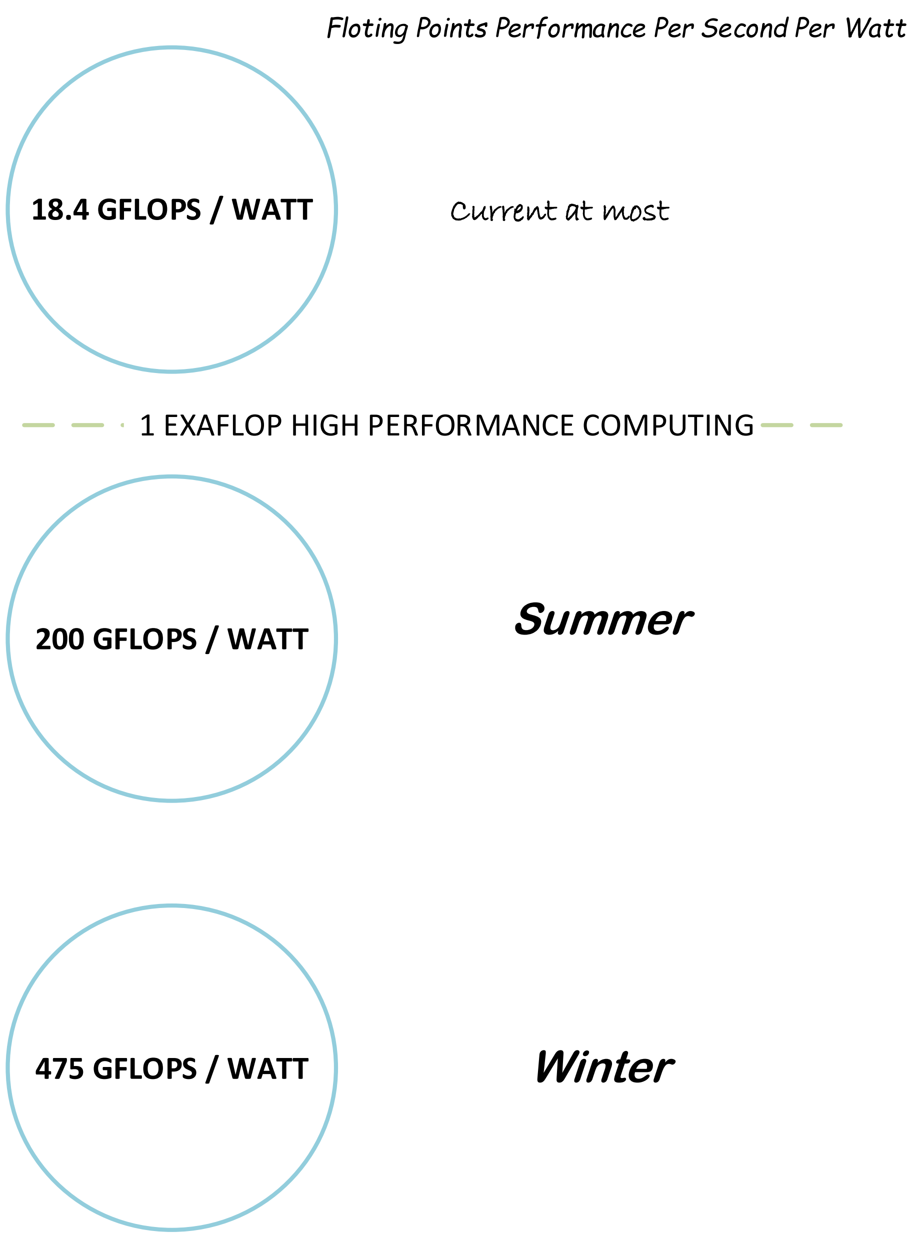


Fig. 15 FLOPs per Watt **Source:** Gravina, Matteo B.

As the facilities design grows in the number of silos per facility, the per power consumption decreases as the number of nodes per server per silo increases. Using internal and external waste heat allows for power management to take advantage of the inverse energy as well. Current floating-points of operation per unit of one watt is 18.4 billion. Unfortunately, realistically, this does not hold true around the planet. With the intellectual property portfolio, managing the thermodynamics of the art allows high rates of floating-point of operation per unit of one watt at intermittent conditions, and increases many folds at other intermittent conditions.

US Patent	Data Center	High Performance Computing	Inverse Ratio	
US 9,510,486	100 – 500 Kw	10 – 250 Kw	1.6 – 8.3 Kw	.167 – 4.2 Kw
			.400 – 2 Kw	.400 – 1 Kw
			.200 – 1 Kw	200 – 500 Kw
US 9,907,213	1 – 5 MW	1 – 20 MW	16 – 83 Kw	16 – 333 Kw
			4 – 20 Kw	4 – 80 Kw
			2 – 10 Kw	2 – 40 Kw
US 10,020,436	25 – 200 MW	100 – 1000 MW	416 – 3334 Kw	1666 – 16667 Kw
			100 – 800 Kw	50 – 400 Kw
			400 – 4000 Kw	200 – 2000 Kw

Table 1 Inverse Source: Gravina, Matteo B.

Using the inverse ratio of the 60:1, 250:1, and the 500:1 ratio, the power inverse needed to produce current power equivalents with much lower power requirements. Example given with US Patent 9,510,486, a data center with 100-500 Kw and a high-performance computing center with 10-250 Kw power requirement, would only need from a low of 200 watts to a high of 8.3 kilowatts of power, just to justify the same computational amount of work. For US Patent 9,907,213, a data center with 1-5 MW and a high-performance computing center with a power requirement of 1-20 MW would require a low of 2-333 Kw of power equivalency to produce the same amount of computation. With US Patent 10,020,436 with a current power requirement of 25-200 MW for data center, and a 100-1,000 MW for high-performance computing, would require from a low of 100 Kw for data centers to a high of 16 MW for high-performance computing equivalency.

ExaFLOPs	$\frac{60}{1}$	$\frac{250}{1}$	$\frac{500}{1}$
1	17	4	2
3	50	12	6
5	83	20	10
10	167	40	20
15	250	60	30
20	333	80	40

Table 2 exaFLOPS to Megawatts Source: Gravina, Matteo B.

By taking advantage of the power ratio in proportion to input, the exaFLOP computing market liberation to the masses becomes the norm. Reaching 1 exaFLOP at a rate of 60 floating-points of operation, a second per watt would require only 17 MW. As of 2018, no government has not reached even this low-level facility power used to reach 1 exaFLOP. OLCF-4, calculated capacity is 200 petaFLOPS at 2 megawatts less. As for the highest order of operation per power use is the equivalent of 20 exaFLOPS at a mere 40 megawatts, which at current rate would take about a decade or two.

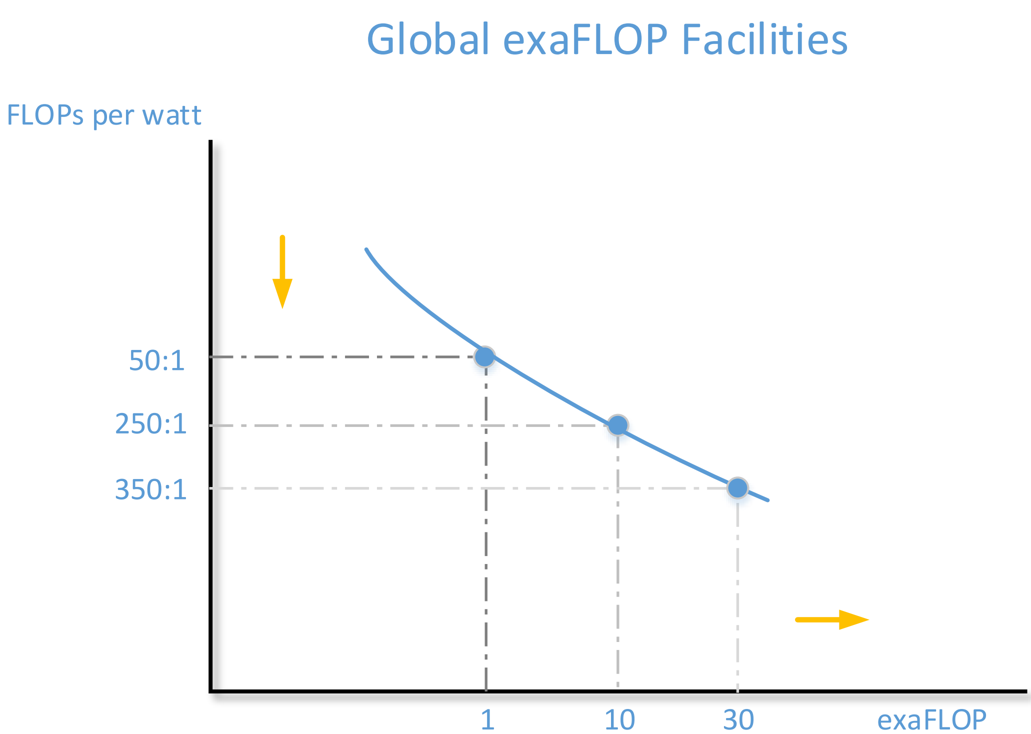


Fig. 16 Global exaFLOP facilities **Source:** Gravina, Matteo B.

The ratio of increase between the amount of power use in relation to the level of computing yields and sped up growth of Exascale computing. The proliferation allows small governments alike to use Exascale computing.

Chemistry

Sea-level air primarily made up by the following gases and humidity. Other trace gases makeup atmospheric air. By large volume Nitrogen and Oxygen make up the largest quantity, follow by Argon, then Carbon Dioxide. Other than water vapor, other trace gases exist in air. The processes behind the intellectual property portfolio use condense air, which is a good conveyance of heat energy, especially the denser the better. As expressed, by varying the quantity by volume of the gasses, facilities experts can control the movement of thermal energy at various intervals of the cyclical cycle. By varying the gasses by volume, it extracted heat from the servers at higher rates, at variable intervals, depending on computing processing, such as controlling humidity, Nitrogen, or Oxygen levels.

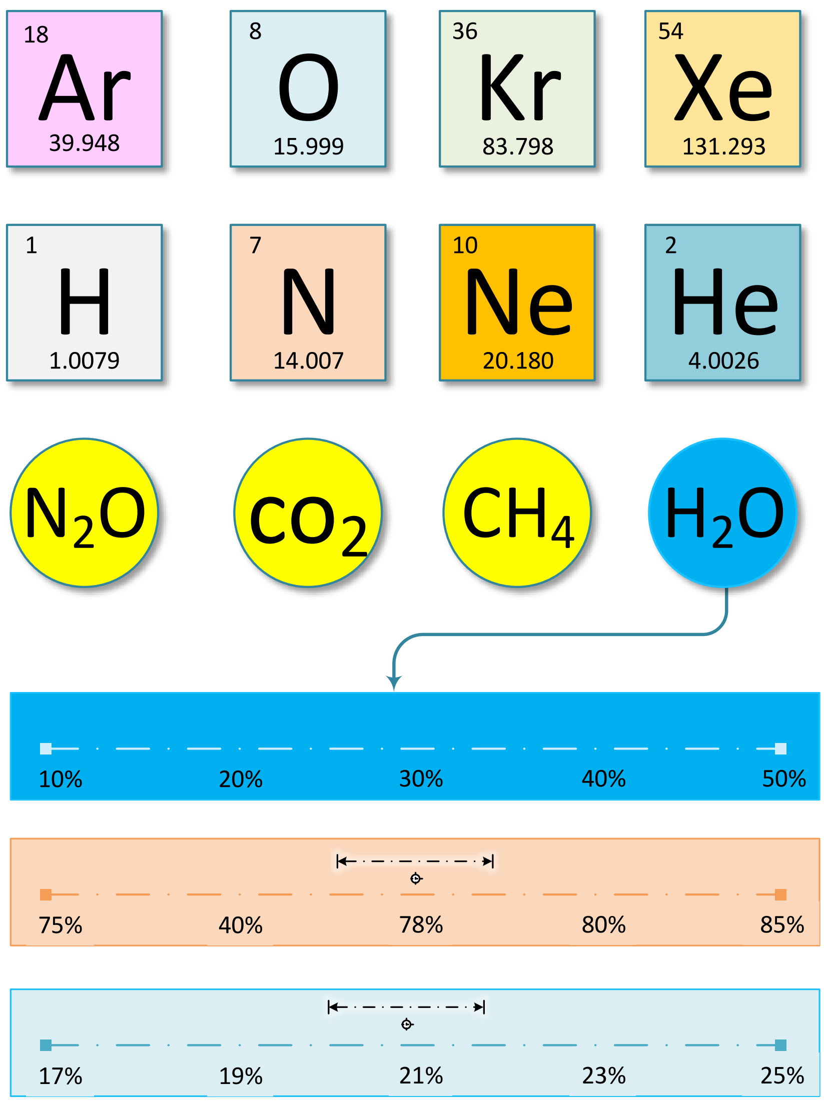
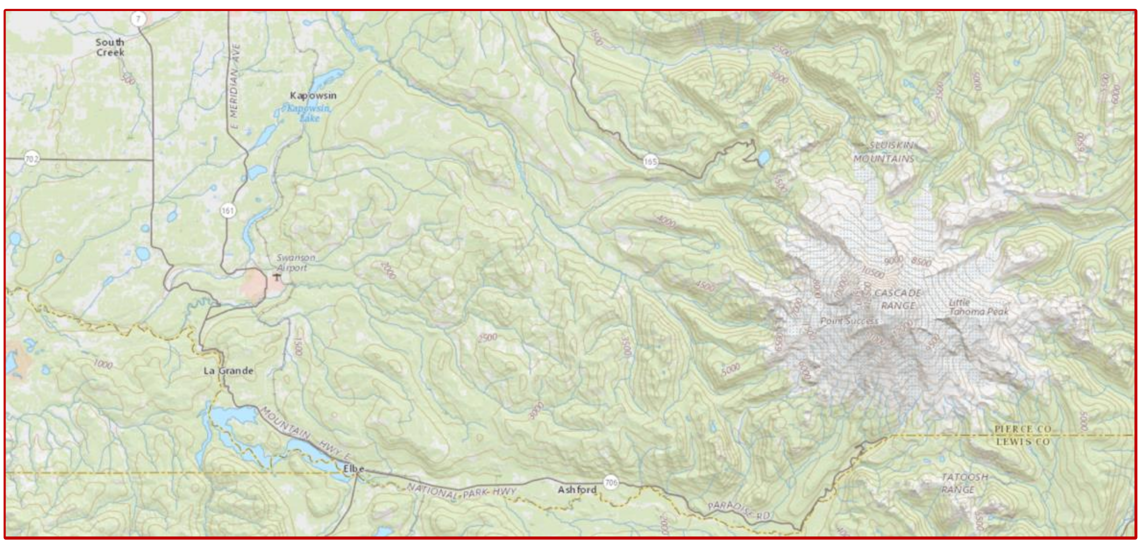


Fig. 17 Chemistry Source: Gravina, Matteo B.

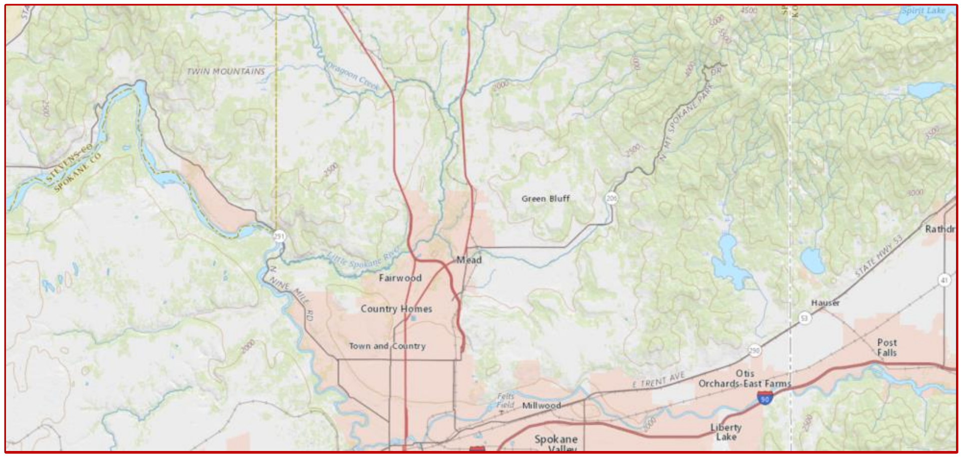
United States Regions 2

The United States has the best regions in the world for using either in combination or single invention at a time. Although the patents are usable in the American jurisdictions, the lower forty-eight states offer a favorable environment. The exception is the big island of Hawaii, because of its volcanic activity. It offers for an extreme difference in thermal normal environmental activities. They selected the following locations for several reasons, as they offer (1) location where data centers or high-performance computing are favorable, (2) the location offers thermal extremes by natural occurrence, being that the elevations surrounding computing centers are freezing, cold, compared to allocating silos. In addition, they also offer interconnectivity with local utilities. A third level of importance is the proximity to interconnectivity to global cable landing points.



