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Document Description	Page Start	Page End
Specification	1	25
Claims	26	30
Abstract	31	31

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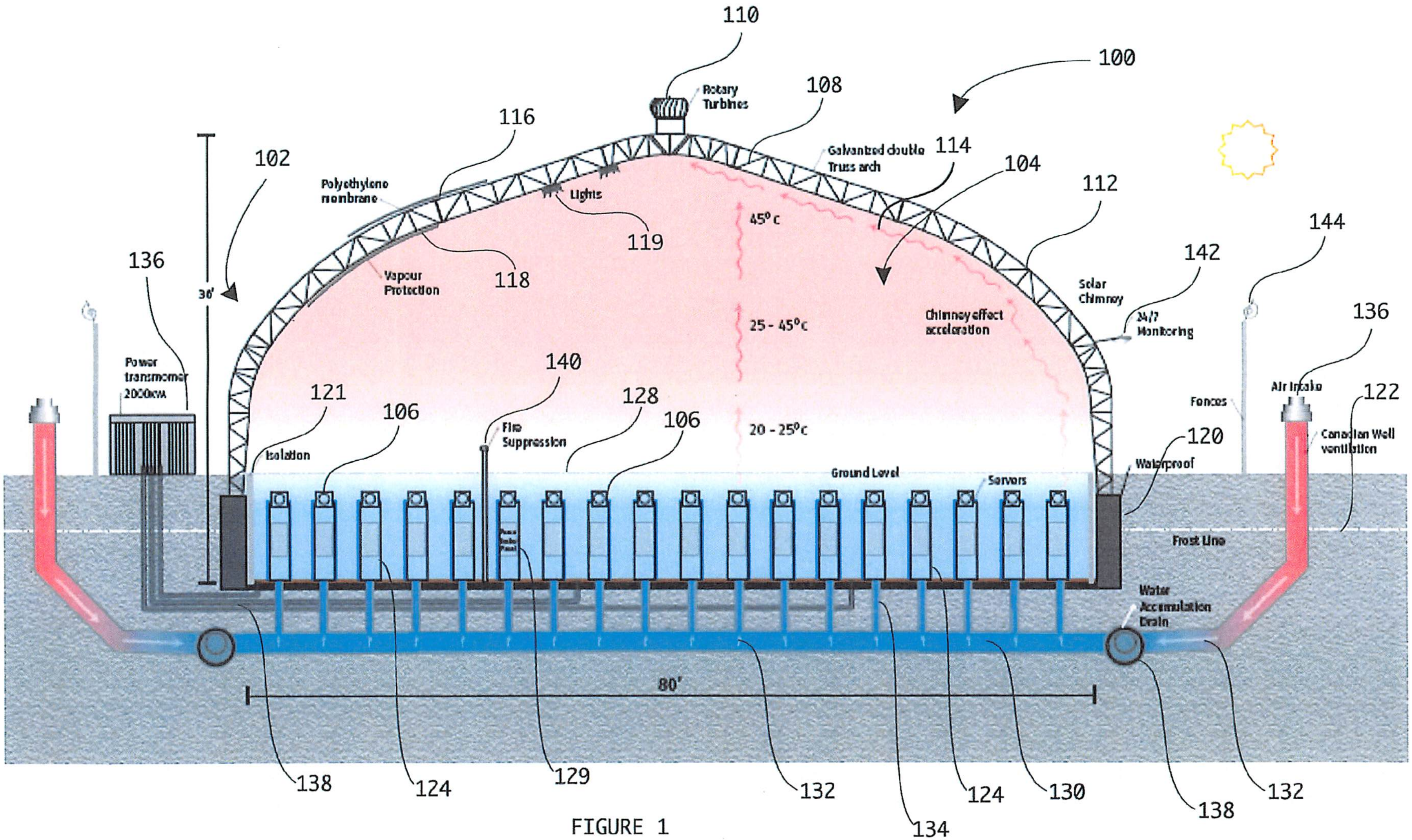
100
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Rotary Turbines
Galvanized double Truss arch
Polyethylene membrane
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30'
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20 - 25°c
Solar Chimney
Chimney effect acceleration
24/7 Monitoring
Power transformer 2000KVA
Fire Suppression
Isolation
Ground Level
Servers
Fences
Air Intake
Canadian Well ventilation
Waterproof
Frost Line
Water Accumulation Drain
80'

FIGURE 1

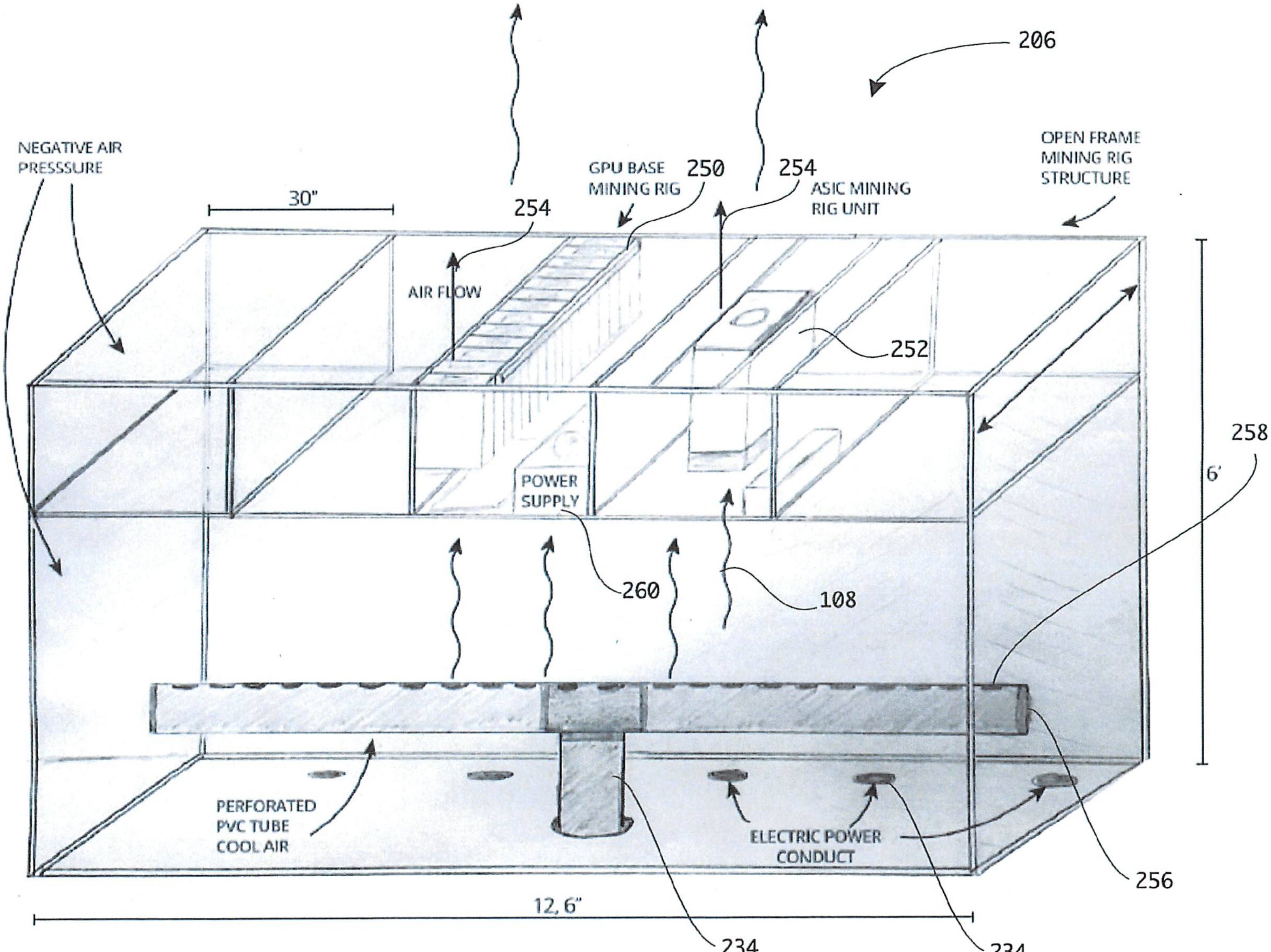
206
NEGATIVE AIR PRESSSURE
30"
254
GPU BASE MINING RIG
250
254
ASIC MINING RIG UNIT
OPEN FRAME MINING RIG STRUCTURE
AIR FLOW
252
258
6'
POWER SUPPLY
260
108
PERFORATED PVC TUBE COOL AIR
ELECTRIC POWER CONDUCT
256
12, 6"
234
234

FIGURE 2

SERVER FARM HOUSING, AND VENTILATION/COOLING SYSTEM AND CONFIGURATION THEREFOR

FIELD OF THE DISCLOSURE

[0001] The present disclosure relates to server farms, and, in particular, to a server farm housing, and ventilation system and configuration therefor.