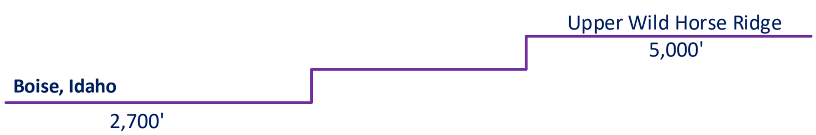
MAP 1. Tacoma, Washington Source: USGS National Map

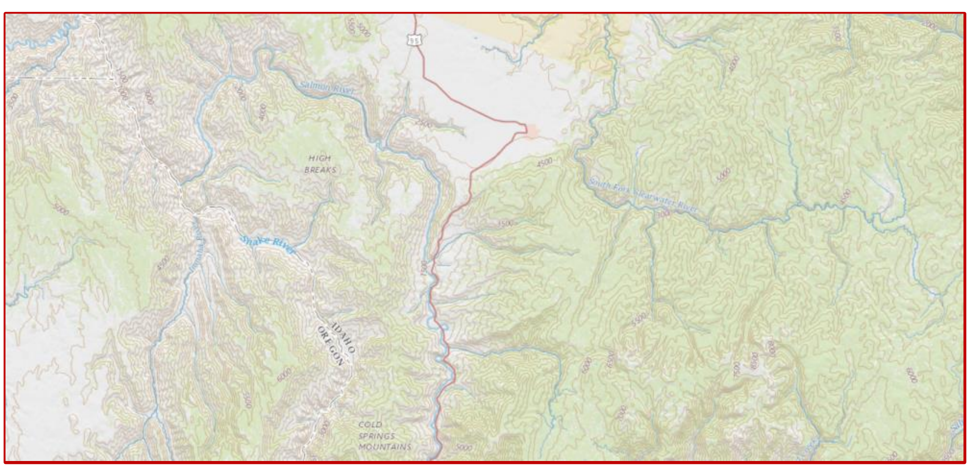
The Tacoma, Washington area has a 2,664 MW of heat value with the range of the Cascades on the Pacific Northwest. The Little Tahoma Peak is one of the highest elevations is in the area with 11, 138 ft of elevation. With elevations reaching over 10,000 ft, the area is above 10^9 BTU for the summer solstice and 100^9 for the winter solstice.



MAP 2. Spokane, Washington Source: [USGS National Map]

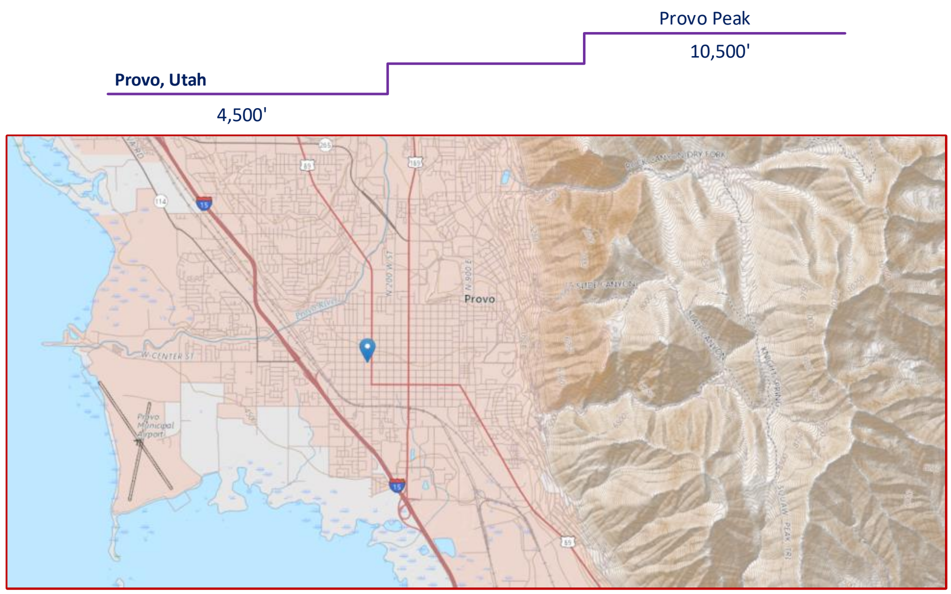
The Spokane, Washington area has an 8,000 MW of heat value with a distant variable range of only 6,000 ft. Although with a lower range than the Tacoma area, the weather, and climate is different, even though it is a few hundred miles away. With lower elevation, the area's energy value is less than 1^9 BTU for the summer solstice and 3^9 BTU for winter solstices.





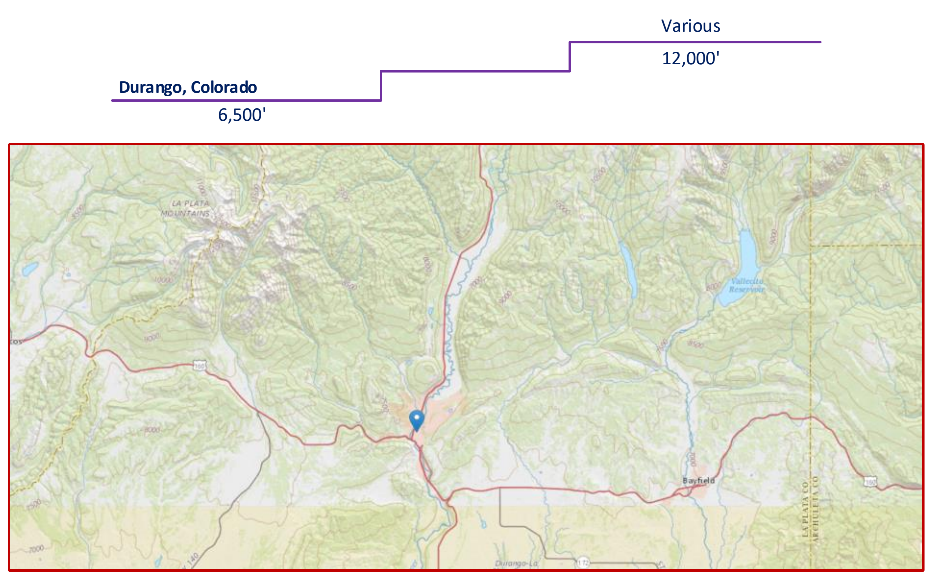
MAP 3. Boise, Idaho Source: [USGS National Map]

The Boise, Idaho has a 1,903 MW heat value area with the Upper Wild Horse Ridge with a variable range of 5,000 ft. Its energy value would reach only 1^9 BTU on average for the year, regardless of solstices.



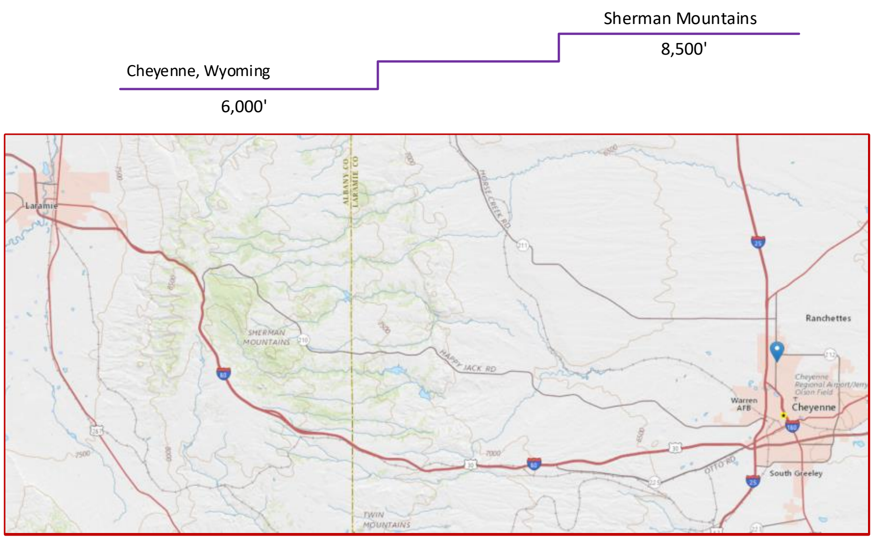
MAP 4. Provo, Utah Source: [USGS National Map]

Provo, Utah in a geographical region well populated, has a heat value of 4,000 MW. With Provo Peak at an elevation of 10,500 ft, and surrounding mountains, the unique locality has 500^9 BTU energy value. The weather and the climate are favorable for small and large scale alike for both IOT Node Center's and HPC Node Center's.



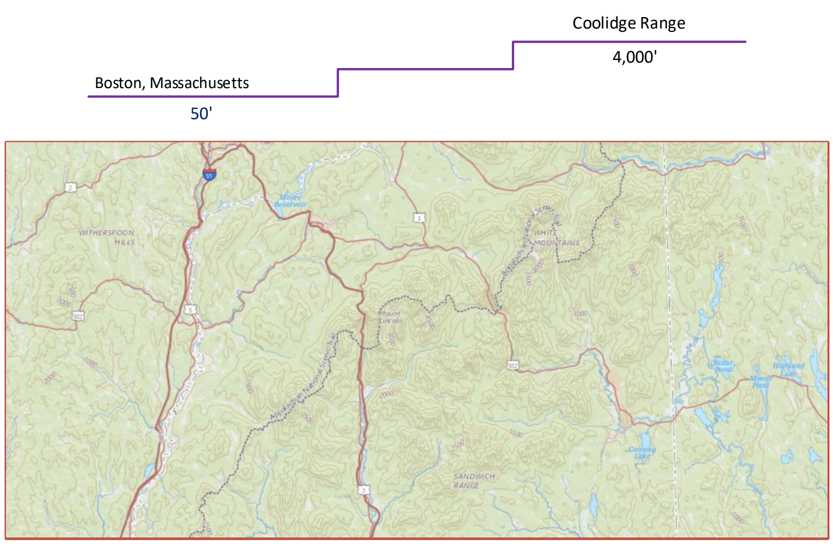
MAP 5. Durango, Colorado Source: [USGS National Map]

Durango, Colorado has a 2,235 MW area heat value with various ranges of 12,000 ft. Durango has a unique contrast between the two values, as it serves as a test bed for sequestering power from two contrasting energy values. With La Plata Mountain range in combination with lower geography allows for 500^9-$1,000^9$ BTU energy value range.



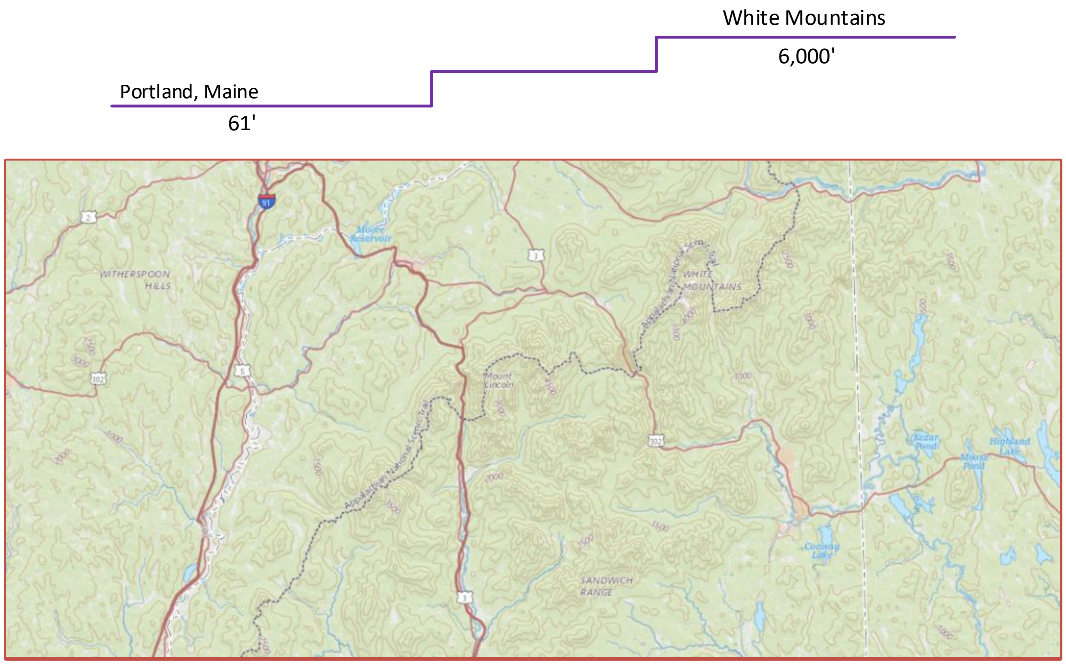
MAP 6. Cheyenne, Wyoming   Source: USGS National Map

Cheyenne Wyoming has a 2,426 of heat value for the region with an elevation of 6,000 ft, it is one of the highest elevated populated cities in the nation. The closest mountainous region is the Sherman Mountains with 8,500 ft, which ideally the weather and the climate are favorable since it has a Köppen climate BSk classification.



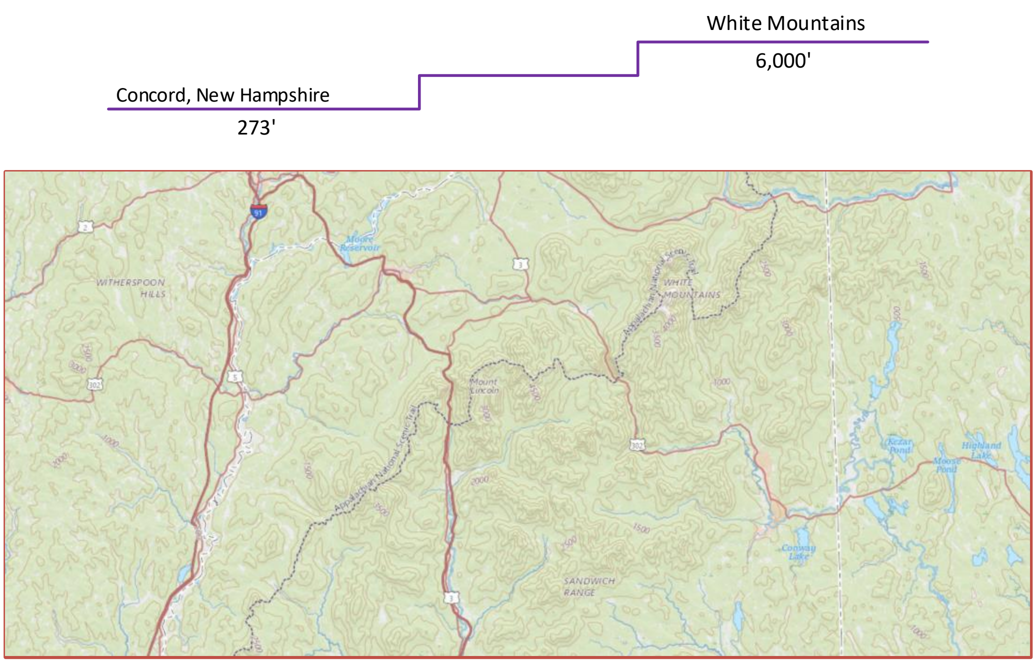
MAP 7. Boston, Massachusetts   Source: USGS National Map

Boston, Massachusetts with only a few feet above sea level, and with the Gulf Stream playing a climate role, the region might seem limited, but it has an ideal pollution and access to a distant favorable region. The combine statistical area has a heat value 8,952 MW with accessibility, beside the Coolidge Range, but also to the White Mountains region in New Hampshire. It is home to Mount Washington, which has a one of the roughest weathers on Earth. The probability of the kinetic inverse energy value could reach above 1^{12} BTU during the winter solstice mean.



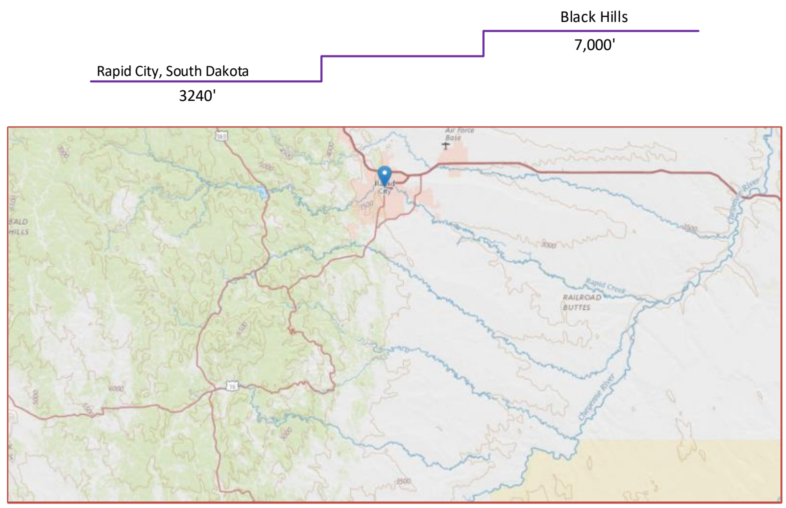
MAP 8. Portland, Maine Source: [USGS National Map]

Portland, Maine region, also shares the strategic Northeast location of the White Mountains region with Boston, although their regional heat value is less than Boston because of its smaller heat value footprint. The heat value of Portland is 996 MW.



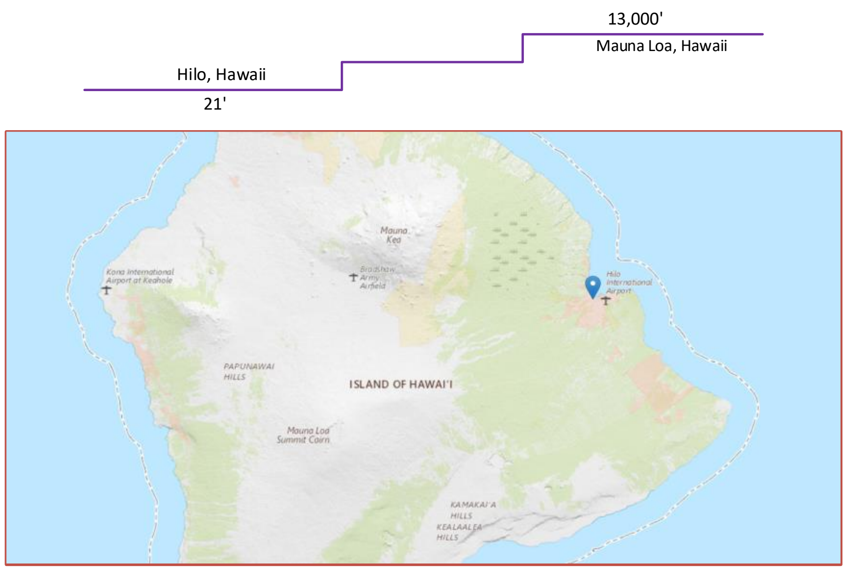
MAP 9. Concord, New Hampshire Source: [USGS National Map]

Concord, New Hampshire also shares the regional favorable conditions of high elevations. The heat value of the local is 816 MW.



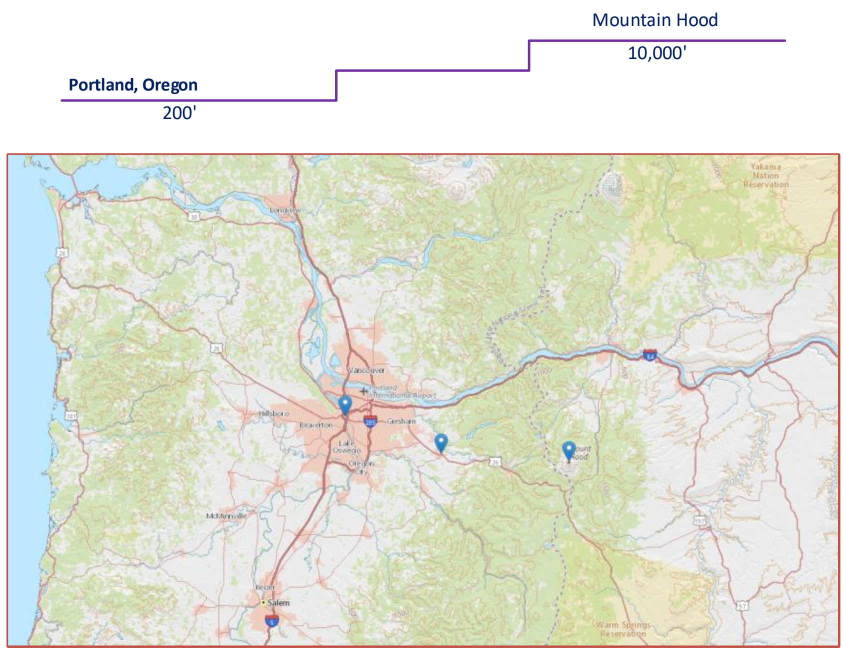
MAP 10. Rapid City, South Dakota Source: [USGS National Map]

With a high elevation, Rapid City, South Dakota has the adjacent Black Hills. The Rapid City heat value is about 77 MW footprint, making it one of the smallest in the country. With the Black Hills having an elevation around 7,000 feet, it still is a candidate location for the intellectual property portfolio.



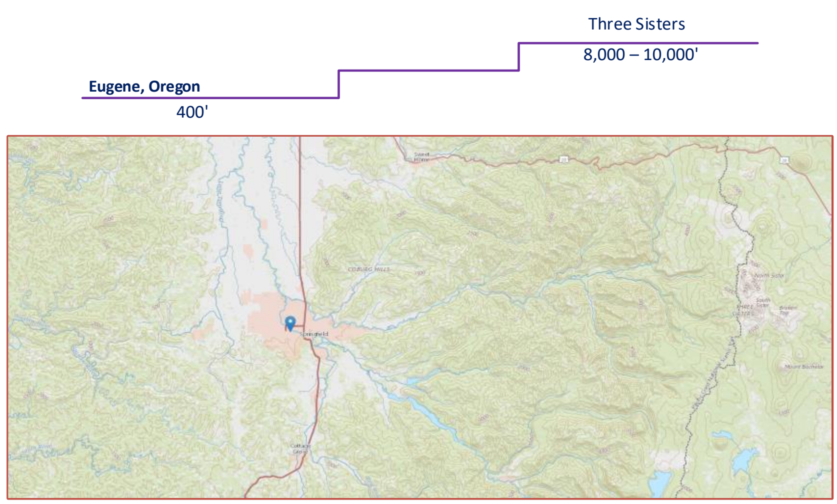
MAP 11. Hilo, Hawaii Source: [USGS National Map.]

Having a distinct category of all the locations in the group, the large Island of Hawaii, possess a unique heat value undetermined for lack of heat value measurement, but it possesses vast underdeveloped heat extraction to inverse energy power values. The volcanic conditions allow for heat energy extracted use for contrasting the very high elevation for such a remote region. With the summit of Mauna Kea having an alpine climate and the summit of Mauna Loa having one as well, they are an ideal location for submarine cable hub for IOT Node Centers and HPC Node Centers, as the region could have an energy value of 1^{12} BTU Bi-Solstice.



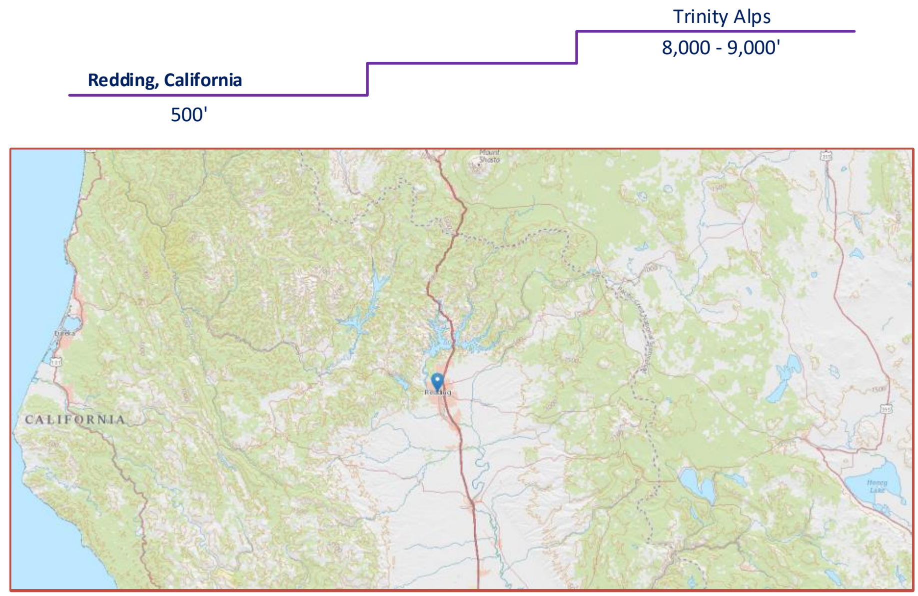
MAP 12. Portland, Oregon Source: [USGS National Map]

Portland, Oregon, resides on the Northwest corner of the Lower 48, which has several transpacific communication ports. The region also has a heat value of 7,562 MW with a proximity to the Mount Hood region, which is highly elevated. The elevation does not offer much inverse energy during the summer, but does offer strategic opportunity during the mean winter solstice. This geographic location offers an opportunity for a multiplication cable landing ports.



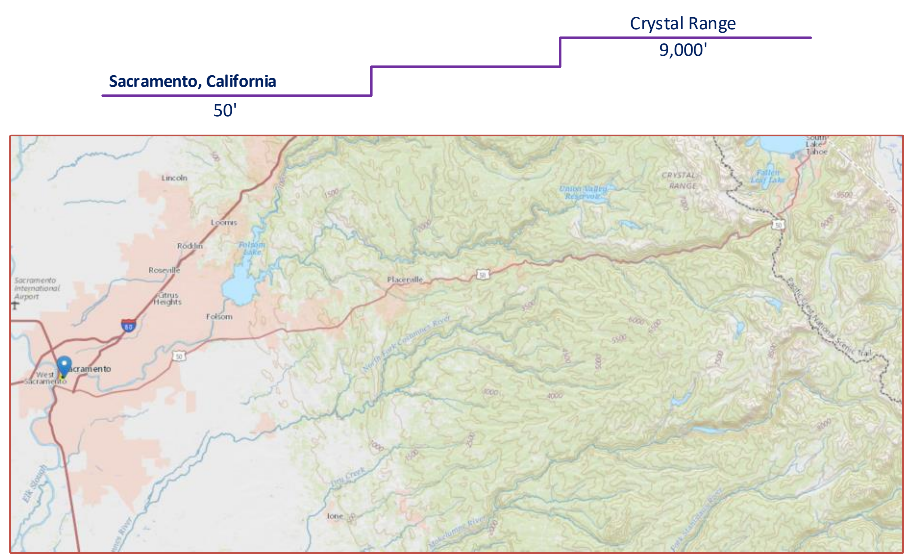
MAP 13. Eugene, Oregon Source: [USGS National Map]

With a much smaller footprint, the Eugene, Oregon region offers 611 MW of heat value, which is ten times less than its neighbor to the North, the City of Portland, Oregon. With a sizeable region, the Three Sisters region also offers mild cooling during the summer solstice but offers good inverse energy values during the winter solstice.



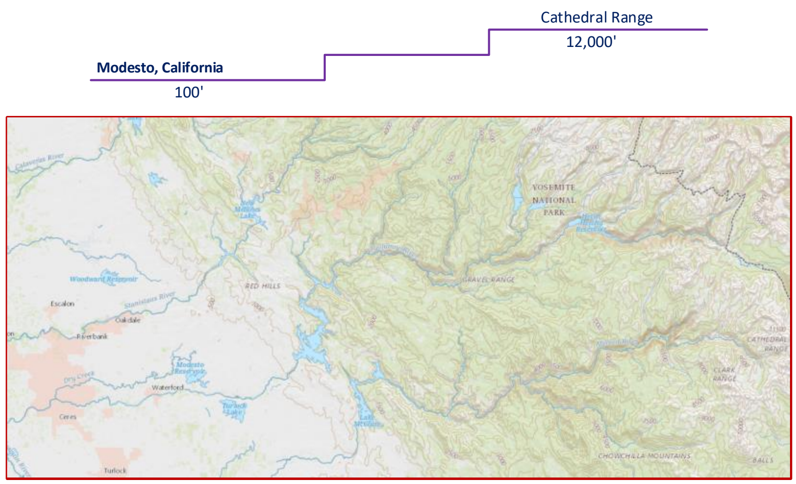
MAP 14. Redding, California Source: USGS National Map.

For a sparsely population region the Redding, California region offer considerable energy value of 3 GW. The Redding, California region, is in proximity to the Trinity Alps and at less than one hundred miles, the Pacific Coast has no cable landing points.



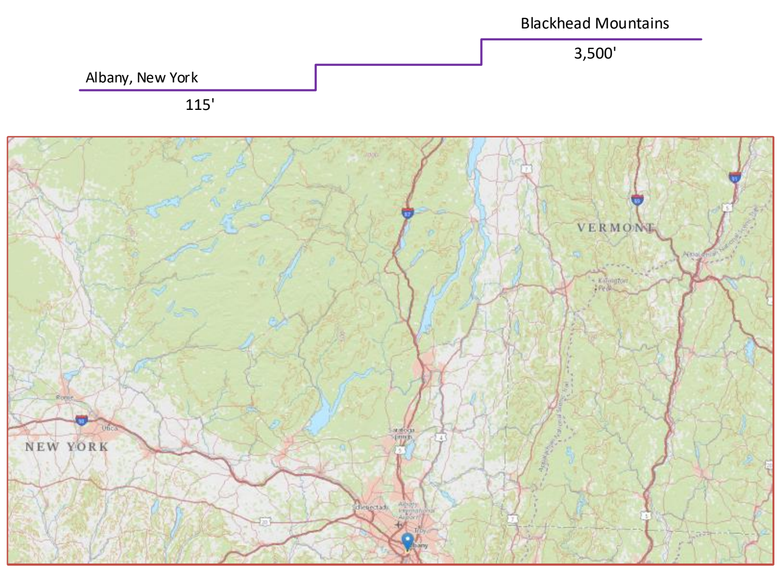
MAP 15. Sacramento, California Source: USGS National Map.

Sacramento, California is another location uniquely position as a global telecommunication port hub, with a 12.3 GW of heat value is a region lying in wait for such a strategic value. With a mean summer solstices' energy value of 800^9 BTU and a mean winter solstice energy value above 2^{12} BTU allows this location for positioning IOT Node Centers and HPC Node Centers. 35 miles distance from access to the world ocean, Sacramento, California is position for cable landing points hub.



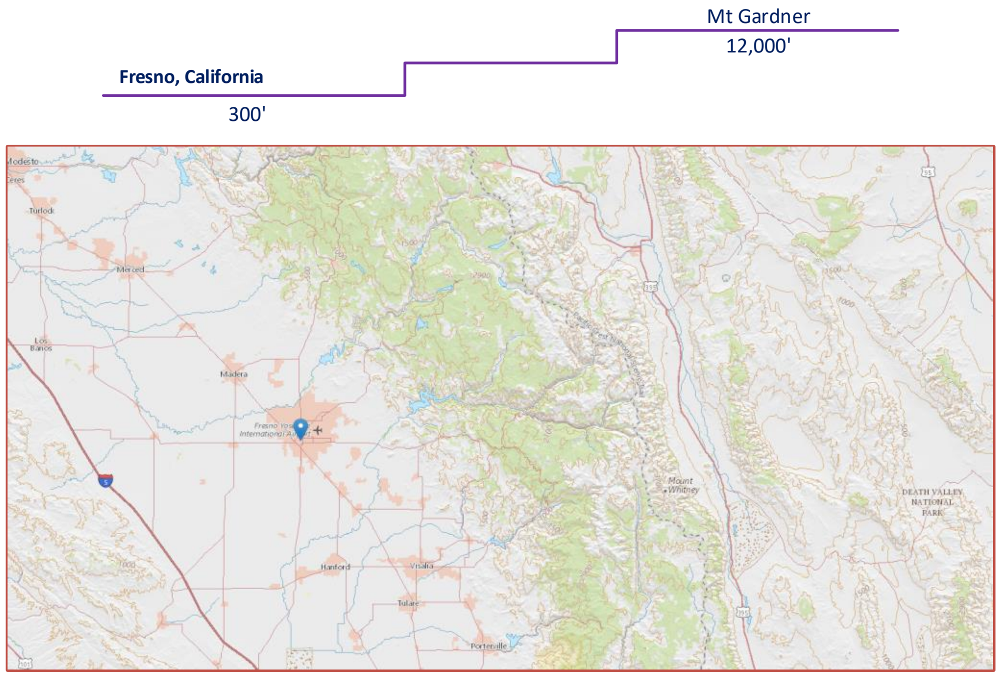
MAP 16. Modesto, California Source: USGS National Map

Modesto, California region has a heat value of 8.4 GW, which is overwhelmingly high for a modest population, although most of the heat value resides in its region. The region has an energy value of 500^6 BTU for the mean summer solstice, but well over 20^9 BTU for the mean winter solstice. At a mere 50 miles, a regional cable landing port could allow large IOT Node Centers as well as HPC Node Centers.



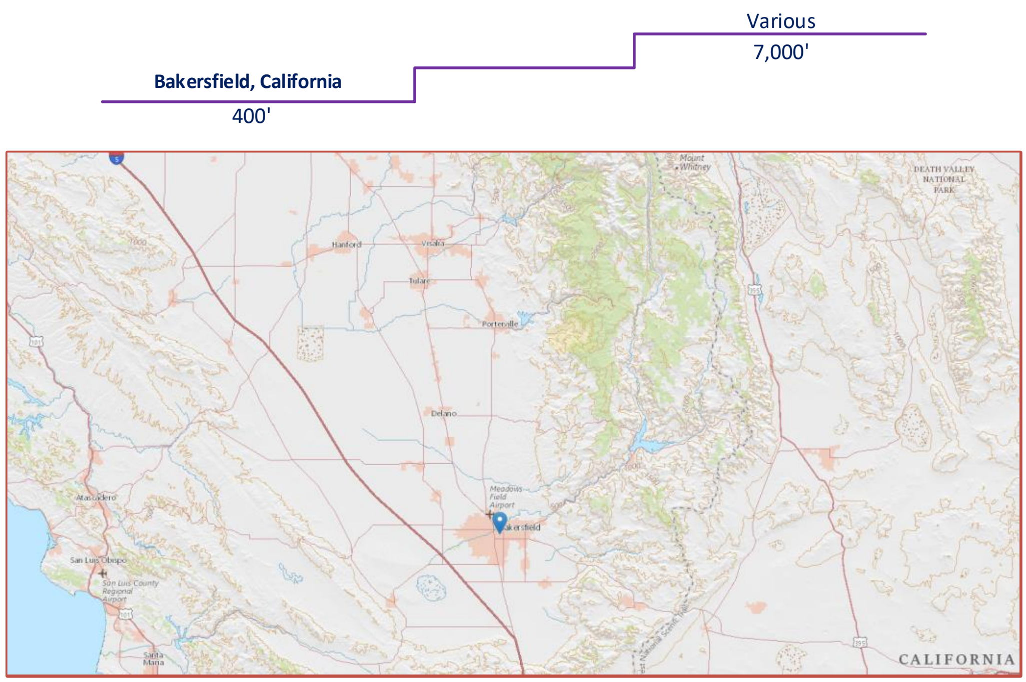
MAP 17. Albany, New York Source: USGS National Map

Albany, New York has a heat value of 3.1 GW with access to energy value of 100^6 BTU, but within 150 miles access to 2^{12} BTU, with access to cable landing points in 130 miles proximity. This location also at a higher range aggregate to 15 GW with a 6^{12} BTU multi access point. With an aggregate to 15 GW and a 6^{12} BTU multi access point, this provides an excellent major Northeastern Multi-Hub Bi-Directional Access Cable Landing Point.