BACKGROUND

[0002] Server farms or server clusters are commonly known to provide a collection of computer servers maintained by an organization to supply server functionality to one or more clients depending on their respective needs. Server farms often consist of thousands of computers that require a large amount of power to run and to keep cool. Typically, server farms will either provide consolidated server functions to a single operator, or provided distributed server functions to a variety of users from within a same commonly operated facility to provide distinct users with access to greater, and often scalable server resources, with added benefits of shared onsite server maintenance, emergency and/or redundancy backup and like services. Server farms will be typically collocated with a variety of network switches and/or routers to enable communication between the various farm servers and/or users thereof. Typical server farm installations will include a series of racks fitted with stacks of servers, routers, power supplies and related hardware in a secured server room or data center, for example. Significant ventilation/cooling installations are generally required, as noted above, to accommodate the high power consumption and related heating associated with operating such a high density of server computers and related equipment, which, given the generally high cost of housing real-estate and infrastructure, results in a constant drive to increase server processing capacity and density, often, at the expense of greater ventilation requirements.

[0003] In fact, in some respects, the performance of large server farms may be limited by the performance of the data center's cooling system and related energy costs, as opposed to the performance of the constituent data processors themselves, which in many implementations, require continuous operation twenty-four hours per day, seven days per week.

[0004] Server farms are commonly used in a variety of applications, from supporting online search engines like Google™ and online shopping portals like Amazon™, to providing cluster computing resources for large scale computational projects, scientific simulations and computer generated imagery, to name a few.

[0005] With the recent surge in crypto currency transactions and related mining loads, significant resources have been poured into the provision of powerful yet efficient processing services, where profits are directly impacted by the power consumption required to perform such transactions. Accordingly, large scale crypto mining farms have been established to address increasing needs, with some choosing to locate in colder climates, such as Genesis Mining Iceland ehf with current mining installations in Iceland, to help reduce cooling costs, at least, during cooler months. Regardless, much concern has been raised as to the profitability of crypto mining given significant processing, and thus physical cooling requirements, as crypto currency transactions increase in popularity, not to mention the significant environmental impact associated therewith.

[0006] This background information is provided to reveal information believed by the applicant to be of possible relevance. No admission is necessarily intended, nor should be construed, that any of the preceding information constitutes prior art or forms part of the general common knowledge in the relevant art.

SUMMARY

[0007] The following presents a simplified summary of the general inventive concept(s) described herein to provide a basic understanding of some aspects of the disclosure. This summary is not an extensive overview of the disclosure. It is not intended to restrict key or critical elements of embodiments of the disclosure or to delineate their scope beyond that which is explicitly or implicitly described by the following description and claims.

[0008] A need exists for a server farm housing, and ventilation system and configuration therefor, that overcome some of the drawbacks of known techniques, or at least, provides a useful alternative thereto. Some aspects of this disclosure provide examples of such housings, systems and configurations.

[0009] In accordance with one aspect, there is provided a server farm installation for housing and operating a plurality of server computers, the installation comprising: an enclosure having walls and a roof structurally installed on a foundation to define an enclosed area of the installation for housing and operating the plurality of servers therein, wherein said roof is at least partially defined by an upwardly converging structure having an exhaust operatively mounted toward an apex thereof and an external surface to be exposed to solar energy and thereby thermally invoke an internal ventilating airflow toward said exhaust; a ground-coupled heat exchanger operatively disposed in relation to said enclosure and having an underground conduit disposed below a local frost line so to cool a cooling exchange fluid conducted therein in delivering a cooling airflow within said enclosure via a network of cooling airflow outlets; a server support structure installed within said enclosure to support the plurality of servers in relation to said cooling airflow outlets so to expose the servers to said cooling airflow emanating therefrom.

[0010] In one embodiment, the enclosure defines a domed structure, wherein said internal ventilating airflow is thermally invoked along an inner surface of said domed structure.

[0011] In one embodiment, the domed structure comprises an elongated domed structure.

[0012] In one embodiment, the roof is at least partially defined by a support structure network and an external membrane secured thereto.

[0013] In one embodiment, at least said walls and roof are removably assembled from an enclosure assembly.

[0014] In one embodiment, the foundation comprises a foundation floor disposed below said local frost line, and foundation walls enclosing said enclosed area so to define a cool air reserve volume, wherein said server support structure is configured to support the servers above said foundation floor and below local ground level within said cool air reserve volume.

[0015] In one embodiment, the support structure is configured to support the servers in a substantially planar configuration such that one or more adjacently disposed servers are operatively disposed at a substantially same vertical distance above said network of cooling airflow outlets in receiving cooling airflow thereby directed thereto.

[0016] In one embodiment, the substantially planar configuration is defined by a single substantially horizontal server layer.

[0017] In one embodiment, the servers are operatively grouped within a corresponding series of server mounting structures, each of said server mounting structures comprising one or more enclosures defined at least in part by a corresponding set of substantially vertical walls within which to mount the servers, and a cooling airflow input to operatively interface with a corresponding cooling airflow outlet such that said corresponding cooling airflow outlet channels cooling airflow within said one or more enclosures to cool the servers therein.

[0018] In one embodiment, each of said series of server mounting structures is configurationally adaptable to accommodate different sever types.

[0019] In one embodiment, the cooling airflow input comprises a substantially horizontal conduit having a series of cooling airflow outlet apertures linearly defined therein to distribute said cooling airflow from a given cooling airflow outlet across multiple servers.

[0020] In one embodiment, the ground-coupled heat exchanger comprises an earth-air heat exchanger.

[0021] In one embodiment, the exhaust comprises one or more exhaust fans or turbines operatively disposed to draw exhaust air from within said enclosure.

[0022] In accordance with another aspect, there is provided a server farm installation for housing and operating a plurality of server computers, the installation comprising: an enclosure defining an enclosed area of the installation for housing and operating the plurality of servers therein, wherein said enclosure comprises at least one exhaust and at least one external surface to be exposed to solar energy and thereby thermally invoke an internal ventilating airflow toward said exhaust; a ground-coupled heat exchanger operatively disposed in relation to said enclosure and having an underground conduit disposed so to cool a cooling exchange fluid conducted therein in delivering a cooling airflow within said enclosure via a network of cooling airflow outlets; a server support structure installed within said enclosure to support the plurality of servers in relation to said cooling airflow outlets so to expose the servers to said cooling airflow emanating therefrom.

[0023] In one embodiment, the at least one surface at least in part creates a solar chimney effect.

[0024] In one embodiment, the ground-coupled heat exchanger forms a Canadian well.

[0025] In one embodiment, the support structure is configured to support the servers in a substantially planar configuration such that one or more adjacently disposed servers are operatively disposed at a substantially same vertical distance above said network of cooling airflow outlets in receiving cooling airflow thereby directed thereto.

[0026] In one embodiment, the substantially planar configuration is defined by a single substantially horizontal server layer.