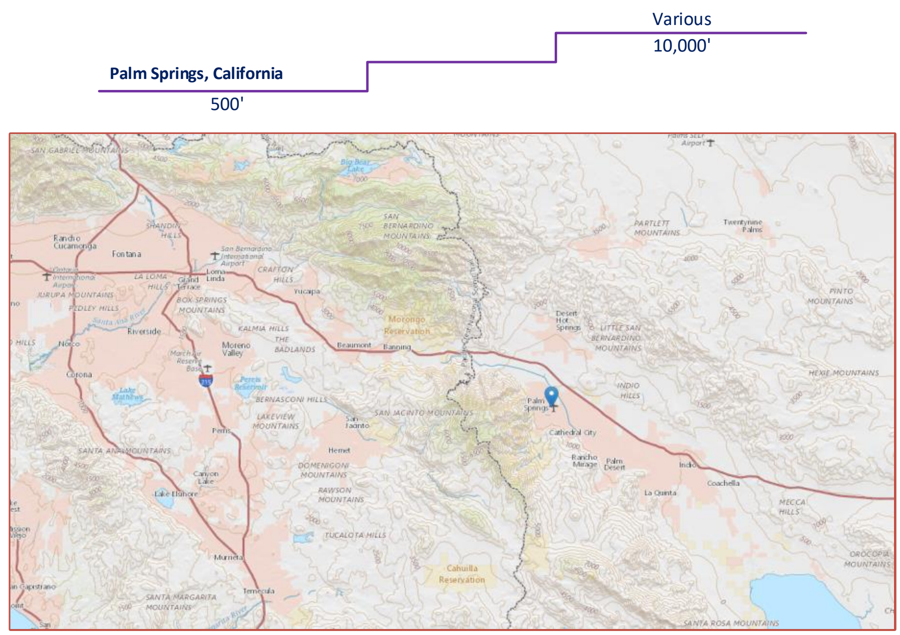
MAP 18. Fresno, California Source: USGS National Map

Fresno, California, has a heat value of 3 GW with a 500^6 BTU summer solstice and an 800^6 BTU for the winter solstice. Fresno is less than 150 miles from the nearest cable landing point.



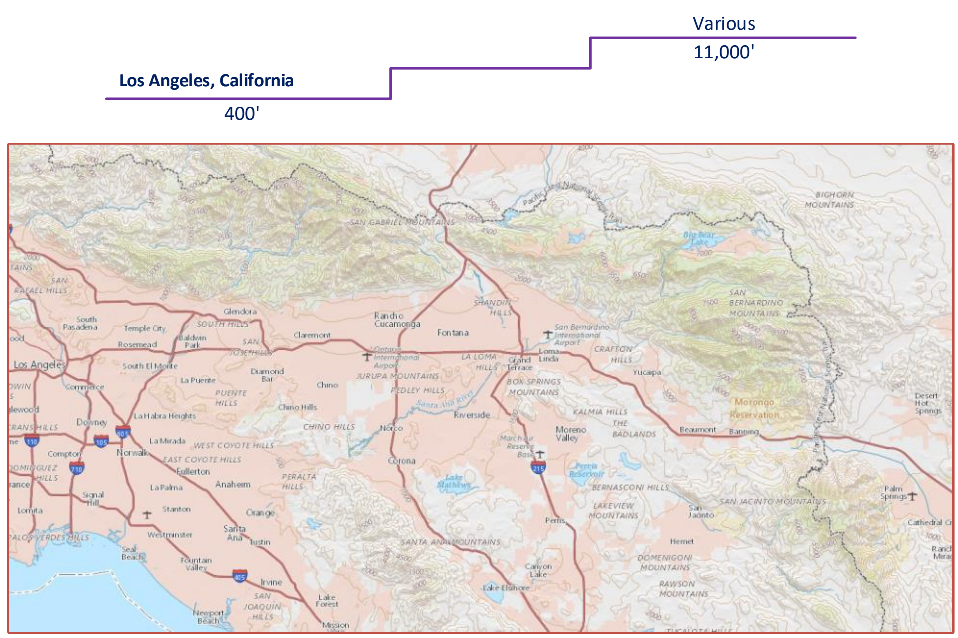
MAP 19. Bakersfield, California Source: USGS National Map.

Bakersfield, California, has a heat value of 5 GW.



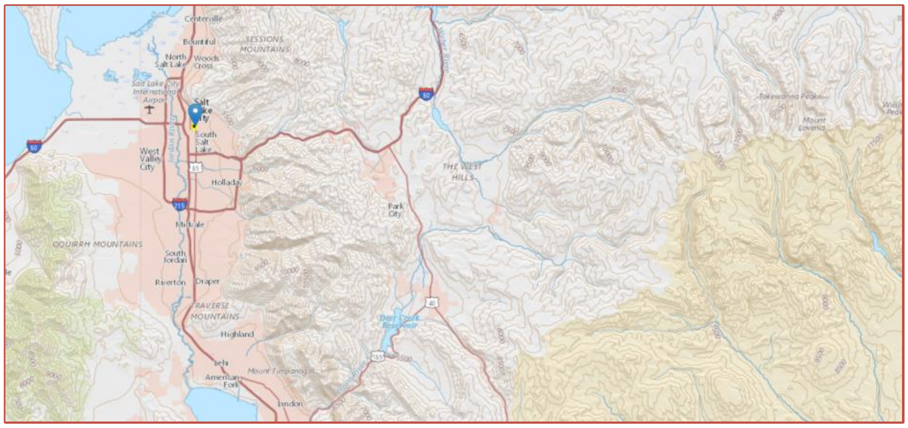
MAP 20. Palm Springs, California Source: USGS National Map

Palm Springs, California, at an elevation of 500 feet above sea level, has a heat value of 1.2 GW.



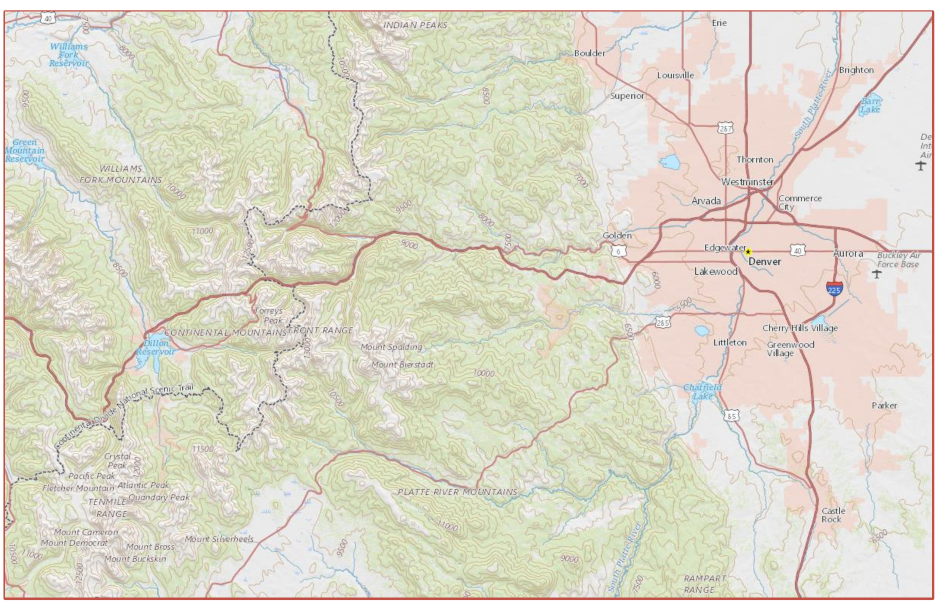
MAP 21. Los Angeles, California Source: USGS National Map

Los Angeles, California has a heat value of 12 GW with a probable energy value of 500^6 BTU during the mean summer solstice to 800^6 BTU mean winter solstices. Los Angeles, California, is a global digital transportation port as it has several cable landing points.



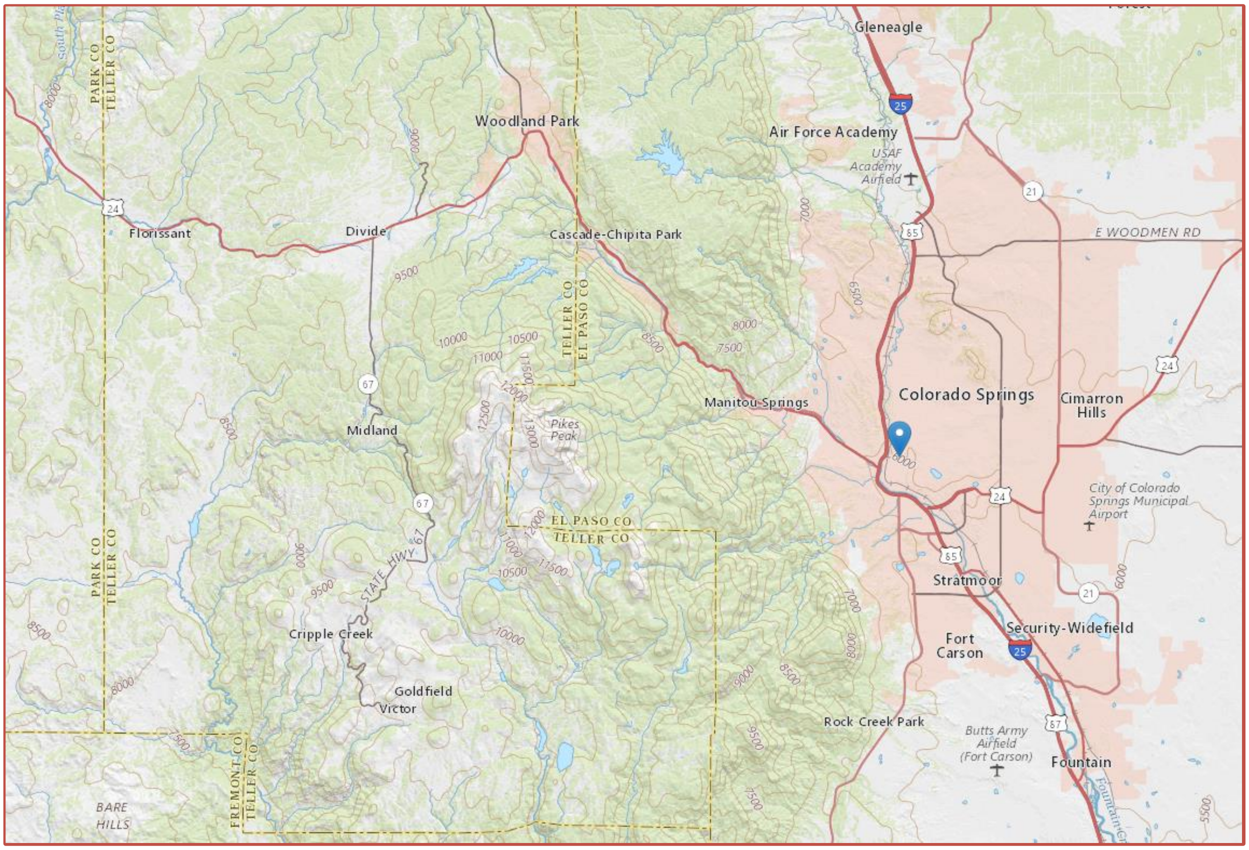
MAP 22. Salt Lake City, Utah Source: [USGS National Map]

Uniquely compatible with Denver, Colorado, Salt Lake City, Utah has also a favorable geographic location. With a sizeable population, the heat value of the region is 3 GW, with a probable 1^{12} BTU energy value.



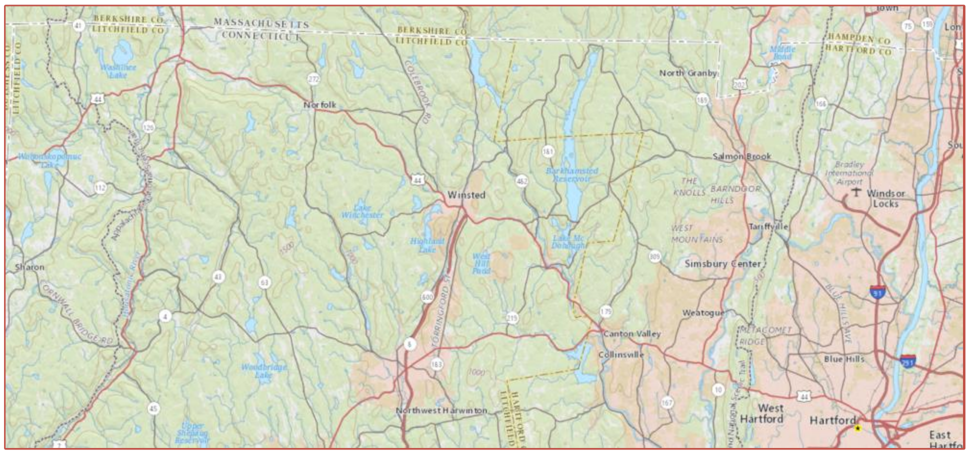
MAP 23. Denver, Colorado Source: [USGS National Map.]

The Mile-High city of Denver, Colorado is in a unique position of a large population with a heat value of 5 GW with probable an energy value of above 5^{12} BTU.



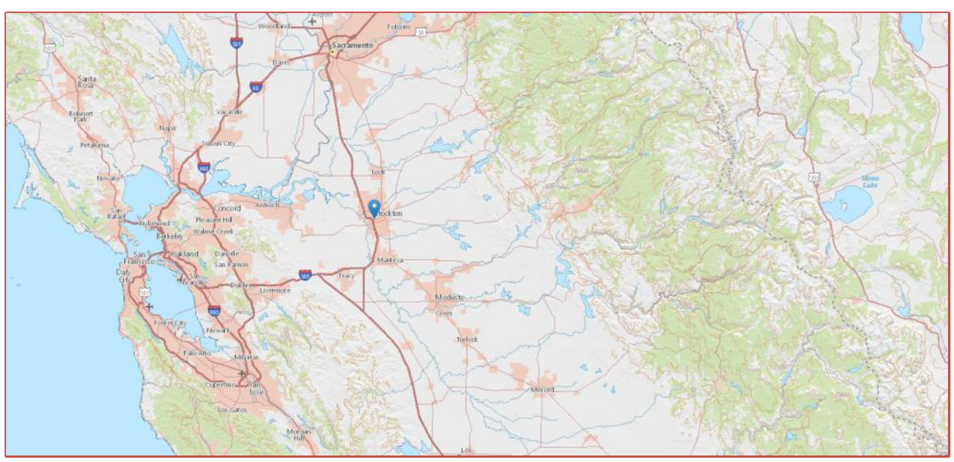
MAP 24. Colorado Springs, Colorado Source: USGS National Map.

With a lower energy footprint than its Colorado counterparts, Colorado Springs, Colorado has a heat value of 2.3 GW in combination with an energy value of 1^{12} BTU.



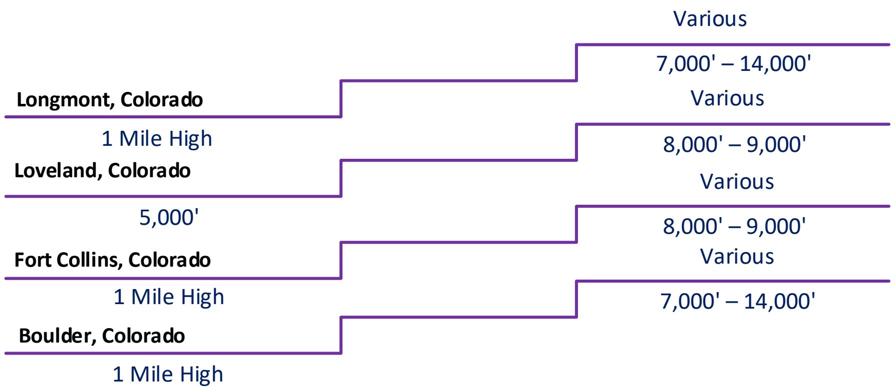
MAP 25. Hartford, Connecticut Source: [USGS National Map.](#)

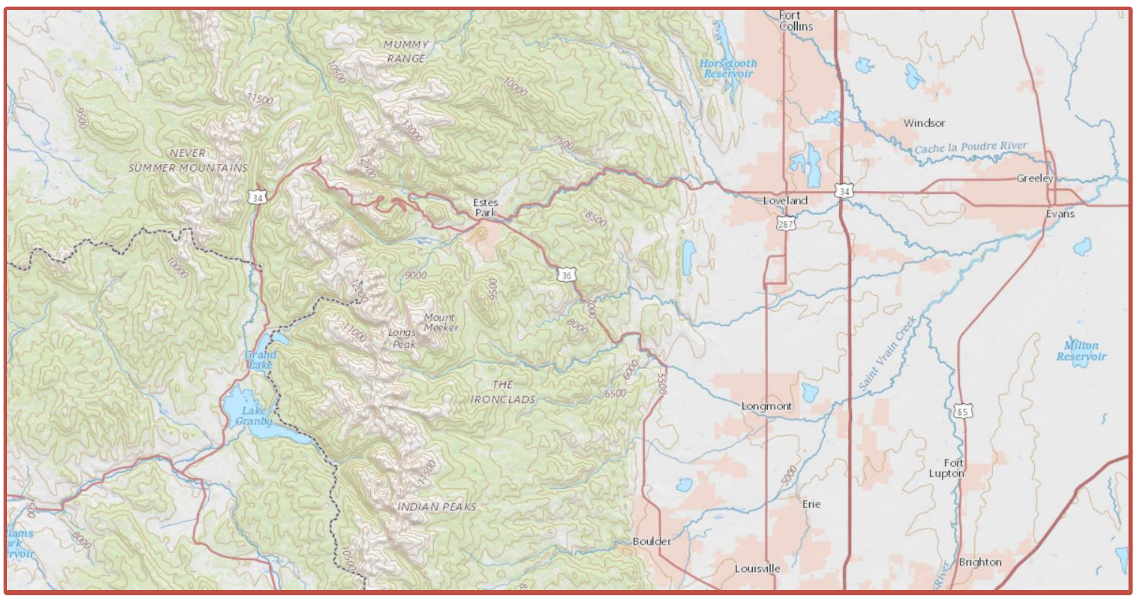
The Hartford, Connecticut area offers mild elevated temperatures during the summer solstice, with good thermal values during the winter solstice. With terrestrial interconnections with cable landing points, the value of the region increases.



MAP 26. Stockton, California Source: [USGS National Map](#)

The Stockton, California region, has an 8.9 GW of thermal energy available, with the possibility of doubling because of its geography. With large metropolitan areas, the opportunity for IOT Node Centers and HPC Node Centers with interconnectivity via the San Francisco-San Pablo Bay-Carquinez Strait-Suisun Bay to lower Southwest California cable landing points.





MAP 27. Longmont-Loveland-Fort Collins-Boulder, Colorado Source: USGS National Map.

The Longmont-Loveland-Fort Collins-Boulder, Colorado mile high region has a heat energy value of 3.5 GW. With a very high elevation, the region also has an inverse energy value higher than 5^{12} BTU. This is perhaps the highest pool of thermal energy for the nation.

Quantum Supremacy 3

General Purpose Computer

The General-Purpose Computer is the foundation for computing today. It is an amalgamation of many contributions in the past several decades. The General-Purpose Computer divided between hardware and software which forms the basis for computing. Computing starts with the circuity, which forms the core of every computing system and the logic behind it. The power that generates results is the binary code as zero's and one's, then comes the logic gates, which switched like light bulbs. Transistors, which are simply switches assign to their type: NOT, AND, OR, NOR, NAND, XOR, and XNOR. Depending on their Boolean algebraic expression, their result is given in a Truth Table. Example: a zero [0] + one [1] will give you a [1]. A Truth Table exists for each of the logic gates. Many of the logic gates working simultaneously will equal a desire for binary result. The American Standard Code for Information Interchange is a standard for electronic communications. The format that is what computers use which is the background for the letters, numbers, and characters. As with the American Standard Code for Information Interchange, the general-purpose computer will process executions in binary, these are the zeros and ones. Every time they execute, they express a voltage and carry out a minute amount of energy with each voltage. Binary 01100011 01101111 01101101 01110000 01110101 01110100 01100101 01110010 forms the word computer. When a computer executes an order, more circuity comes into play, therefore, increasing energy use as needed for carrying out many executions. Billions of these gates operate, so does related circuity, so then when a processor is running, so will other peripherals in a node (motherboard). Therefore, when placing thousands of nodes in parallel will consume enormous amounts of energy, when reaching this level, you get to the level of high-performance computing which consume power in the megawatt scale, such as the US Department of Energy, Frontier (21 megawatts).

Floating-Point of Operation

At the level of high-performance computing, three main measurements come to effect: 1) floating-points of operation, 2) power, and 3) floating-points of operation a second per watt use. At the level of the high-performance computing, floating-points of operation a second per watt use is basically a measurement of efficiency. Because so much power is consumed, efficiency matters as a measurement of economic costs. The power is the total power used by the high-performance computer, also known as a supercomputer. The floating-points of operation are measurement, analogous to speed, therefore, the higher the speed, the higher in energy consumption. Today, designers are trying to design supercomputers as efficient as possible with the minimal amount of energy consumption, therefore, floating-points of operation per second per watt. Even running Summit supercomputer for twenty-four hours a day, seven days a week for three hundred sixty-five days a year, it would achieve seventeen yotaFLOPS-year. At this rate it would take 40–60 years to find a cure, make an 85% photovoltaic cell, discover an inverse-gravitational engine with a specific impulse that speeds up a 20-ton mass to space with 1/8th effort of today's technology.

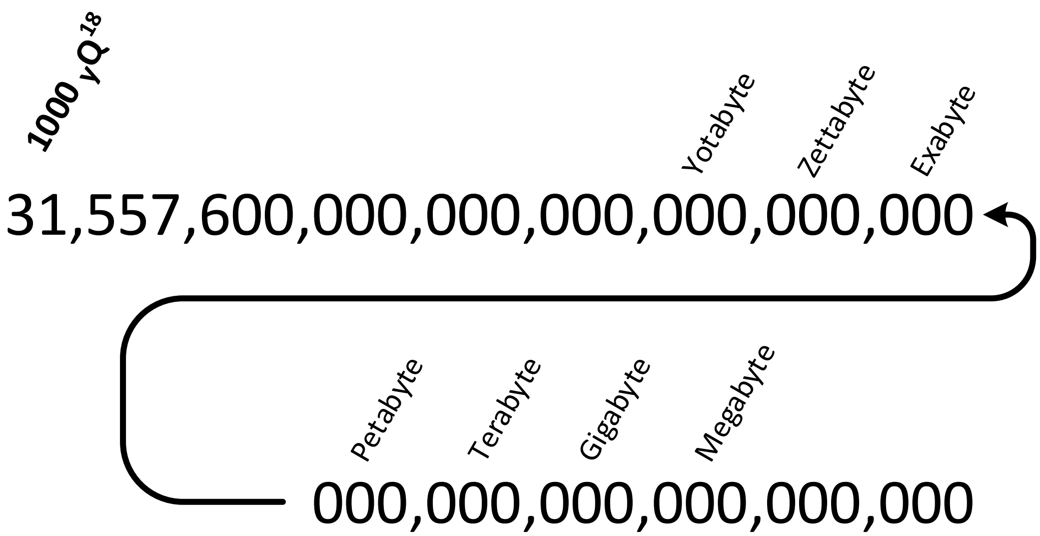


Fig. 18. 1000_yQ^{18} **Source:** Gravina, Matteo B.

When dealing with a high-performance computer or all the world's working supercomputers spewing datasets by the thousands per week, the order of numbers is very high. No longer at the global level than are we dealing with megawatt level energy consumption, but the next level is the gigawatt range in the 20th decade, and then moving to the terawatt level when 5G, IOT, EV, and SPACE markets take market domination. We therefore measured power at this market domination in the Octillion, Nonillion, perhaps to the Decillion level. These are levels measure for a full years' worth of computing power of all the high-performance computing facilities.

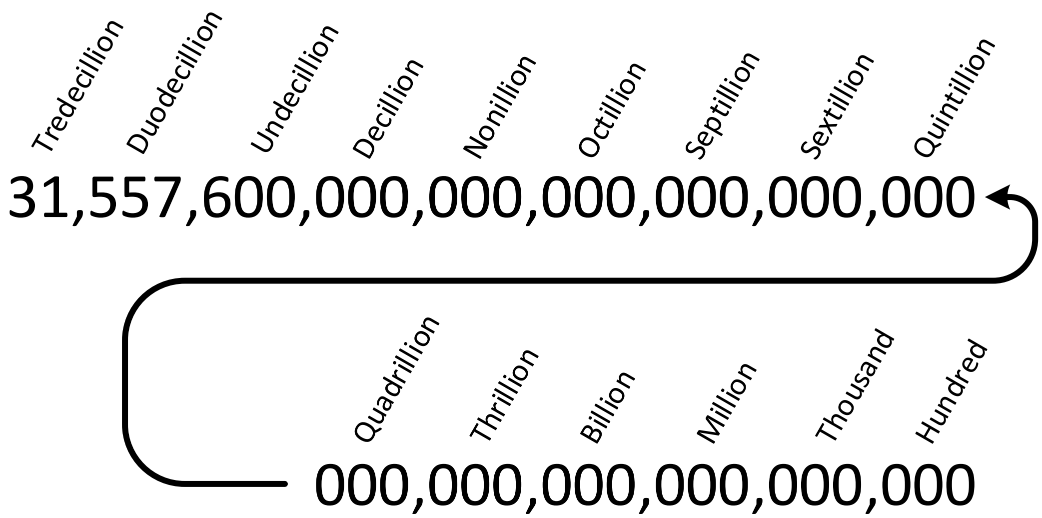


Fig. 19 Tredecillion **Source:** Gravina, Matteo B.

The intellectual portfolio in association with other technologies at the stated levels above allow for the utilization of high-performance computing at the Exascale scale spread to markets around the planet, penetrating universities, computing service markets, and providers that would not be able today because of extensive logistical costs. From a niche handful of countries penetrating the petaFLOP realm, the ExaFLOP level will comprise mid-size companies around the world providing services to the auto industry, companies providing coordination around the planet and a plethora of innovative new industries. The developing technologies will give way to the next technological step, fostering SPACE 5.0.

Table 1. $500_{y}Q^{15}$ **Source:** Gravina, Matteo B.

$500\ {}_{y}Q^{15}$ FLOP/WATT-YEAR = ${}_{y}1_{f}^{15}$	
Year 1	Process datasets for national and foreign governments
Year 2	Process datasets for scientific community
Year 3	Discover forerunner cure for AIDS
Year 4	Improve efficiencies for dwindling fossil fuel usage
Year 5	Discovery of nuclear efficiencies leading to extending resource
Year 6	Discover predecessor technologies leading toward fusion energy
Year 7	Discovery new metalloids
Year 8	Hypersonic travel

With some multiple high-performance computing facilities around the world, each with their own goals, every year will see new discoveries in their fields of research. Opportunities abound in improvements in healthcare, metallurgy, that discoveries will take years instead of decades. As the landscape changes, multi-ExaFLOP facilities will give way to even larger and profound discoveries in science, especially in Solar System technology, permitting us the opportunity to move from Industry 3.0 to Industry 4.0 to even faster to Industry 5.0. If human belief self-driven terrestrial vehicles are an inspiring phenomenon, space mobility will be only mesmerizing.

$1000\ {}_{y}Q^{18}$ FLOP/WATT-YEAR = ${}_{y}1_{f}^{18}$	
Year 1	Precursor medical cures
Year 2	First set of celestial discoveries
Year 3	Space engineering
Year 4	Global weather forecasting
Year 5	Precursor autonomous artificial intelligence
Year 6	Second set of celestial discoveries
Year 7	Discovery new materials
Year 8	Space travel

Table 2. $1000_{y}Q^{18}$ **Source:** Gravina, Matteo B.

Artificial Intelligence

Artificial Intelligence, as perceived by humans, is the moment in time where an expected sequence happens in an instant vertical alignment. We recognize intelligence in non-human beings, specifically through electronic means, due to an interaction between humans and machines. For example, when someone opens a laptop, the computer automatically starts at the last sequence the individual was using. Another example is when an electronic device attached to a heart sends a signal via Bluetooth to one's router, which sends the signal, along with data, to a medical surveillance center. The center then sends the information to the person's doctor database and another signal to the patient. In return, the medical surveillance center makes an automated call to the patient about scheduling an unexpected doctor's appointment. These sequences are programmed via software to servers connected via the internet of things. The next leap forward between basic data centers is growing IOT Node Centers. These centers are sectional with special servers and software. They can no longer handle just data but information and data used for specific routines or expected intelligent outcomes.

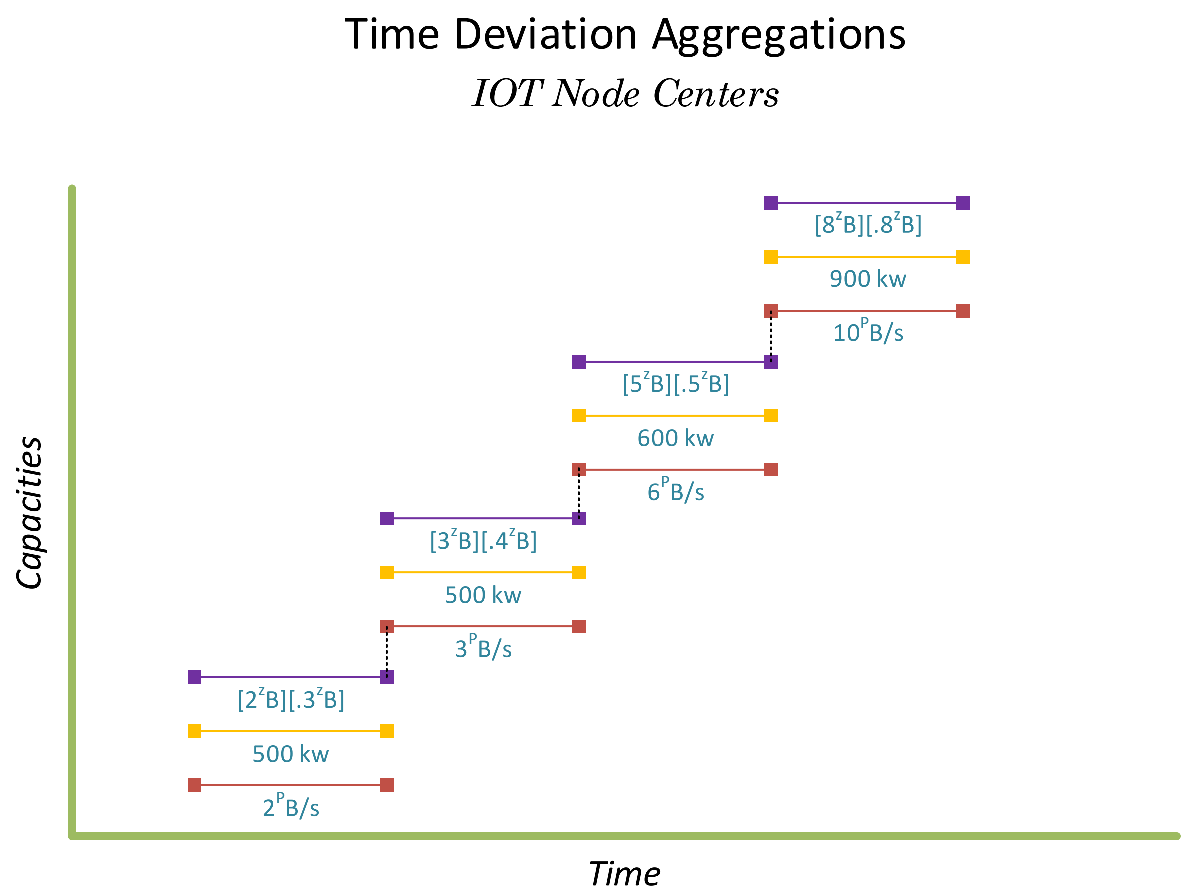


Fig. 20. IOT Node Centers **Source:** Gravina, Matteo B.

As with IOT Node Centers, High Performance Computing centers also expect an exponential growth. With the market no longer control by governments, the commercialization of exaFLOP centers allows the flow of process datasets. The HPC Node Centers deviation from IOT Not Centers is that their contribution to universities, small countries, and commerce is real time handling of massive datasets for their communities. As with the assembly line a hundred years ago, large complex datasets running multiple processes for governments, whereby hundreds of intersects occurring simultaneously will run HPC Node Centers and IOT Node Centers, an example given controlling the flow of points of entry in the United States of America of humans. The matrix will advert humans in charge of probable and imminent conditions. Such a colossal amount of sequestered and solve datasets requires interaction between the IOT Node Centers, HPC Node Centers, and the mass handling data highways.