[0027] In one embodiment, the servers are operatively grouped within a corresponding series of server mounting structures, each of said server mounting structures comprising one or more enclosures defined at least in part by a corresponding set of substantially vertical walls within which to mount the servers, and a cooling airflow input to operatively interface with a corresponding cooling airflow outlet such that said corresponding cooling airflow outlet channels cooling airflow within said one or more enclosures to cool the servers therein.

[0028] In one embodiment, the cooling airflow input comprises a substantially horizontal conduit having a series of cooling airflow outlet apertures linearly defined therein to distribute said cooling airflow from a given cooling airflow outlet across multiple servers.

[0029] In accordance with another aspect, there is provided a server comprising an enclosure having a mounting structure dimensioned to operatively support a server mounted thereon within said enclosure, wherein said enclosure comprises a cooling inlet for substantially sealed fluid coupling with a cooling air source, and an exhaust for operative substantially sealed coupling to a server exhaust fan such that a negative pressure induced within said enclosure by said server exhaust fan draws in cooling air from said cooling air source via said cooling inlet.

[0030] In one embodiment, the mounting structure is dimensioned to operatively support two or more servers thereon within said enclosure, and wherein said exhaust comprises respective exhausts for respective operative coupling to corresponding server exhaust fans.

[0031] In one embodiment, the cooling air inlet comprises an elongate air cooling member disposed so to distribute cooling airflow across each of said two or more servers.

[0032] In one embodiment, the support structure is configured to support the servers in a substantially planar configuration such that one or more adjacently disposed servers are operatively disposed at a substantially same vertical distance above said network of cooling airflow outlets in receiving cooling airflow thereby directed thereto..

[0033] Other aspects, features and/or advantages will become more apparent upon reading of the following non-restrictive description of specific embodiments thereof, given by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0034] Several embodiments of the present disclosure will be provided, by way of examples only, with reference to the appended drawings, wherein:

[0035] Figure 1 is a schematic diagram of a server farm housing, and ventilation/cooling system and method therefor, in accordance with one exemplary embodiment; and

[0036] Figure 2 is a schematic diagram of a server mounting structure to be operatively mounted with a server farm housing, such as that illustrated in Figure 1, and be subject to cooling/ventilation, in accordance with one embodiment.

[0037] Elements in the several figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be emphasized relative to other elements for facilitating understanding of the various presently disclosed embodiments. Also, common, but well-understood elements that are useful or necessary in commercially feasible embodiments are often not depicted in order to facilitate a less obstructed view of these various embodiments of the present disclosure.

DETAILED DESCRIPTION

[0038] Various implementations and aspects of the specification will be described with reference to details discussed below. The following description and drawings are illustrative of the specification and are not to be construed as limiting the specification. Numerous specific details are described to provide a thorough understanding of various implementations of the present specification. However, in certain instances, well-known or conventional details are not described in order to provide a concise discussion of implementations of the present specification.

[0039] Various apparatuses and processes will be described below to provide examples of implementations of the system disclosed herein. No implementation described below limits any claimed implementation and any claimed implementations may cover processes or apparatuses that differ from those described below. The claimed implementations are not limited to apparatuses or processes having all of the features of any one apparatus or process described below or to features common to multiple or all of the apparatuses or processes described below. It is possible that an apparatus or process described below is not an implementation of any claimed subject matter.

[0040] Furthermore, numerous specific details are set forth in order to provide a thorough understanding of the implementations described herein. However, it will be understood by those skilled in the relevant arts that the implementations described herein may be practiced without these specific details. In other instances, well-known methods, procedures and components have not been described in detail so as not to obscure the implementations described herein.

[0041] In this specification, elements may be described as "configured to" perform one or more functions or "configured for" such functions. In general, an element that is configured to perform or configured for performing a function is enabled to perform the function, or is suitable for performing the function, or is adapted to perform the function, or is operable to perform the function, or is otherwise capable of performing the function.

[0042] It is understood that for the purpose of this specification, language of "at least one of X, Y, and Z" and "one or more of X, Y and Z" may be construed as X only, Y only, Z only, or any combination of two or more items X, Y, and Z (e.g., XYZ, XY, YZ, ZZ, and the like). Similar logic may be applied for two or more items in any occurrence of "at least one ..." and "one or more..." language.

[0043] The systems and methods described herein provide, in accordance with different embodiments, different examples in which a server farm may be installed within an energy efficient enclosure to draw from an energy efficient ventilation and coolling system and configuration, which can provide for reduced energy consumption costs and/or improve an overall environmental impact thereof.

[0044] For greater certainty, the term "server farm" will be used herein to define a cluster or set of network interfacing data processing computers, commonly known and thus interchangeably referred to herein as a server, data processing server, server computer and like terminology, and their related intra and/or inter-networking and operating components such as switches, routers, power sources, backups, etc., that are collocated within a same establishment and generally managed, though not necessarily so, by a same enterprise. Data storage and/or processing resources and/or services of such server farms may be utilized by a same user or shared between distinct users based on various commonly known resource sharing configurations and installations readily known in the art. For instance, different inter-user security levels may be implemented depending on the application and type of user at hand, which may vary from the secure physical segregation of a certain subset of farm resources to virtualized resource and processing channel segregation, to name a few examples. As the innovative embodiments of the herein described installations, systems and configurations are not restricted by the specific data processing and storage resource allocation and/or user-specific segregation techniques employed within a given farm, no further details are deemed necessary herein for one of ordinary skill in the art, upon reading the following non-limiting description of illustrative embodiments, to readily work these embodiments and apply the teachings provided herein.

[0045] Furthermore, as noted above, the terms "server", "data processing server" or "server computer" will be used interchangeably herein to define a network-interfacing computing device locally and/or remotely operable to execute, alone or in combination, certain digital data processing functions such as, but not limited to, data storage and management; transactional or algorithmic data processing; network-based or interfacing data exchanges, process validations and/or cryptographic processing such as, but not limited to secured cryptographic transactions (e.g. encryption/decryption, authentication, financial transactions, etc.), virtual currency transaction processing and/or mining (e.g. Bitcoin, Etherium or other virtual currency coin/token mining, processing, validation and/or management); multimedia (e.g. video and/or image) data processing; Web, email and/or e-commerce hosting and management; telecommunication servers or like computational hardware, processes, functions and/or features as may be readily appreciated by the skilled artisan. Without loss of generality, servers may include, but are not limited to, different server types, configurations and/or interconnections such as illustrated in the accompanying figures to include GPU-based servers, ASIC-based and other such server types as may be appropriate for the intended application and/or context at hand. It will also be appreciated by a given server farm enclosure may be dedicated to a particular type of server or farm (e.g. virtual currency mining and/or transaction processing farm, data storage server farm, Web hosting farm, etc.), which may allow for a particular level of security, redundancy, maintenance and/or management suitable for that particular type of server farm, or the user(s) thereof, or again provide a shared server farm environment to accommodate a variety of users.

[0046] With reference to Figure 1, and in accordance with one exemplary embodiment, a sever farm installation, generally referred to using the numeral 100, will now be described. In the illustrated embodiment, the installation 100 generally comprises an enclosure 102 defining an enclosed area 104 for housing and operating a plurality of servers 106 (illustrated herein schematically as server rigs) therein. As schematically illustrated, the housing is designed and installed to take advantage of one or more passive ventilation/cooling techniques so to reduce applicable cooling, and thus, increase profitability of the server-based services being delivered.

[0047] For example, in the illustrated embodiment, the enclosure 102 is generally defined by a domed structure 108 having at least one exhaust 110 (e.g. a rotary turbine, or in a linear dome configuration, generally, a set of concurrently or selectively operated linearly spaced rotary turbines or like exhaust mechanisms) at or toward it's apex, and at least one external surface, in this case the entire dome surface 112, to be exposed to solar energy and thereby thermally invoke an internal ventilating airflow 114 toward the exhaust 110. Accordingly, in operation, the enclosure 102 can be configured to invoke a solar chimney effect (i.e. otherwise known as a thermal chimney or provençal chimney effect) whereby warm internal air is naturally entrained toward the exhaust in providing passive exhaust ventilation to the enclosure. In this particular embodiment, the dome structure consists of galvanized double truss arches externally covered by a polyethylene membrane 116 and internally provided with a vapour protection barrier 118, for example. Internal lighting (e.g. lights 119) can also be operatively mounted therein or otherwise installed throughout the installation. Suitable structures of this type may include, but are not limited to, the MegaDome® designed and manufactured by Harnois Industries Inc. in Québec, Canada.