Time Deviation Aggregations

HPC Node Centers

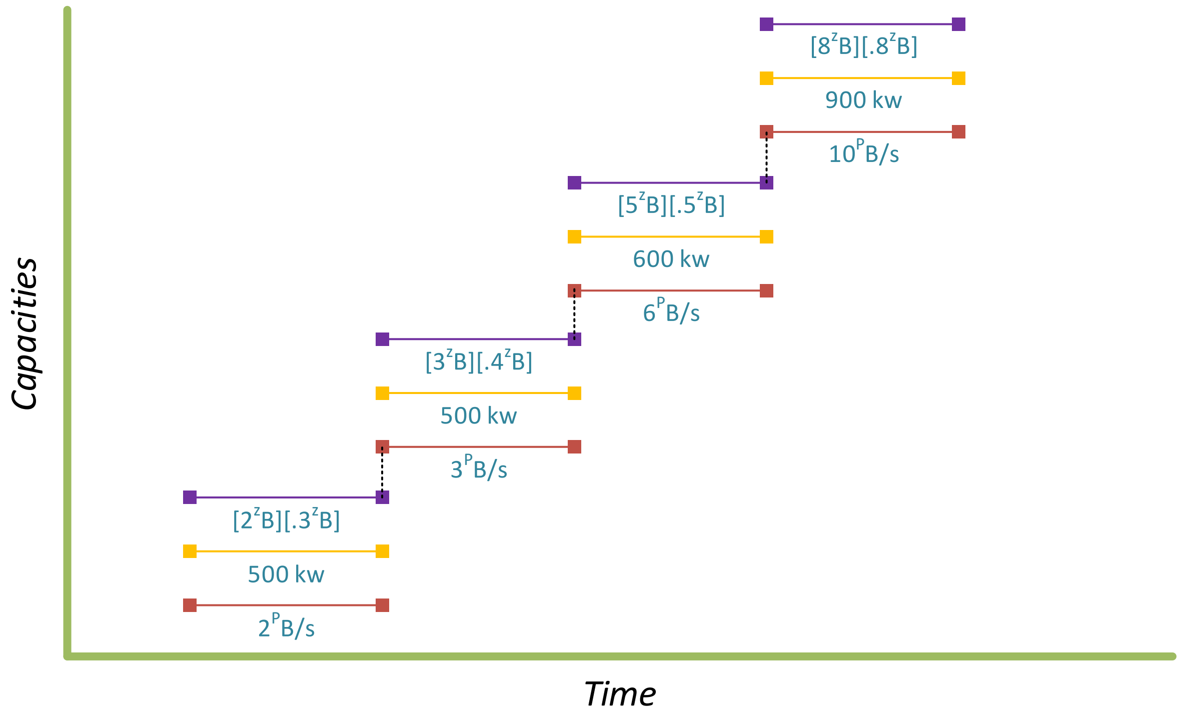


Fig. 21 HPC Node Centers Source: Gravina, Matteo B.

Therefore, as IOT Node Centers and HPC Node Centers, interact with a complexity of electronic devices, such as cellular networks, vehicle transport systems, airline, and many other intelligent systems, the need for a National IOT Node Center for Data & Information Transportation comes into play. Transportation layers moving simultaneously petabits of information back and forth is imperative to keep up with packets running over data and information transport nodes. Just as the Interstate Highway System connected the cities and states, so will the actual information highway, not meaning the internet. Together, the IOT Node Centers with the HPC Node Centers, along with a national data-information superhighway, will allow actual artificial intelligence.

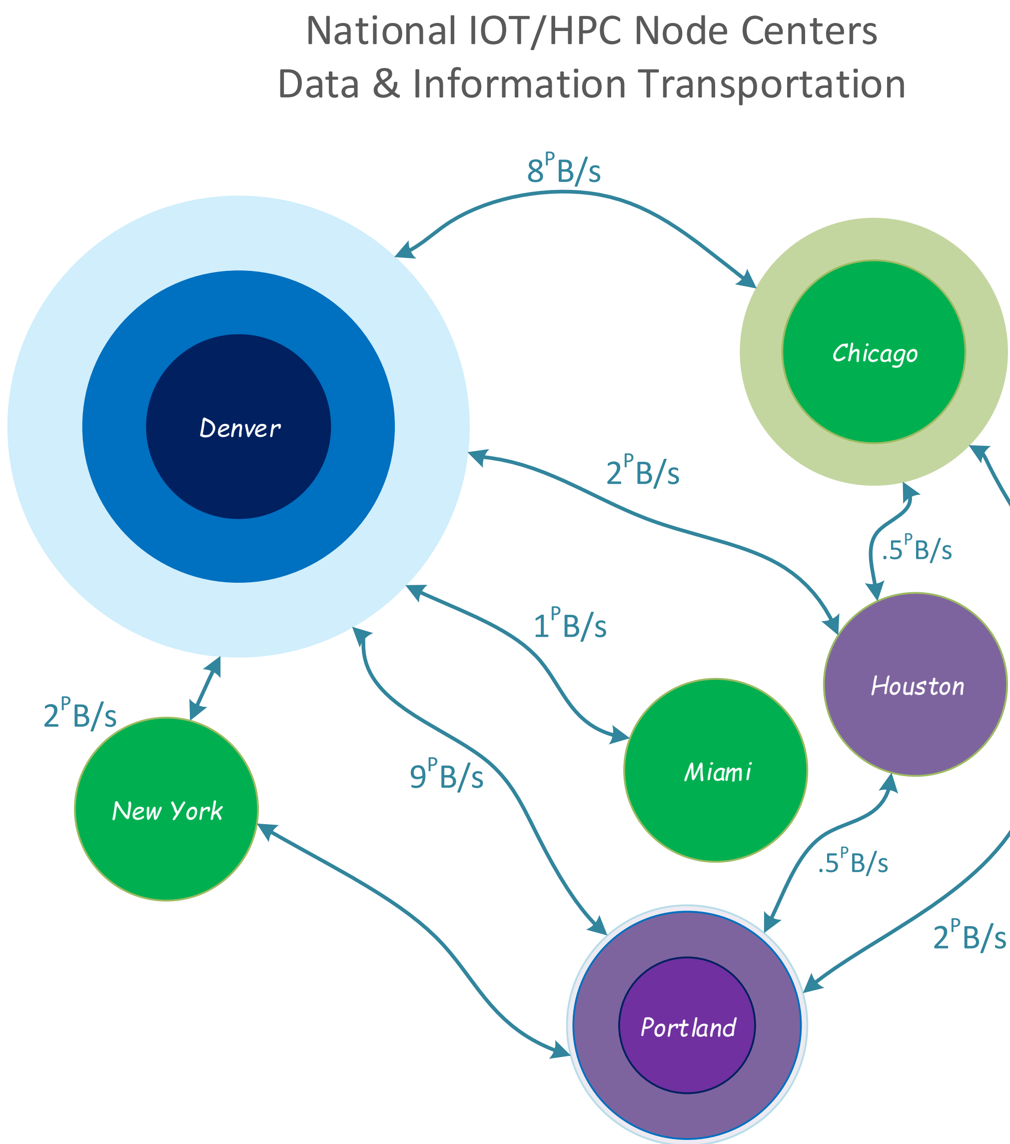


Fig. 22. **National Data & Information Transportation** **Source:** Gravina, Matteo B.

General Artificial Intelligence

The next step from Artificial Intelligence is General Artificial Intelligence. This next step is the actual cognitive interaction between electronically connected manufactured products and action taken independently of humans. This level brings about decision making by General Artificial Intelligence over humans. Everyday ongoing decisions overtaken for humans as viewing traffic at the state levels, such as surveillance of highways and roads, whereby informing humans of traffic violations, accidents, or calling on humans with accidents. In General Artificial Intelligence humans are still in the control but are not of oversight. At this level, they are advice in the event human interaction is required. Still IOT Node Centers and HPC Node Centers oversee day-to-day operations.

Artificial Super Intelligence

The next level after Artificial General Intelligence is Artificial Super Intelligence. At this level, the manufactured machine takes command and control of situations. This level is where IOT Node Centers and HPC Node Centers, in alignment with the National IOT Node / HPC Node Centers Data & Information Transportation takes precedence over conditions, interpretations, and oversight of society. This is the level where Artificial Super Intelligence allows of oversight human command & control. Example of these operations is a matrix starting, planning, and executing of terrestrial-space interphase flights without or with very limited human interference or work.

Quantum Computing

Quantum Computing is in a field of its own. Given that a field of its own, only through hybrid bridging to classical computing will quantum computing emerge before coming into its own. The challenges are still manifested at the facility level, while emerging onto everyday use out on the field is at a least of two decades away. Anyhow, quantum coherence, and software for this new platform are still in its infancy, which requires breakthroughs as time passes by.

Transition to Quantum Supremacy

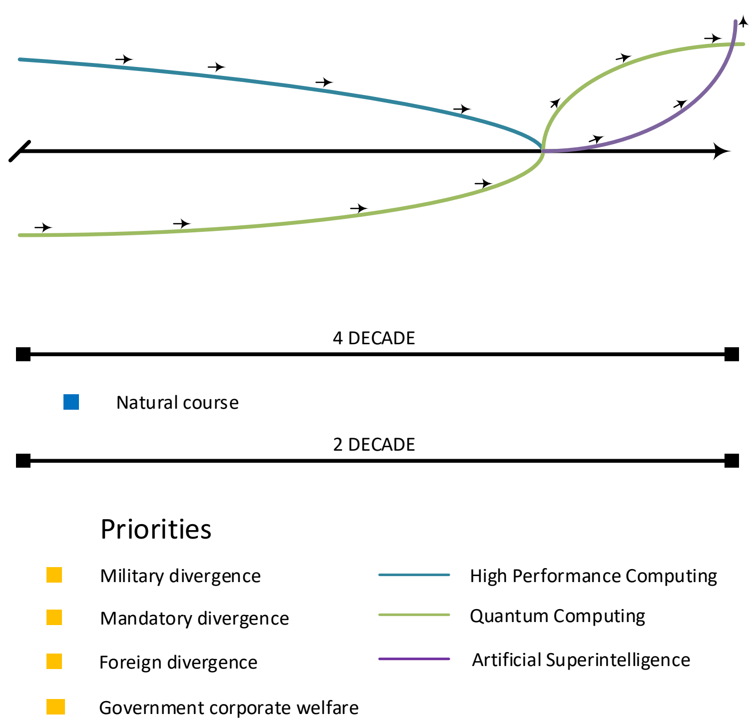


Fig. 23 Transition to Quantum Supremacy Source: Gravina, Matteo B.

Transitioning to Quantum Supremacy

Transitioning from Artificial Super Intelligence to Quantum Supremacy will take more than just controlling x^2 qubits. The transition at this level is quantum computing with classical computing to transcend onto quantum. As with every order of time, discoveries contribute to quantum computer will slowly give way in overtaking classical computing.

Singularity

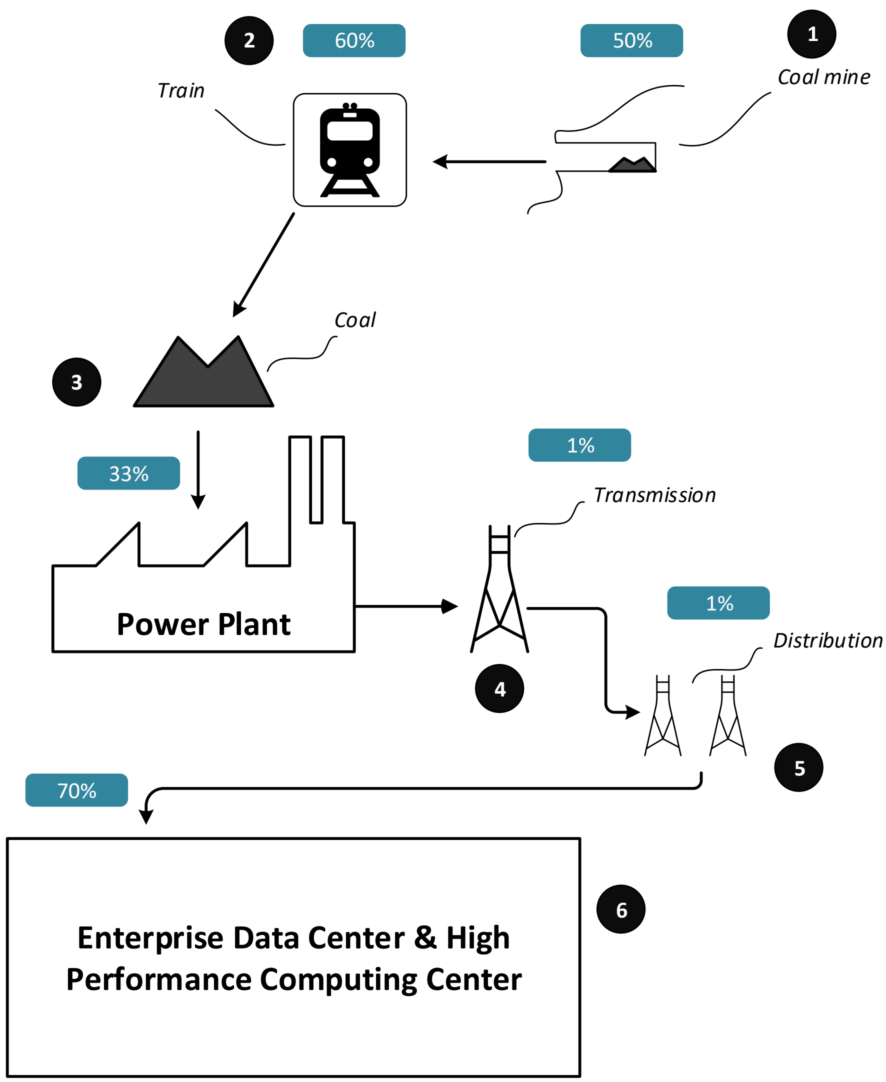
Singularity is the point in time where computing surpasses all earlier generations of computing. Singularity is the level where Artificial Autonomous Supreme Sentients supersede all levels of work by humans. The infinite point in time is also the transitioning of human supremacy of the Solar System, thus ushering evolution of the sentients with self-cognitive autonomous driven artificial acclamation: ***thought***. They are independent of IOT Node Centers and HPC Node Centers, as well as Quantum/hybrid centers.

The Methane Effect 4

Power Loss

The United States has the most reliable electric and heat grid on the planet. Having a source of power generation permits the continuance of data centers and high-performance computing centers to develop to global complementary super centers. For the most part power stations power externally most data centers. Not to mention the efficiencies within data centers. Data centers lose most of the power when it eventually reaches them. Power is lost before it reaches data centers and high-performance computing centers.

Fig. 24 Loss Source: Gravina, Matteo B.



Crossroads

Crossroads represents the point where production of greenhouse gases exceeds the earth's capacity to absorb and process them. Beginning with the industrial revolution in England and its later expansion to the United States of America production of carbon dioxide has contributed to global warming. With China inheriting the West's industrial base the accelerated growth of greenhouse gases has expanded. The European expansion into the Americas and the rest of the world has contributed to degradation of the planet through inefficient industrialization, human arrogance, and deforestation in Brazil and Indonesia. The imbalance in the Earth's respiratory system along with producing greenhouse gases is devastating our ecology as is the eradication of forests and jungles.

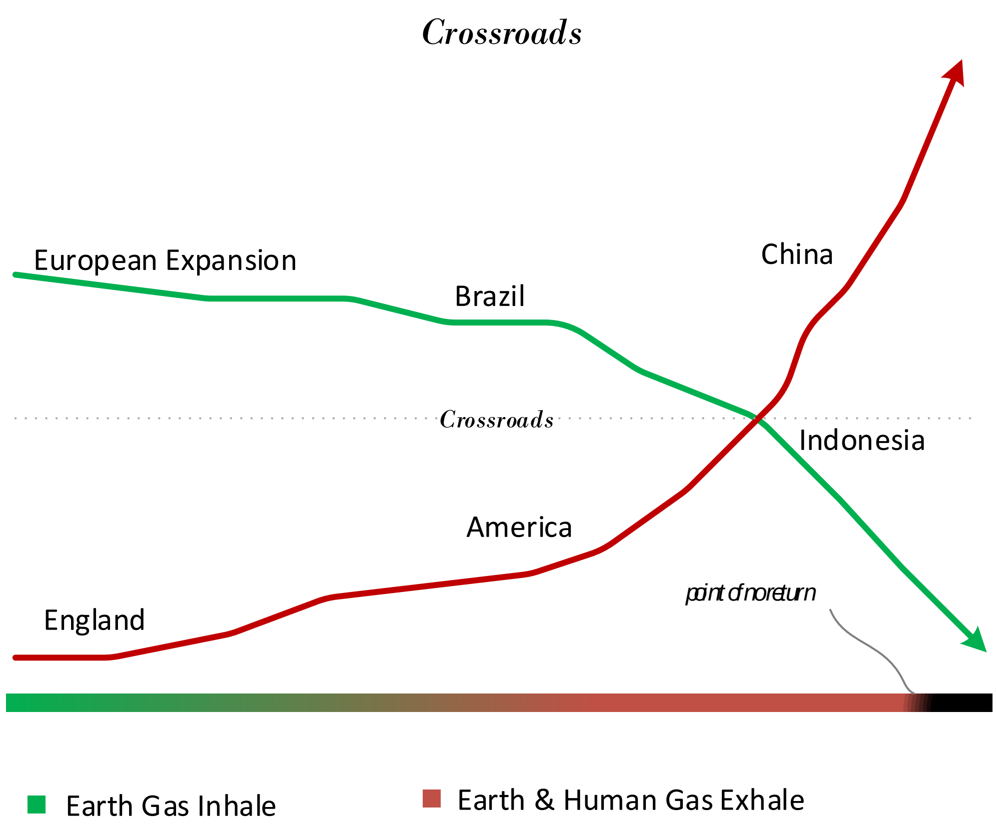


Fig. 25 Crossroads Source: Gravina, Matteo B.

North & South Pole

Our daily weather is changing in congruence to increase in climate change. Weather does change and is changing with or without human interference. Our climate, unlike weather, is changing also with or without human interaction. The consequence is that human intervention in climate is clear on our planet. All locations on the planet are experiencing and will experience a change in climate right before our eyes. Initially with the industrial revolution climate never change in a single generation. Anthropocene started when the first human spark the first flames of fire thousands of years ago. Since then, we have influenced the world around us, as we have annihilated species around the planet. Only, ever since we initiated our extractions from the ground humans have change the ecologies that make species dwindle. Ironically, the same carbon atoms that went up in the air are key to our eventual demise.

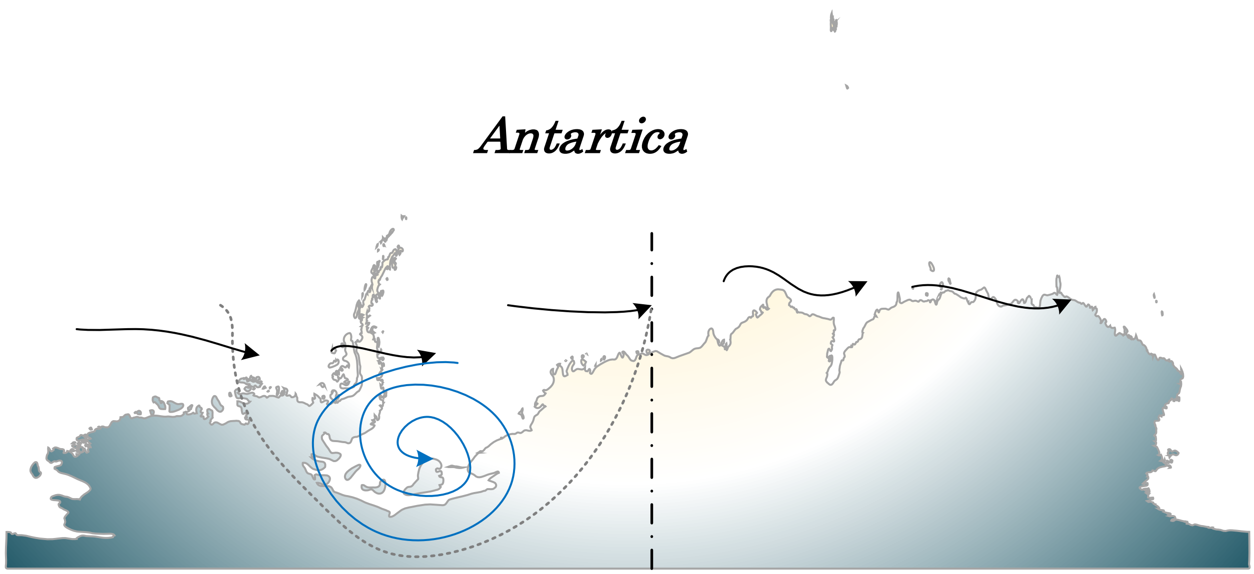


Fig. 26 Antarctica **Source:** Gravina, Matteo B.

Both in the Artic and Antarctica live frozen in time, large reserves of methane and frozen water.

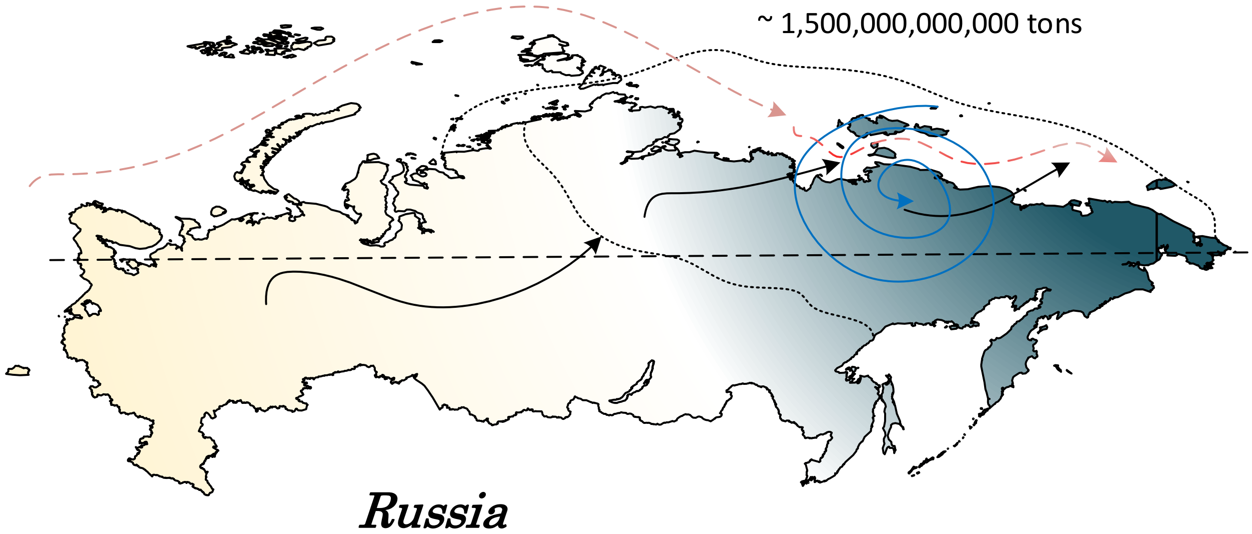


Fig. 27 Russia   **Source:** Gravina, Matteo B.

Theoretical table exemplifies on average ratio of other atoms carbon atoms per cubic meter around the world . Snap Count is the trigger that will warm enough the Laptev Sea and surrounding land mass in Russia. At the other end of the planet in Antarctica, a same event accrues, hence double single event, double binary. The double binary will trigger the release of billions of tones of methane. Therefore Carbon Dioxide, is the releaser, not the event itself. The average readings for carbon dioxide will rise therefore the positive feedback will increase above 1,000 parts per million. The tree of life will give rise to a very different world than what we may expect, as only a minimal number of species will survive the new climate. Humans will strengthen to the dominant species but will take again thousands of years to recuperate. Just like the meteor that changes life forever on Earth, the tree of life will develop with new branches. The new climate will allow new weather patterns in regions of the planet.

Snap Count

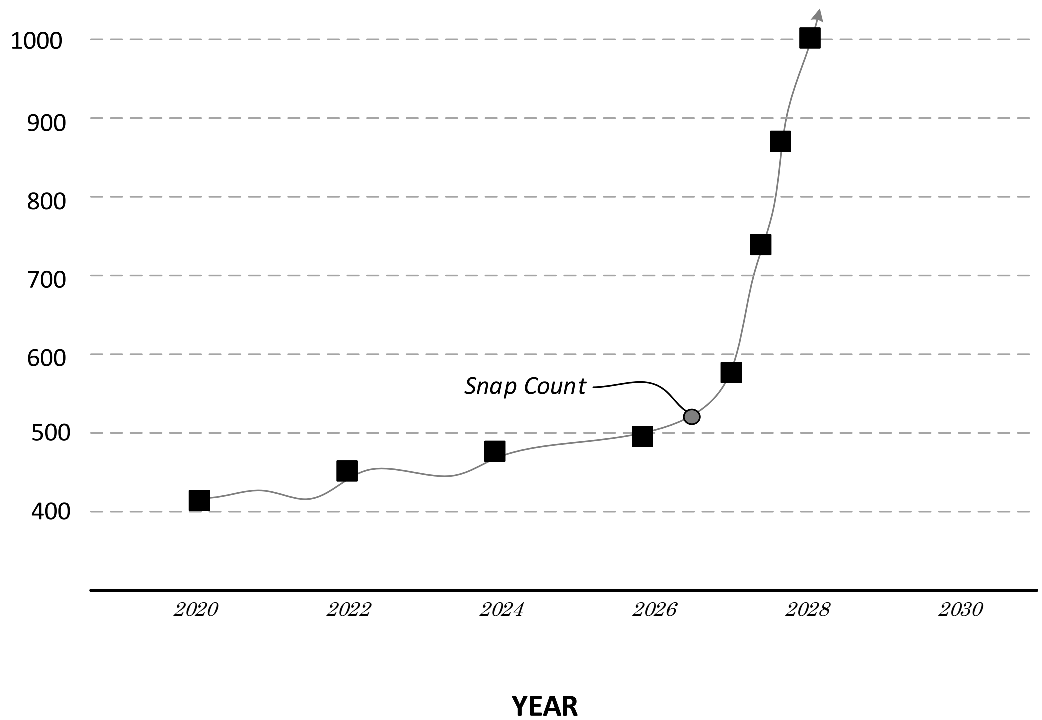


Fig. 28 Snap Count **Source:** Gravina, Matteo B.

Continuation of data centers on the world and our growing supercomputers to be business as usual will bring us closer to “Snap Count.” Those same carbon atoms that spark the industrial revolution are the same carbon atoms key to opening the doors of no return. Carbon atoms and other gases, will release methane on the upper corners of Russia, specifically the Laptev Sea.

Technical Collapse

Unfortunately, every almost beginning has an end before it starts, therefore, technical collapse comes soon after, “Snap Count.” Human arrogance as the Middle East, Asia, Western Europe, Russia, look the other way for climate change and global warming. Whether humans could use other species from evolutionary road is irrelevant, as naysayers and the studied inform societies alike experience in shocks how climate pulses weather in all environments. In between a linearity of life and time, conditions in weather slams farming and industry alike. The 26.680894, 50.819894 area temperatures soon will reach 155° Fahrenheit making it impossible to work without life support, sea surge at 30 feet via two hundred fifty miles an hour in the 40.667517, -74.048217 coordinate, or at the following coordinates 22.516782, 113.752158 starts sudden blows which speed up technical collapse.

Technological Collapse

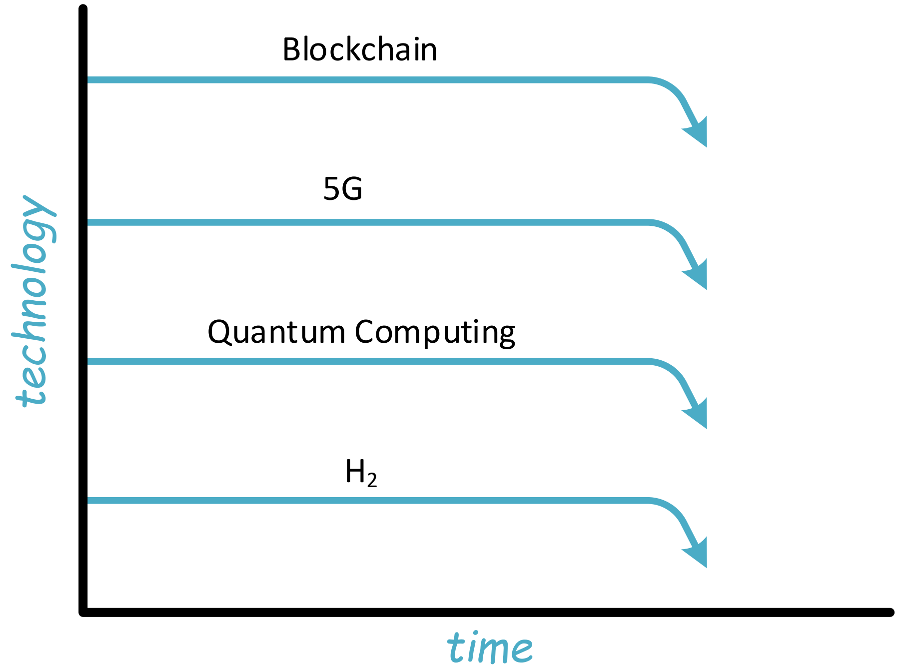


Fig. 29 Collapse Source: Gravina, Matteo B.

Social Collapse

Soon after technical collapse, social collapse follows as well. Key shock points vital for the global economy culminate with society's inability for continuance. Key indicators of complexity in some areas of the world have been declining. Roads, airports, and draining systems, to name a few, are in decline in the United States. As they exhibited shell shock jolts a key choke points of society, the inevitable is the collapse of society.

Quantum Panspermia 5

Carbon Dioxide [CO_2] Export

Symbiosis is key to defying global warming by exporting Carbon Dioxide from Earth to Mars. Carbon Dioxide is taking the kingdoms of Planet Earth into a death spiral, species, genus, and in time, the whole family is to die out. Land animals are becoming rare in several regions of the planet, on the sea growing areas of fish demographics are not even appearing. Global warming is a vanishing forest around the world. Therefore, with the single stage to orbit and deep space multi-stage becoming less expensive, it is only logical to explore the ability to export Carbon Dioxide to the Planet Mars.

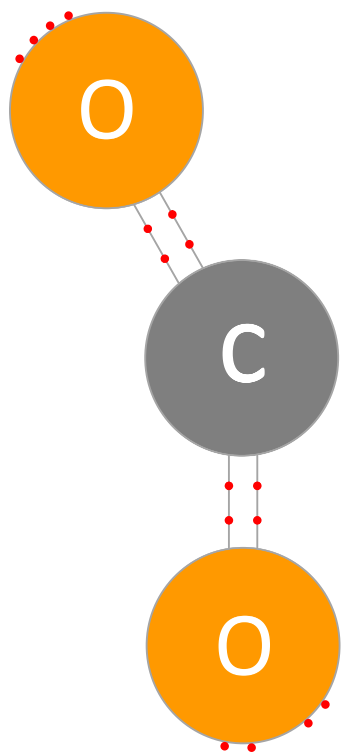


Fig. 30 Carbon Dioxide **Source:** Gravina, Matteo B.

Methane [CH_4] Export

Methane, as with Carbon Dioxide is in abundance on frozen areas of the North Pole and the South Pole. An estimated area of Russia may have around 1,500 gigatons of Methane. The vast amounts of methane bring about another opportunity for exporting it to Mars. With an energy return on energy invested of 25,000:1 in extraction to deliver, it makes perfect sense to use our abundance for an opportunity to terraform our closest planet in the solar system.

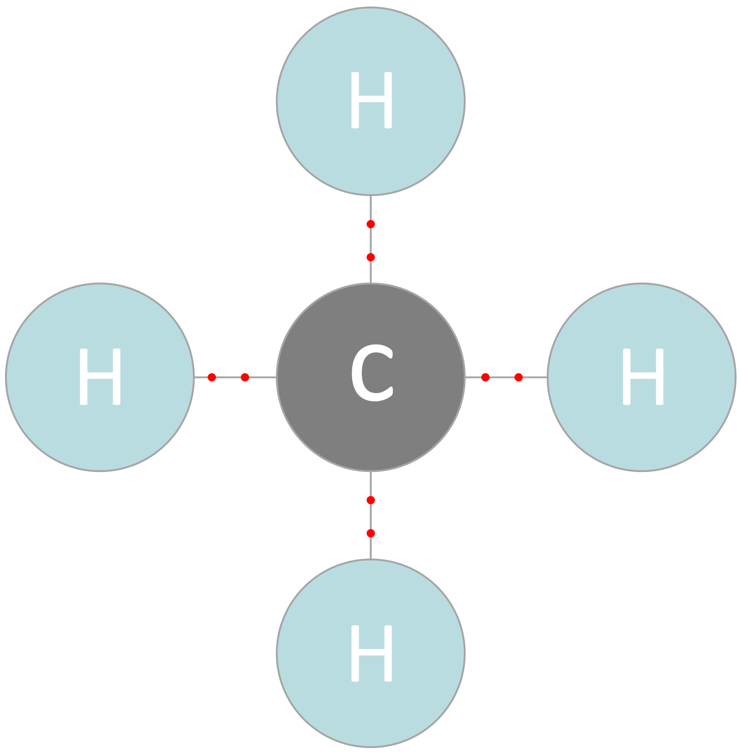


Fig. 31 Methane **Source:** Gravina, Matteo B.

Terraforming

The terraforming of the planet Mars via the importation of methane and carbon dioxide opens up markets, expanding our space economy. At the current global production rate of 10 gigatons of carbon dioxide, the value of carbon dioxide would be $20 per ton, which equals $200 billion. If the rate increases to 25 gigatons, the value of carbon dioxide rises to $45 per ton, the value would be $1.125 trillion. Methane rated at $45 per ton, and with a captive production of 50 gigatons per decade, the value of methane delivered at $55 per ton is $2.8 trillion. Nations with large manufacturing operations and corporations, such as China, Russia, and the United States, have yet to benefit from the profits of carbon capture and methane sequestration, providing a secure investment opportunity.

Single-Stage-to-Orbit

Single-Stage-to-Orbit fairing is launching a space vehicle without multi-stage help and return to Earth from space. Single-State-to-Orbit missions aim is to deliver or extract a payload under geosynchronous orbit. Ever since the first space fairing missions, humans would pick up the rockets after they fall back to Earth. Fuel and intense labor make Single-Stage-to-Orbit an expensive manual task. Therefore, with automated technology, and the decline in fuel cost per payload mission completion proliferates. Single-Stage-to-Orbit allows for a reduction in human involvement. What it would take per se twenty-five thousand humans per mission completion, with Artificial Intelligence, culminating with General Artificial Intelligence, humans to mission ratio declines to few hundred. With none-human help, Single-Stage-to-Orbit market proliferates.

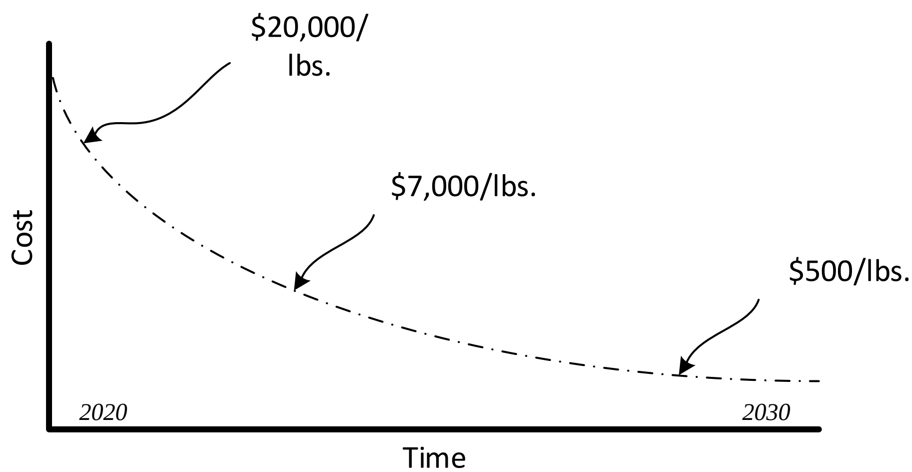


Fig. 32 Single-Stage-to-Orbit **Source:** Gravina, Matteo B.