[0048] Other similar structures may also be considered without departing from the general scope and nature of the present disclosure. For example, a similar or alternative enclosure may include walls and/or a roof structurally installed on a foundation to define the enclosed area of the installation, wherein the roof is at least partially defined by an upwardly converging structure having an exhaust operatively mounted toward an apex thereof and an external surface to be exposed to solar energy and thereby thermally invoke an internal ventilating airflow toward the exhaust. Accordingly, different dome or otherwise sloping peaked structures may provide a similar effect. As will be detailed below, in some embodiments, the passive-exhaust domed or like structure may be assembled from a temporary building assembly so to provide various cost-effective advantages, such as potentially lower installation costs, land lease or permit costs, and the like.

[0049] With continued reference to Figure 1, the dome structure 108 is mounted to a waterproofed foundation 120, in this case, dug into and below the local frost line 122, for example, and insulated accordingly (121). A series of server mounting structures 124 are also provided to extend substantially vertically from a foundation floor base 126 to effectively support enclosed servers 106, in this example, below a local ground level 128. Associated power panels 129 may also be provided and operatively supported by these structures, as can other related equipment. Locating operating servers 106, and related equipment, below ground can, in this particular embodiment, effectively allow for operation within a cooling air volume or reserve which naturally exhausts to a warm air reserve defined thereabove by the enclosure walls/ceiling, in this case the passively exhausting dome structure.

[0050] To promote passive cooling, the installation illustrated in Figure 1 is also operatively coupled to an earth-coupled heat exchanger (ECHX), in this embodiment an earth-to-air exchanger otherwise known as a Canadian well or provençal well. In general, the ECHX comprises an underground conduit 130, such as a series of horizontal 24-inch pipes in the example described below, disposed so to cool a cooling exchange fluid (in this example air) conducted therein in delivering a cooling airflow 132 within the enclosure via a network of cooling airflow outlets 134, in the example below consisting of a series of 12-inch vertical pipes in fluid communication with a corresponding horizontal pipe 130. For instance, ambient air can be drawn in through an external air intake 136 and conducted underground (via a water accumulation drain 138) to be cooled and ultimately delivered through the series of cooling airflow outlets 134. In the schematically illustrated embodiment, each cooling airflow outlet 134 is provided in one-to-one corresponding arrangement with vertical support structures 124 so to directly deliver cooling airflow thereto. As will be described in further details below with reference to the embodiment of Figure 2, the cooling air outlets 134 may be operatively coupled to dedicated server mounting structures/enclosures specifically adapted to distribute and optimize cooling from the passively cooled ECHX airflows.

[0051] With continued reference to Figure 1, an external power transformer 136 (e.g. 2000KVA transformer) is also provided to power the enclosed servers and related equipment, via appropriate power delivery channels 138, as will be readily known in the art.

[0052] Further installation features, such as fire suppression towers 140 or sprinklers, security monitoring equipment 142, perimeter fences 144 and the like, may also be considered, as illustratively included in the embodiment of Figure 1.

[0053] With reference to Figure 2, and in accordance with one embodiment, each server, schematically illustrated herein as GPU based mining server(s) 250 and/or ASIC based mining server(s) 252 respectively optimized for Ethereum and Bitcoin cryptocurrency mining operation, as detailed in the below example, will be operatively mounted within a server mounting enclosure, generally referred to using the numeral 206. Other equipment, such as power supplies 260 and/or network routing hardware (not shown), or again other related equipment, may also be included within the enclosure, as will be readily appreciated by the skilled artisan.

[0054] In general, each server enclosure 206 will be operatively mounted to interface with a corresponding cooling air outlet 234 so to promote direct passive cooling of the servers. To enhance cooling by further entraining cool air ventilation, in some embodiments, each enclosure will be effectively sealed from ambient air, and thus negatively pressurized by virtue of the server and/or power supply exhausts 254 (e.g. fans) operating from within the enclosure to exhaust within the greater server farm enclosure (e.g. dome space). Namely, the servers 250, 252 may be mounted in a substantially sealed fashion such that operation of their respective exhaust fans (or like exhaust mechanisms) naturally draws air from within the enclosure to induce a negative pressurization effect that, in turn, induces or enhances a cooling airflow being produced from the outlet 234.

[0055] In the illustrated embodiment, in order to distribute cooling airflow across multiple mounted servers 250, 252, the (vertical) cooling airflow outlet 234 is fluidly coupled to a transversal spreader 256, such as a horizontally disposed PVC tube or like conduit having a series of ventilation apertures 258 defined therein along a length thereof. Likewise, servers 250, 252 (in the illustrated embodiment up to five (5) servers to a given enclosure 206) are mounted side-by-side in a substantially horizontal layer to draw and/or be exposed to substantially equal amounts of cooling airflow.

[0056] The Blockchain Dome example provided below, up to 1,000 individual cryptocurrency mining servers can be accommodated within a same server farm housing, which can, for example, be configured in 20 rows of 50 servers per row with a 30-inch separation between rows. Each row can consist of 10 rack units / enclosures of about 2 x 12 feet and each rack can hold up to 5 servers (e.g. see enclosure 206 of Figure 2).

[0057] As noted above, a negative air pressure can be maintained within each mining rig enclosure to promote cooling. For example, each mining rig enclosure can be sealed on all sides with a 4 mil thick Medium Density Polyethylene (MDPE) moisture and vapor barrier liner. Internal air is forced out by the mining rig's power supply and/or GPU card fans so that a negative air pressure is created and maintained, thus passively pulling cooling air into the enclosure from the ECHX inlet pipes fluidly coupled into each enclosure, while warm air generated by the server and power supply is extracted from the enclosure.

[0058] Accordingly, in one embodiment, the server mining rig can be designed to be airtight, that is allowing no air in through electrical outlets and/or cooling well pipes which could otherwise restrict creation/maintenance of a negative air pressure within the server enclosure. Regular smoke tests can be conducted on a routine basis to ensure mining rigs remain sufficiently sealed. In doing so, passive cooling airflow is entrained within the mining rigs, while warm air is expelled therefrom into the BlockChain Dome, where warmer air is progressively entrained to exhaust from the dome structure.

[0059] As will be appreciated by the skilled artisan, while the following contemplates a blockchain cryptocurrency mining farm example, other applications and uses for the above-described embodiments, and their equivalents, can be considered, without departing from the general scope and nature of the present disclosure. The following example is provided to illustrate one particular and non-limiting implementation and use of the herein described server farm housings, and ventilation/cooling systems and methods therefor.

EXAMPLE: BLOCKCHAIN DOME

[0060] In the past year, Cryptocurrency mining has become exceedingly popular both with individuals and commercial operations. This is due to the rising value of cryptocurrencies as well as an increased awareness of the financial opportunities from mining. However establishing cryptocurrency mining operations is still a complex and expensive process and provides variable returns on investment based on available technical skills and direct costs of operations which are often linked to economies of scale.

[0061] It is well established for example, that mining operations are extremely energy intensive and as such the profitability of mining operations is highly dependent on the efficiency of the mining rigs and more importantly, the cost of electricity used for both the rigs themselves and the massive cooling requirements from the heat they generate.

[0062] In one exemplary embodiment, a mining farm as described above may be specifically developed to act as a cryptocurrency mining facility, which, in some examples, may house up to 1,000 mining servers, for example, including both ASIC (application-specific integrated circuit) and GPU (graphics processing unit) based capabilities to enable the mining of both Bitcoin and Ethereum currencies. Other server types may also or alternatively be considered, depending on the application at hand and/or the evolution of existing and/or new crypto-currencies, without departing from the general scope and nature of the present disclosure.

[0063] In one particular embodiment, such servers can be sold to investors (individual, group or corporate) and operated by a same overseeing enterprise, for example, under different profit sharing agreements and/or arrangements in an operationally innovative environment that minimizes costs and maximizes financial returns.

[0064] Using this configuration, the Blockchain Dome can provide complete cryptocurrency mining capacity to individuals, groups of individuals and commercial operations on a reasonable investment basis and allow all participants to own their own rigs and benefit from economies of scale. These economies of scale can be realized, for example, through lower capital costs (though volume purchasing); lower utility costs, for example, by leverage advantageous local, regional, provisional (e.g. Quebec), state and/or national utility cost reduction incentives; as well as basic overhead costs which can be amortized over all the mining servers in a specific Blockchain Dome.

[0065] As such, the Blockchain Dome may appeal to various levels and demographics of miners ranging from individuals (or groups of individuals) who want to get into the mining business, to commercial operations and to general investors who want a turnkey managed play in cryptocurrency mining.

[0066] As detailed above, in accordance with certain embodiments, a given Blockchain Dome can be designed for rapid deployment and benefit from cost-effective land purchase or lease arrangements (e.g. agricultural, rural or remote urban locations) given the general nature of the deployable and optionally removable structural building considerations noted above and further detailed below.

[0067] On that basis, and consistent with one exemplary embodiment, each mining server in a Blockchain Dome can have segregated ownership. This means that a specific server (or servers) can be purchased by an individual, a commercial entity or ownership can be shared by a group. Group ownership will allow individuals to jointly purchase a server making this more within reach to more people.

[0068] Owners of mining servers may also be able to rapidly change their server preference between ASIC and GPU (based on the availability of servers), for example, allowing them to adjust their mining activity based on their personal mining strategy.

[0069] Blockchain Dome servers can be provided on a turnkey basis and can be managed by a single overseeing organization, in some examples, or again under different management types as may be appropriate or preferred given a particular use case. Centralized management can thus improve management efficiency by centralizing responsibility to oversee all aspects of the mining operation, for example.

[0070] As noted above, electricity is generally the primary direct cost related to mining servers. By selecting jurisdictions that offer favorable rates for high consumption customers (e.g. Quebec), significant economies of scale may be achieved by consolidating mining resources within a centrally managed environment. For example, the high consumption rate in Quebec is set at US $0.026 per kWh plus a monthly demand charge of US $9.60 per kW where monthly usage exceeds 2 Megawatts, an overall usage, and thus rate, not readily available to small or individual operations.

[0071] As detailed above, the Blockchain Dome can leverage the advantageous design attributes noted above, such as a relatively inexpensive design amenable for rapid deployment, as well as benefit from highly innovative energy features, such as by providing passive cooling using the ground as a natural source of cooling, combined with an effective chimney effect by design. As a result, little to no electricity may be required to cool the installation depending on the local climate, even in warmer months/climates, thus significantly reducing overhead costs and thus increasing potential profit margins.

[0072] Furthermore, all owners of mining servers can gain access to a web portal that can allow them real time monitoring of their server, for example. Monitoring information can include real time revenue and direct cost data as well as server performance data, server and ambient temperature, etc.

[0073] Certain Blockchain Domes may also include meeting facilities for activities related to education and exchange of information in cryptocurrency mining, for example, to promote the development of "mining communities" to promote best practices in the industry. Such facilities may include areas where server owners can meet in a "café-style" social setting, for instance, in Blockchain Domes located near urban centers.

[0074] In this exemple embodiment, the Blockchain Dome facility consists of a semi-permanent steel framed structure with an enhanced heavyweight woven High Density Polyethylene (HDPE) exterior.

[0075] Some advantages of this type of structure may include, but are not limited to, the following.

[0076] Cost: this type of structure can be set in place at a fraction of the cost of other types of buildings.

[0077] Speed of Construction: once the foundation and Canadian well components are in place, this structure can be assembled in 2 days.

[0078] Zoning: as a "semi-permanent" structure, there are fewer zoning requirements to comply with and the structure would qualify for placement on agricultural land. At the same time, the structure is fully compliant with all local building codes

[0079] Durability: the exemplary Blockchain Dome is designed to be strong, highly durable and well equipped to handle weather extremes and other natural forces. The structural steel is high strength, low alloy and exceeds commercial steel specifications.

The HDPE exterior is highly resistant to the elements and has been proven to withstand extreme conditions

[0080] Ventilation: all ventilation can be passive to reduce both energy utilization and noise.

[0081] Structural Integrity: although the structure is deemed "semi-permanent" for zoning purposes, it does in fact maintain all the structural integrity of a permanent structure. The structural footings and supports are engineered to the same or higher standards as a permanent facility and designed for heavy wind conditions and snow loads.

Blockchain Dome – Installing structural footings

[0082] The high strength structural steel contains no recycled materials and the specifications exceed those of commercial steel and meet structural and mechanical properties of ASTM A-500 GR B standards.

[0083] Tubular components are pre-galvanized whereby the galvanization treatment occurs at the time the tube is roll-formed during production. Referred to as "in-line galvanization" or "pre-galvanization", this treatment is applied before any transformation occurs to the tubing. A steel plate goes through a hot molten zinc bath before it is formed and welded into a long, uniform tube. These tubes are then cut and welded at the manufacturing facility. Furthermore welding on the steel frame is of the silicon-bronze type, in order to preserve the pre-galvanization's corrosion protection properties.

Blockchain Dome – structural supports

[0084] The surface covering of the structure is of RU88X-6, a High Density Polyethylene or HDPE, a heavyweight fabric designed for structural applications. The scrim is produced in a special weaving pattern to enhance thickness, flatness, abrasion resistance, and tear properties. The proprietary coating is used to enhance abrasion resistance, flex resistance, seam strength, UV resistance and longevity.

Passive Cooling using Canadian well and chimney effect techniques

[0085] Passive cooling is a building design approach that focuses on heat gain control and heat dissipation in a building in order to improve the indoor thermal comfort with low or no energy consumption. This approach works either by preventing heat from entering the interior (heat gain prevention) or by removing heat from the building (natural cooling). Natural cooling utilizes on-site energy, available from the natural environment, combined with the architectural design of building components (e.g. building envelope), rather than mechanical systems to dissipate heat.

[0086] Therefore, natural cooling depends not only on the architectural design of the building but on how the site's natural resources are used as heat sinks (i.e. everything that absorbs or dissipates heat). Examples of on-site heat sinks are the upper atmosphere (night sky), the outdoor air (wind), and the earth/soil.

[0087] Passive cooling and ventilation will be used in the Blockchain Dome to significantly reduce power consumption required for air conditioning and power ventilation. This is accomplished through a combination of the use of "Canadian well" technique coupled with the chimney effect which results from the heat generated by the mining servers.

[0088] Canadian wells use the thermal inertia of the ground to cool intake air in summer and if required, heat it in winter. Also known as a ground-coupled heat-exchanger, it is combined with a controlled double flow manual mechanical ventilation system – one at the intake level and one at the turbine exhaust level. The overall design will keep the interior of the structure at floor level at 20-22° C and a relative humidity of 45-50% depending on the season and is achieved through controlling airflow. A minimum flow is always maintained through the buried system to prevent the stagnation of the air in the tubes.

[0089] In this example, the Canadian well component consists of 20 non-corrugated vertical intake pipes (10 on each side of the structure) which are 36 inches in diameter and extend 4 feet above grade and are set a minimum of 30 feet from the structure as shown in the example of Figure 1. The choice of such a wide pipe is to minimize resistance of incoming air and allow for maximum air volume exchange over time. The use of smooth versus corrugated piping is designed to reduce induced air turbulence.