Multi-Stage to Launch-Mission

In Multi-stage launch, the mission completes from planning to closing, including the fairing of payloads to geosynchronous orbit and beyond. The distance from a single point on Earth to geosynchronous orbit is close to 23,000 miles above the Earth. Therefore, the complexities involved in reaching this distance are far greater than those of under geosynchronous orbit. With the help of General Artificial Intelligence along with reduced fuel costs, automated multi-stage launch missions will cause lower overall costs. This will also lead to a decline in the number of humans involved, while space-related occupations will proliferate in correlation with Single Stage to Launch-Missions.

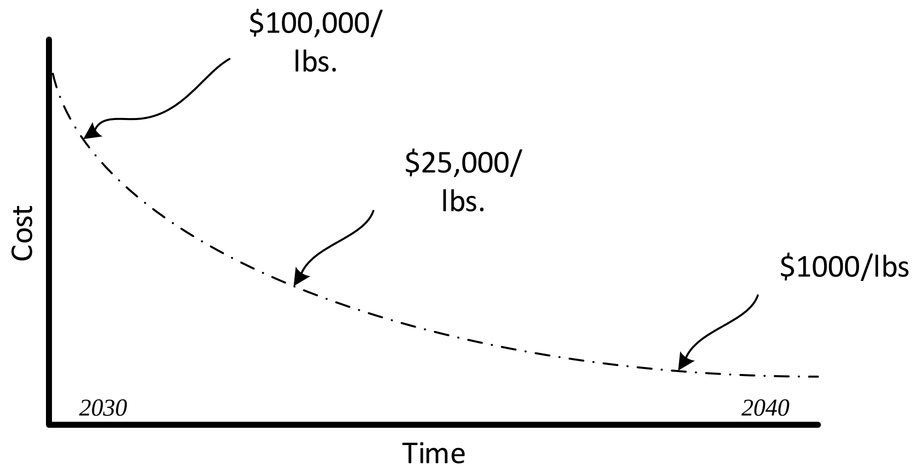


Fig. 33 Costs **Source:** Gravina, Matteo B.

The level of complexity transcends time, with classical computing leading to hybrid classical-quantum systems leading the way from a unidirectional planetary to interplanetary missions.

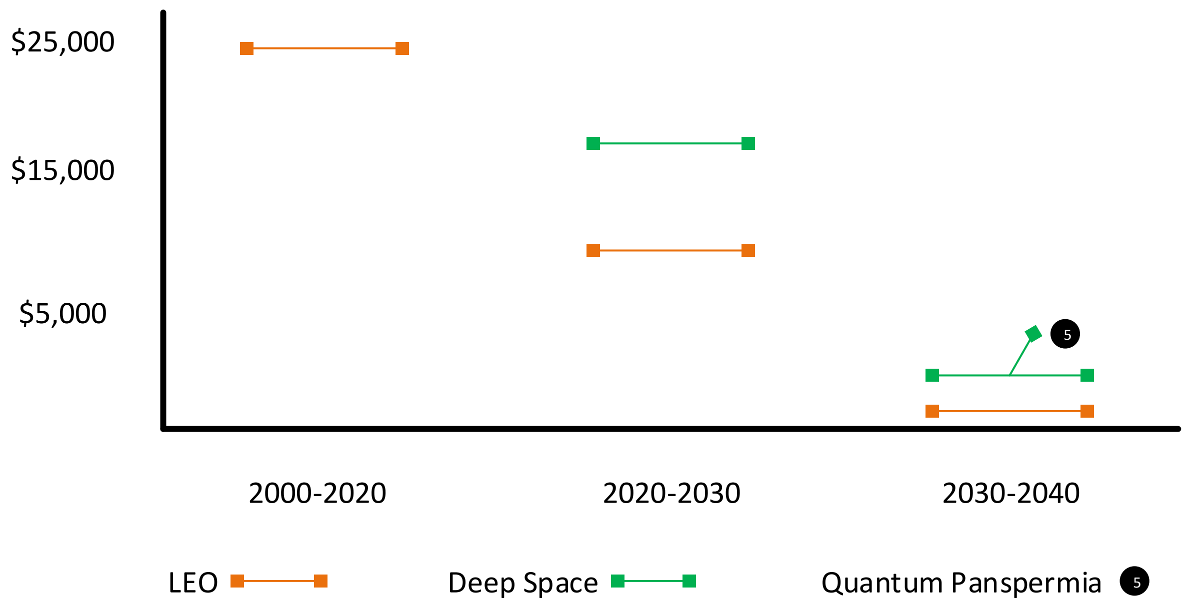


Fig. 34 Payload **Source:** Gravina, Matteo B.

Before we reach Quantum Panspermia, our payload fairing costs will spiral downward.

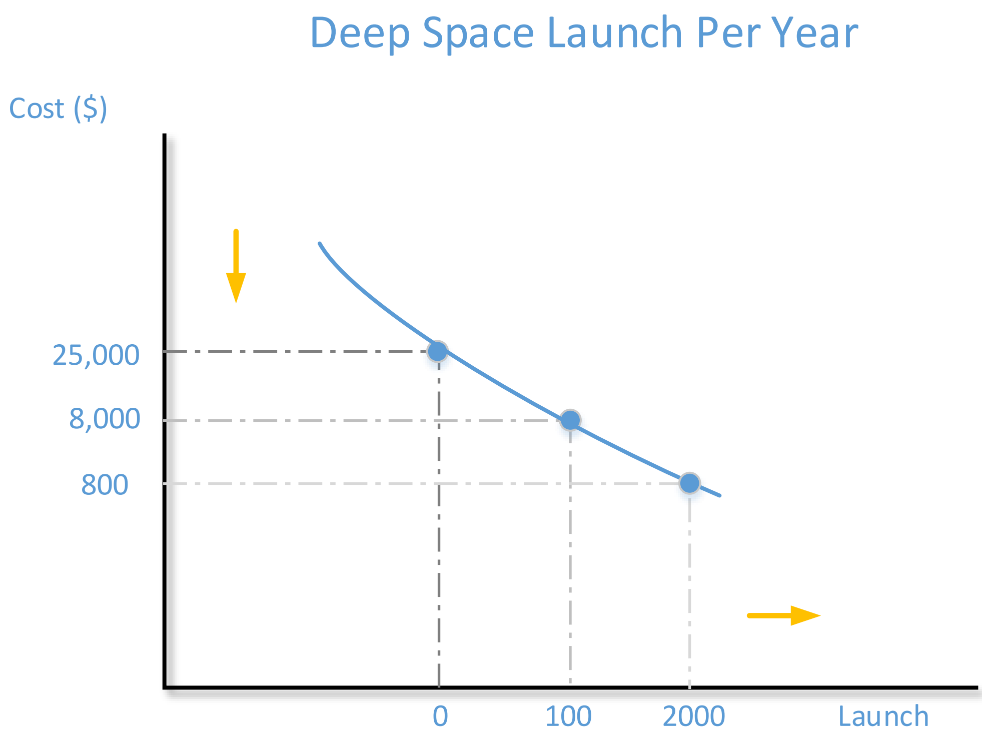


Fig. 35 Deep Space Fairing **Source:** Gravina, Matteo B.

The economics of mass payload fairing increases in creating a positive feedback.

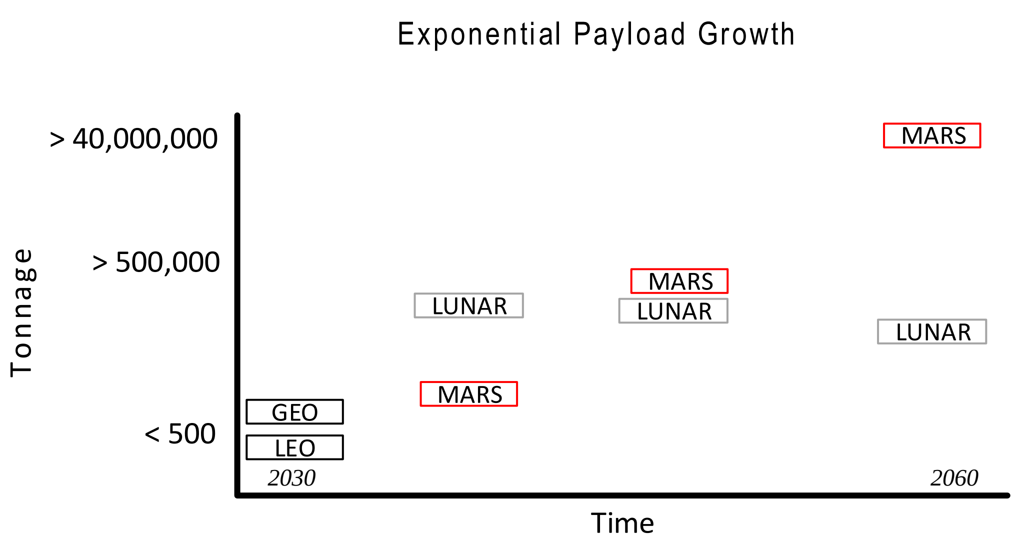


Fig. 36 Fairing tonnage **Source:** Gravina, Matteo B.

Space Travel

Industry 5.0 ushers in space travel, which allows for an interplanetary economy. Unlike our current planetary economy that deals with trade between countries. Bringing our interplanetary markets closer, the space economy differs in that microgravity expands our horizons. Communication, farming, and other industries create opportunities for life on Earth. Super Artificial Intelligence makes this happen by maintaining and controlling the complexities of missions, commerce between planets, and life support systems.

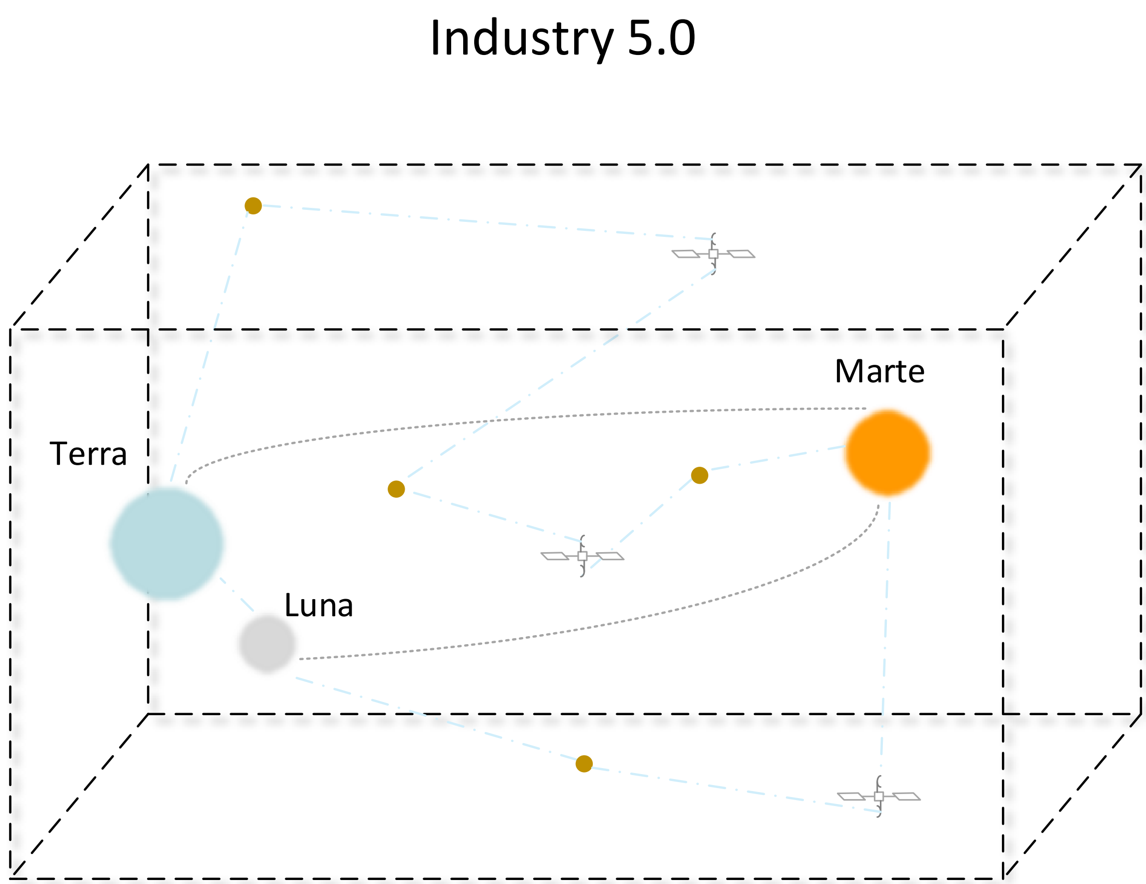


Fig. 37 Industry 5.0 **Source:** Gravina, Matteo B.

Industry 5.0

A far cry from 19th-century farming, the Internet of things controlled by Artificial Super Intelligence drives new markets to prosper in the space realm. Artificial Super Intelligence permits independent control of markets by entities other than humans, surpassing the capabilities of planetary domain. At this level, Industry 5.0 (Space 5.0) develops the control over humans in the loop. Most of the markets within the *Solar System Economy* are space-based industries, beginning with Earth-to-Space, Deep Space, and Interplanetary. As new occupations develop in support to space-based markets, eventually some occupations become obsolete. Migrating unskilled labor becomes irrelevant as robotics controlled by Artificial Super Intelligence matrix commands preference.

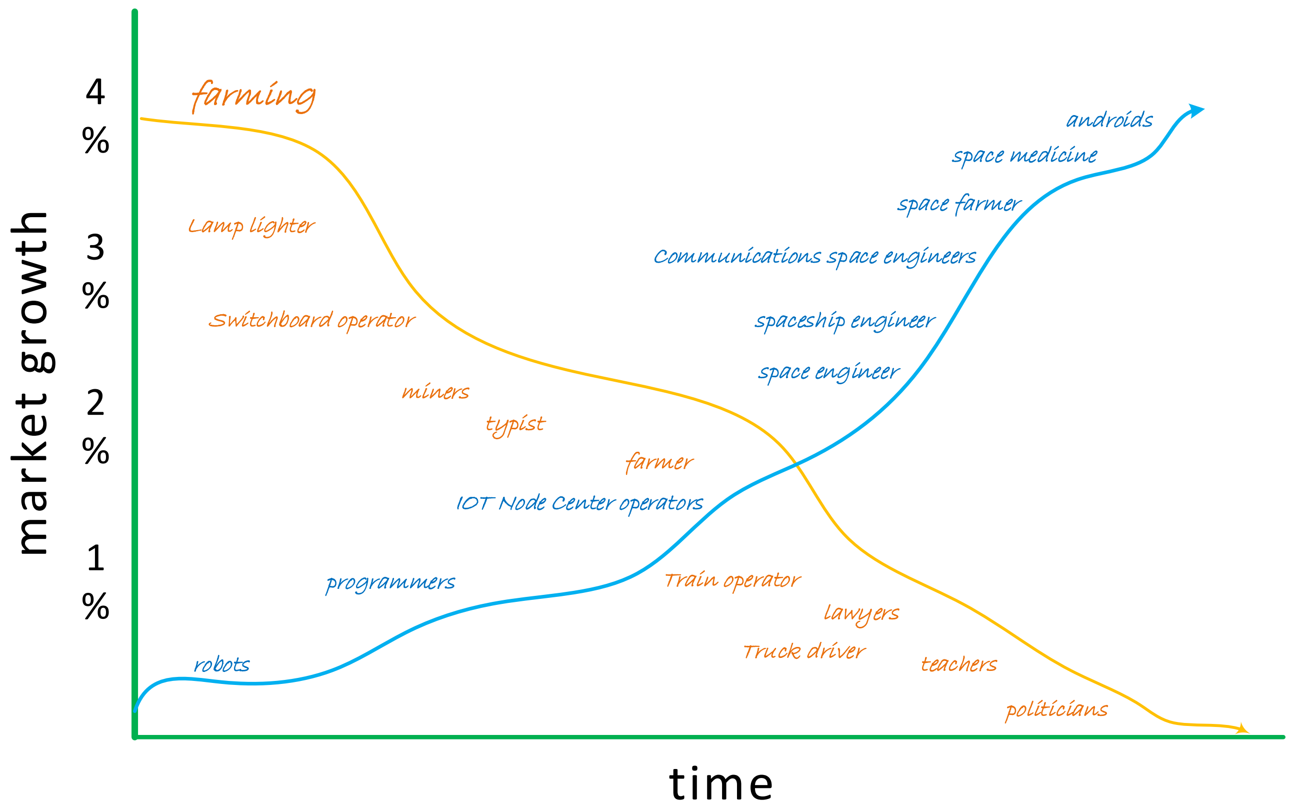


Fig. 38 Jobs   Source: Gravina, Matteo B.