[0090] Each intake pipe feeds a 24-inch horizontal pipe which is set 8 feet below grade. Note from the diagram that there are 2 diameter reduction points which are undertaken at 45° angles. The first reduction is from 36 to 30 inches and then from 30 to 24 inches. This 2-phase reduction and use of 45° angles versus a single reduction point at 90° is again designed to reduce air resistance and maximize airflow. It is along the 30-foot run below grade that the air cooling occurs. There are 2 drain points in this pipe; one on each side of the structure. The pipe is positioned with a 2° upward slant from the drain, in this example. This configuration ensures that any condensation which develops within the pipes is drained immediately.

Mining Server Configuration and Cooling

[0091] The Blockchain Dome in this example can accommodate up to 1,000 individual mining servers. These are illustratively configured in 20 rows of 50 servers per row with a 30-inch separation between rows. Each row can consist of 10 rack units / enclosures of about 2 x 12 feet and each rack can hold up to 5 servers (e.g. see Figure 2).

[0092] Each 24-inch horizontal pipe illustratively includes 20, 12 inch vertical ventilation pipes with each pipe feeding cool air to an individual server rack / enclosure. As illustrated in Figure 2, the vertical pipes which enter the structure have a T-shaped air spreader which directs cool air evenly under the server rack. The vertical sides of the racks are themselves comprised of a transparent film designed to force and direct air upward and pass through the servers efficiently.

[0093] In one exemplary embodiment, as illustrated in Figure 2, a negative air pressure can be created / maintained within each mining rig enclosure to promote cooling. For example, each mining rig enclosure can be sealed on all sides with a 4 mil thick Medium Density Polyethylene (MDPE) moisture and vapor barrier liner, either predisposed to be sold and installed as such, or wrapped on the server rack/rig during installation. In sealing the enclosure around the cooling air outlet, power cable port and other such openings, and allowing exhaust only via the server exhaust fans, e.g. via correspondingly aligned or formed holes / apertures in the liner, a negative air pressure can be generated by the server exhaust fans. Namely, ambient air from within the server enclosure can be forced out by the mining rig's Assic server and/or GPU card fans so that a negative air pressure is created and maintained, thus passively pulling cooling air into the enclosure from the ECHX inlet pipes fluidly coupled into each enclosure, while warm air generated by the server and power supply is extracted from the enclosure.

[0094] Accordingly, in one embodiment, the server mining rig can be designed to be airtight, that is allowing no air in through electrical outlets and/or cooling well pipes which could otherwise restrict creation/maintenance of a negative air pressure within the server enclosure. Regular smoke tests can be conducted on a routine basis to ensure mining rigs remain sufficiently sealed. In doing so, passive cooling airflow is entrained within the mining rigs, while warm air is expelled therefrom into the BlockChain Dome, where warmer air is progressively entrained to exhaust from the dome structure.

Solar Chimney Effect

[0095] In the case of the Blockchain Dome, the cooling capacity of the Canadian well is enhanced by the chimney effect created from the heat generated by the mining servers, the individual server cooling fans and the solar chimney created by the structure itself.

[0096] As the heat is generated by the servers and by the sun during the day (at the top of the structure), the warm air rises and is expelled from the structure via passive rotary turbines in the roof (which can be dampened as necessary). This creates a vacuum which sucks cool air in from the Canadian well tubes or from the ambient air vents as appropriate. This effect is further enhanced by cooling fans on the mining servers themselves. Each server GPU card contains its own cooling fan and each server has 13 cards. At full capacity this means some 13,000 micro-fans running to circulate air.

[0097] The net result of the Canadian well and chimney effect is an efficient passive cooling system for the mining servers that are effective in all climate conditions.

Blockchain Dome Base

[0098] The base of the Blockchain Dome will be set approximately 6 feet below grade keeping it below a typical frost line of 24-30 inches and supporting the passive cooling system. The floor itself will be plywood raised 6 inches on cedar beams over a gravel base. A dust and moisture proof membrane will be placed under the plywood. This will provide natural runways for power supplies and any other required utilities. Entering the Cyber-Dome, visitors will descend a short stairway onto the base.

Connectivity

[0099] Connectivity for the mining servers will be provided, in this example, via a TNW SD1 (soft defined wide area network) bonded technology which aggregates connectivity from a combination of sources including DSL, fibre, cable and LTE, for example.

Fire Suppression System

[00100] The fire suppression system will consist of sprinklers located immediately above each server and supplied through piping running parallel to the rack rows. Demineralized water will be used at the fire suppression fluid. Both the location of the sprinklers and the choice of distilled water will minimize damage to any other servers in the event of a fire.

Power Requirements and Power Supply

[00101] The Blockchain Dome mining servers will each consume 1.5 kW on an ongoing basis. Therefore the Blockchain Dome itself will require a 2,000 kVA power entrance to supply 1,000 mining servers. All servers will be supplied via power runways under the Blockchain Dome floor and each row will have a dedicated 400 AMP service box with breakers.

Hydro-Quebec and the LG Tariff

[00102] Hydro-Quebec is Quebec's provincially-owned electricity company and is one of the largest in the world. It is a clean energy provider with approximately 99% of its power coming from low or no carbon emission sources. In addition to being a continuous

and reliable supply of renewable electricity, it is a low cost energy supplier and not subject to the price volatility of other energy sources.

[00103] For large power customers related to commercial activity, Hydro-Quebec has a special tariff referred to as "Rate LG". Rate LG is based on a combination of an energy consumption charge (kilo Watts used) and a demand or power charge (peak kilo Watts during a monthly period). In this particular example, Blockchain Domes assembled and operated in the province of Quebec may be operated to comply with Hydro-Quebec Standard F. 22-01 for Electricity Metering for Medium- and High-Voltage Installations, thus taking advantage of preferential utility rates and allowing Blockchain Dome users to joint share in these advantageously lower overhead operating costs.

Security

[00104] In one example, the Blockchain Dome facility can be surrounded by a high security fence and barbed wire, for example, or other suitable facility security measures, as may be appropriate or desired. A security office can also be located within the structure and all the structure's interior and exterior perimeter can be equipped with a high definition video surveillance system and intrusion detection for 24/7 on-site and remote monitoring. These and other security measures may be considered or varied, again, in accordance with site requirements and/or preferences.

Mining Servers

[00105] In one particular implementation, the Blockchain Dome operator may acquire off the shelf servers, or again furnish their own. For instance, dedicated server systems may be optimized in this context as mining servers, for instance, to provide optimized performance for the intended application.

[00106] For example, Ethereum focused servers may be acquired or developed to rely on available or customized GPU (Graphics Processing Unit) mining servers based on state-of-the-art technology and which can be assembled and tested in house. In this particular example, in-house GPU-based Ethereum servers will be configured in accordance with the following specifications:

- 13 GPUs for Ethereum mining
- 400 Mega Hash per second (400 MHash/sec) in precise overclock calibration
- Power draw of 1,492 watts per hour (1.492 kW/h)
- 2 ETH mining capacity per 31 day period based on under current Ethereum network difficulty

[00107] These specifications are based on actual field-testing using a third party mining pool using a processing unit and tandem graphics cards as contemplated in this example. As will be appreciated by the skilled artisan, alternative processing configurations and hardware may be considered to provide adequate results and/or address these or other mining activities as may be required or desired.

[00108] For instance, in one particular implementation, the Blockchain Dome may further house off-the shelf ASIC servers for Bitcoin mining. An example of an appropriate ASIC server may include, but is not limited to Antminer S9 servers with expected hash rates of about 13.5 TeraHash/s and power consumption of about 1.323 kW, for example. Again different server hardware and/or configurations may be considered, as will be readily apparent to the skilled artisan.

[00109] While the present disclosure describes various embodiments for illustrative purposes, such description is not intended to be limited to such embodiments. On the contrary, the applicant's teachings described and illustrated herein encompass various alternatives, modifications, and equivalents, without departing from the embodiments, the general scope of which is defined in the appended claims. Except to the extent necessary or inherent in the processes themselves, no particular order to steps or stages of methods or processes described in this disclosure is intended or implied. In many cases the order of process steps may be varied without changing the purpose, effect, or import of the methods described.

[00110] Information as herein shown and described in detail is fully capable of attaining the above-described object of the present disclosure, the presently preferred embodiment of the present disclosure, and is, thus, representative of the subject matter which is broadly contemplated by the present disclosure. The scope of the present disclosure fully encompasses other embodiments which may become apparent to those skilled in the art, and is to be limited, accordingly, by nothing other than the appended claims, wherein any reference to an element being made in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described preferred embodiment and additional embodiments as regarded by those of ordinary skill in the art are hereby expressly incorporated by reference and are intended to be encompassed by the present claims. Moreover, no requirement exists for a system or method to address each and every problem sought to be resolved by the present disclosure, for such to be encompassed by the present claims. Furthermore, no element, component, or method step in the present disclosure is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the claims. However, that various changes and modifications in form, material, work-piece, and fabrication material detail may be made, without departing from the spirit and scope of the present disclosure, as set forth in the appended claims, as may be apparent to those of ordinary skill in the art, are also encompassed by the disclosure.

CLAIMS

What is claimed is:

1. A server farm installation for housing and operating a plurality of server computers, the installation comprising:

an enclosure having walls and a roof structurally installed on a foundation to define an enclosed area of the installation for housing and operating the plurality of servers therein, wherein said roof is at least partially defined by an upwardly converging structure having an exhaust operatively mounted toward an apex thereof and an external surface to be exposed to solar energy and thereby thermally invoke an internal ventilating airflow toward said exhaust;

a ground-coupled heat exchanger operatively disposed in relation to said enclosure and having an underground conduit disposed below a local frost line so to cool a cooling exchange fluid conducted therein in delivering a cooling airflow within said enclosure via a network of cooling airflow outlets;

a server support structure installed within said enclosure to support the plurality of servers in relation to said cooling airflow outlets so to expose the servers to said cooling airflow emanating therefrom.

2. The server farm installation of claim 1, wherein said enclosure defines a domed structure, wherein said internal ventilating airflow is thermally invoked along an inner surface of said domed structure.

3. The server farm installation of claim 2, wherein said domed structure comprises an elongated domed structure.

4. The server farm installation of any one of claims 1 to 3, wherein said roof is at least partially defined by a support structure network and an external membrane secured thereto.

5. The server farm installation of any one of claims 1 to 4, wherein at least said walls and roof are removably assembled from an enclosure assembly.

6. The server farm installation of any one of claims 1 to 5, wherein said foundation comprises a foundation floor disposed below said local frost line, and foundation walls enclosing said enclosed area so to define a cool air reserve volume, wherein said server support structure is configured to support the servers above said foundation floor and below local ground level within said cool air reserve volume.

7. The server farm installation of any one of claim 1 to 6, wherein said support structure is configured to support the servers in a substantially planar configuration such that one or more adjacently disposed servers are operatively disposed at a substantially same vertical distance above said network of cooling airflow outlets in receiving cooling airflow thereby directed thereto.

8. The server farm installation of claim 7, wherein said substantially planar configuration is defined by a single substantially horizontal server layer.

9. The server farm installation of claim 7 or claim 8, wherein the servers are operatively grouped within a corresponding series of server mounting structures, each of said server mounting structures comprising one or more enclosures defined at least in part by a corresponding set of substantially vertical walls within which to mount the servers, and a cooling airflow input to operatively interface with a corresponding cooling airflow outlet such that said corresponding cooling airflow outlet channels cooling airflow within said one or more enclosures to cool the servers therein.

10. The server farm of claim 9, wherein each of said series of server mounting structures is configurationally adaptable to accommodate different sever types.

11. The server farm of claim 9, wherein said cooling airflow input comprises a substantially horizontal conduit having a series of cooling airflow outlet apertures linearly

defined therein to distribute said cooling airflow from a given cooling airflow outlet across multiple servers.

12. The server farm installation of any one of claims 1 to 11, wherein said ground-coupled heat exchanger comprises an earth-air heat exchanger.

13. The server farm installation of any one of claims 1 to 12, wherein said exhaust comprises one or more exhaust fans or turbines operatively disposed to draw exhaust air from within said enclosure.

14. A server farm installation for housing and operating a plurality of server computers, the installation comprising:

an enclosure defining an enclosed area of the installation for housing and operating the plurality of servers therein, wherein said enclosure comprises at least one exhaust and at least one external surface to be exposed to solar energy and thereby thermally invoke an internal ventilating airflow toward said exhaust;

a ground-coupled heat exchanger operatively disposed in relation to said enclosure and having an underground conduit disposed so to cool a cooling exchange fluid conducted therein in delivering a cooling airflow within said enclosure via a network of cooling airflow outlets;

a server support structure installed within said enclosure to support the plurality of servers in relation to said cooling airflow outlets so to expose the servers to said cooling airflow emanating therefrom.

15. The server farm installation of claim 1, wherein said at least one surface at least in part creates a solar chimney effect

16. The server farm installation of claim 14 or claim 15, wherein said ground-coupled heat exchanger forms a Canadian well.

17. The server farm installation of any one of claims 14 to 16, wherein said support structure is configured to support the servers in a substantially planar configuration such that one or more adjacently disposed servers are operatively disposed at a substantially same vertical distance above said network of cooling airflow outlets in receiving cooling airflow thereby directed thereto.

18. The server farm installation of claim 17, wherein said substantially planar configuration is defined by a single substantially horizontal server layer.

19. The server farm installation of claim 17 or claim 18, wherein the servers are operatively grouped within a corresponding series of server mounting structures, each of said server mounting structures comprising one or more enclosures defined at least in part by a corresponding set of substantially vertical walls within which to mount the servers, and a cooling airflow input to operatively interface with a corresponding cooling airflow outlet such that said corresponding cooling airflow outlet channels cooling airflow within said one or more enclosures to cool the servers therein.

20. The server farm of claim 19, wherein said cooling airflow input comprises a substantially horizontal conduit having a series of cooling airflow outlet apertures linearly defined therein to distribute said cooling airflow from a given cooling airflow outlet across multiple servers.

21. A server comprising an enclosure having a mounting structure dimensioned to operatively support a server mounted thereon within said enclosure, wherein said enclosure comprises a cooling inlet for substantially sealed fluid coupling with a cooling air source, and an exhaust for operative substantially sealed coupling to a server exhaust fan such that a negative pressure induced within said enclosure by said server exhaust fan draws in cooling air from said cooling air source via said cooling inlet.

22. The server mount of claim 21, wherein said mounting structure is dimensioned to operatively support two or more servers thereon within said enclosure, and wherein said

exhaust comprises respective exhausts for respective operative coupling to corresponding server exhaust fans.

23. The server mount of claim 22, wherein said cooling air inlet comprises an elongate air cooling member disposed so to distribute cooling airflow across each of said two or more servers.

24. The server mount of any one of claims 21 to 23, wherein said support structure is configured to support the servers in a substantially planar configuration such that one or more adjacently disposed servers are operatively disposed at a substantially same vertical distance above said network of cooling airflow outlets in receiving cooling airflow thereby directed thereto.

ABSTRACT

Described are various embodiments of a server farm housing, and ventilation/cooling system and configuration therefor.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1007P-DOM-PR01
	Application Number	
Title of Invention	SERVER FARM HOUSING, AND VENTILATION/COOLING SYSTEM AND CONFIGURATION THEREFOR	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
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Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

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All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	132815
Email Address	admin@mrfip.com [Add Email] [Remove Email]

Application Information:

Title of the Invention	SERVER FARM HOUSING, AND VENTILATION/COOLING SYSTEM AND CONFIGURATION THEREFOR		
Attorney Docket Number	1007P-DOM-PR01	**Small Entity Status Claimed**	☐
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	2	**Suggested Figure for Publication (if any)**	1

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1007P-DOM-PR01
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Title of Invention	SERVER FARM HOUSING, AND VENTILATION/COOLING SYSTEM AND CONFIGURATION THEREFOR

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	132815		

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix	
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1007P-DOM-PR01
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Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the application number blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Filing Date (YYYY-MM-DD)	Access Code (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1007P-DOM-PR01
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Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1007P-DOM-PR01
	Application Number	
Title of Invention	SERVER FARM HOUSING, AND VENTILATION/COOLING SYSTEM AND CONFIGURATION THEREFOR	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

- (●) Assignee
- ( ) Legal Representative under 35 U.S.C. 117
- ( ) Joint Inventor
- ( ) Person to whom the inventor is obligated to assign.
- ( ) Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	INVESTEL CAPITAL CORPORATION		
Mailing Address Information For Applicant:			
Address 1	200 Granville Street, Suite 1210		
Address 2			
City	Vancouver, BC	**State/Province**	OT
Country	CA	Postal Code	V6C 1S4
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1007P-DOM-PR01
	Application Number	
Title of Invention	SERVER FARM HOUSING, AND VENTILATION/COOLING SYSTEM AND CONFIGURATION THEREFOR	

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

Organization Name	INVESTEL CAPITAL CORPORATION

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	200 Granville Street, Suite 1210		
Address 2			
City	Vancouver, BC	**State/Province**	OT
Country i	CA	Postal Code	V6C 1S4
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1007P-DOM-PR01
	Application Number	

Title of Invention	SERVER FARM HOUSING, AND VENTILATION/COOLING SYSTEM AND CONFIGURATION THEREFOR

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Andre Merizzi/			Date (YYYY-MM-DD)	
First Name	Andre	Last Name	MERIZZI	Registration Number	64355

Additional Signature may be generated within this form by selecting the Add button.

Régie du bâtiment Québec

Installations électriques

Objet de ce formulaire : [X] Demande d'alimentation [ ] Déclaration de travaux

1. Numéro de dossier du distributeur	Numéro de formulaire 580502	Numéro de projet *(à l'usage de l'entrepreneur)*
2. Début des travaux (aaaa mm jj) : 2018-04-04	3. Fin des travaux (aaaa mm jj) : 2018-04-04	4. Alimentation prévue le (aaaa mm jj) : 2018-04-04

5. Propriétaire *(voir AVIS... au verso de la page 2)*

Nom légal : **Investel capital corporation**
Tél. travail : **514-313-3432** Ext. :
Tél. dom. :
Matricule : *(NEQ)*

6. Adresse des travaux

Nº civique : **1560** Rue ou route rurale : **Rang Petit** Suite :
Ville : **Ste-Madeleine** Prov.: **QC**
Code Postal : **J0H 1S0**
Nom de la rue avoisinante :

7. Responsable de l'abonnement *(si différent de la case 5)*

Nom :
Tél. travail : Ext. :
Télécopieur :

8. Adresse postale pour facturation *(si différente de l'adresse des travaux)*

Nº civique : **200** Rue ou route rurale : **Granville street** Suite : **1210**
Ville : **Vancouver** Prov.: **BC**
Code Postal : **V6C 1S4**

9. Usage du lieu

- [ ] Résidentiel unifamilial
- [ ] Résidentiel multi-logements : Nombre de logements : Nombre d'étages :
- PRÉCISER :
- [X] Commercial **Bitcoin**
- [ ] Industriel
- [ ] Institutionnel
- [ ] Autre

10. Type de travaux

- [X] Nouvelle installation permanente
- [ ] Branchement seulement
- [ ] Nouvelle installation temporaire
- [ ] Modification
- [ ] Addition ou réparation
- [ ] Force majeure
- [ ] Déplacement
- [ ] Ajout de branchements du client au branchement existant du distributeur
- [ ] Vérification pour l'alimentation
- [ ] Projets spéciaux

Travaux exécutés par l'entrepreneur :
- [ ] déconnecter au point de raccordement
- [ ] reconnecter au point de raccordement

11. Type de branchement [ ] Aérien [ ] Souterrain [X] Aérosouterrain

Branchement > 30 m [ ] oui

Coffret ≤ 200 A : *(120/240 V)* Branchement du distributeur à remplacer ou joint à refaire [ ] Oui

12. Type de réseau(x) existant(s) [X] Aérien [ ] Souterrain
Prolongement requis : [ ] Oui

13. Mode de chauffage [X] Électricité [ ] Mazout [ ] Gaz [ ] Bi-énergie

14. Type de chauffage électrique [X] Radiant ou plinthe [ ] Pompe thermique eau/air [ ] Pompe thermique air/air [ ] Chaudière à vapeur [ ] Chaudière à eau chaude [ ] Serpentin [ ] Central à air chaud

15. Détail des puissances à installer

Chauffage des locaux :	2 kW
Eau chaude :	4 kW
Appareils de cuisson :	kW
Climatisation :	kW
Réfrigération :	kW
Éclairage :	30 kW
Force motrice : (case 17) *	6 kW
Procédé de chauffe :	kW
Ventilation : (case 16) *	32 kW
Soudeuse :	kW
Autres :	1 400 kW
Total :	1 474 kW

* *Reporter sans facteur de conversion*

16. Forces motrices de la ventilation à installer

Nombre		Puissance		Total
5	x	4	=	20 HP
6	x	2	=	12 HP
	x		=	HP
Grand total :				32 HP

17. Autres forces motrices à installer

Nombre		Puissance		Total
2	x	3	=	6 HP
	x		=	HP
	x		=	HP
	x		=	HP
	x		=	HP
Grand total :				6 HP

18. Branchement du client [ ] 120/240 V [X] 347/600 V
Intensité nominale Coffret : **3000** A V *(autre tension)*

Branchement enlevé [ ] 120/240 V [ ] 347/600 V
Intensité nominale Coffret : A V *(autre tension)*

19. Mesurage des coffrets de branchement secondaires

	Nombre	Intensité nominale	Tension
		A	V
		A	V
Services :		A	V

24. Installation pour le mesurage [ ] Non mesuré (à forfait)

- [ ] Embases / [ ] Dispositif compteurs multiples — [ ] régulier / [ ] bi-énergie — [ ] Extérieur / [ ] Intérieur
- [ ] Coffret de branchement — Armoire pour transformateurs : [ ] située à droite du coffret [ ] située à gauche du coffret
- [X] Cabinet blindé (plans obligatoires)

Cas particuliers

20. Installation d'équipement sur poteaux du distributeur
- [ ] Amplificateurs/surpresseurs
- [ ] Signalisation
- [ ] Éclairage public

21. Pose de compteur seulement [ ]

22. Génératrice kW

23. Correction de défectuosités Numéro de dossier de l'avis

25. Compteur : Descellé le (aaaa mm jj) : Réinstallé (aaaa mm jj) : [ ] Oui [ ] Non No du compteur :

26. Remarques :

27. Coordonnées du titulaire de la licence

Nom légal : **Les Entreprises Électriques A&R Ltée**
Nº civique : **5655** Rue ou route rurale : **rue Lamoureux** Suite :
Ville : **St-Hyacinthe** Prov.: **Qc**
Code Postal : **J2R 1S3** Tél : **450-253-8690**
Cell : Fax : **450-253-0017**
Nº de la licence : **82640970**

28. Mandataire du client *(autre que le titulaire de la licence)*

Nom :
Nº civique : Rue ou route rurale : Suite :
Ville : Prov.: **Qc**
Code Postal : Tél :
Télécopieur :

30. Plans requis *(voir verso de la page 1)* Inclus : [ ] Oui

À compléter seulement lors de la déclaration des travaux

29. Signature du titulaire de la licence
Nom du signataire: **St-Onge Mathieu** Signature : X *Mat Stge*
Date de la signature (aaaa mm jj) : **2018-04-04**

31. Prêt pour le distributeur (aaaa mm jj) : **2018-04-04**

Formulaire officiel autorisé par la Régie du Bâtiment du Québec