GREEN DATA CENTER
TECHNOLOGIES
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Questions and Answers

Date 30.06.2024

Contents

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Why is the patent right relevant?

The relevance of the patent lies in its protection of technology that:

A. Actively reduces actual power consumption through software-driven optimization, thereby directly lowering the energy costs for data centers, and
B. Increases the temperature of secondary heat via the same software-driven optimization, increasing the heat's value by facilitating its sale for additional secondary industrial applications beyond the standard waste heat, while also contributing to a lower carbon footprint.

How big is the market?

The potential market size is significant. The patent family safeguards all technologies that optimize servers towards higher quality (read temperature) of secondary heat.

Heat recovery from data centers is applicable in a variety of regions worldwide, each with unique opportunities based on local conditions:

- **Colder Climates**: Northern Europe, Northern USA, Canada, South Australia, Japan, and Northern China where the waste heat can be used for district heating or warming facilities.
- **Temperate Zones**: During colder months, waste heat can be utilized for heating, whereas during warmer periods, the priority may be on efficient heat management within the data centers themselves.
- **Urban Areas**: Cities with dense populations can integrate waste heat into district energy systems, providing heating for residential and commercial buildings.
- **Industrial Areas**: Heat-intensive industrial processes, prevalent in various global regions, can benefit from the waste heat for operations like manufacturing and production.
- **Agricultural Regions**: Areas with significant agricultural activity might use waste heat for processes like ethanol production, food processing, and greenhouse heating.
- **Coastal Regions**: These areas can harness waste heat for marine-related applications like desalination, water treatment, and aquaculture.

Heat recovery from data centers is viable across the globe, yet various factors such as climate conditions, economic viability, and technological advancements influence its practical implementation. Thus, we've narrowed our market estimation to include data centers outside temperate zones. In temperate zones, while waste heat is useful in cooler times, the emphasis shifts to effective heat dissipation during warmer seasons to regulate data center temperatures.
Our market analysis includes both new and existing data centers being modernized or retrofitted in response to evolving regulatory standards.
Based on these criteria, we project that the potential market size includes over half of all existing and future data centers starting from 2024.

Sources:

https://brightlio.com/data-center-stats/#:~:text=The%20global%20data%20center%20market%20is%20massive%20and%20growing.,%3A%20Cloudscene%2C%20Datacentermap%2C%20Statista)

- *There are approximately 10,978 data center locations worldwide as of December 2023. (Various: Cloudscene, Datacentermap, Statista)*

- *The top 20 countries with the most data centers are the United States (5,388), Germany (522), the U.K. (517), China (449), Canada (336), France (315), Australia (306), Netherlands (300), Russia (255), Japan (219), Italy (168), Mexico (166), Brazil (163), India (152), Poland (143), Hong Kong (122), Singapore (99) New Zealand (81), Spain (81), Indonesia (79). (Various: Cloudscene, Datacentermap, Statista)*
- *Data centers consumed 7.4 Gigawatts of power in 2023, a 55% increase from the 4.9 Gigawatts in 2022. (Cushman Wakefield)*

The Data Center Marked is growing at an unprecedented rate

Numerous experts indicate a perfect storm where demand for new technology like generative AI necessitates a substantial number of new data centers and upgrades to existing ones, while there is a need for sustainable, energy-efficient solutions due to energy and environmental concerns.

Experts predict that investment in data centers will double, reaching a staggering $2 trillion within the next 4 to 5 years. (Source: Jensen Huang, CEO Nvidia, https://www.datacenterdynamics.com/en/news/nvidia-ceo-jensen-huang-predicts-data-center-spend-will-double-to-2-trillion/)

Energy constraints are the largest bottle-beck for building out data centers

If no action is taken, data centers alone are projected to consume between 10-35% of the world's electric energy by the year 2030. This is an amount of energy that by far exceeds what's available, even including planned new power plants. This statement is confirmed by executive leaders like **Mark Zuckerberg who describe energy constraints as the largest bottleneck for Meta's data center rollout.** (Source: https://www.datacenterdynamics.com/en/news/metas-mark-zuckerberg-says-energy-constraints-are-holding-back-ai-data-center-buildout/).

Regulatory Authorities are moving towards requiring data centers to reuse heat

Due to the significant energy constraints, combined with a drive towards sustainability, experts explain that intense pressure will be placed on data center owners and developers to implement solutions for reusing surplus heat and that this will be essential for obtaining construction permits and required electricity supply. **Regulatory authorities in several countries, such as the USA, Canada, and the EU, are looking into making such practices mandatory**.
For example, in the Digital Decade strategy, the EU states that it should take the lead in making data centers climate neutral and energy efficient by 2030, and that the **excess energy of the data centers should be recovered** (Source: https://www.ramboll.com/extract-heat-from-data-centres/will-data-centers-be-required)

Sources:

1. https://www.opencompute.org/documents/2024-02-22-ocp-heatreuse-wp-policies-vfinal-docx-2-pdf
   Policies to Accelerate Data Center Heat Reuse: Achieving Economic and Climate Change Goals, February 2024
   Report by Open Compute Project with authors from Stuttgart University, Uppsala University, and several Global Data Center Vendors, amongst them Microsoft:

   Data centers generate significant amounts of heat, and the industry uses significant amounts of power to cool them. ***But this liability can be turned into an asset by reusing this heat in industrial and commercial settings with needs for low temperature heat.*** *Doing so helps to save money and reduce carbon emissions both at data centers, through reduced power needs*

for cooling, and at industrial and commercial facilities, through an avoidance of carbon-intensive fuels to generate heating, cooling, and hot water. Key sectors which could use data center heat include commercial buildings such as large retail and office buildings, pharmaceuticals, food and beverage, hotels and resorts, medical and research laboratories, hospitals, bioethanol plants, and desalination and water treatment plants.

While data center heat reuse is a proven approach which has been available for more than a decade, only a limited number of projects have occurred as projects must overcome certain barriers. Those barriers include lack of knowledge of the technology and the opportunity; lack of proximity and connections between data centers and heat users; variations in local climate conditions cause differing heat needs; high risks and high costs of implementation; and lack of national and sub-national policy to facilitate and incentivize it

Fortunately, governments in Canada, Europe (Germany, the Netherlands, etc.), and the United States (US) have begun to adopt policies which could help. Governments at all levels should adopt policies to seize this opportunity.

Note! A comprehensive list of government policies pushing for heat reuse are listed in chapter 5.

2. https://www.apec.org/docs/default-source/publications/2023/apec-regional-trends-analysis-february-2023-update/promoting-energy-efficient-and-resilient-data-centres-in-the-apec-region/223_ewg_promoting-energy-efficient-and-resilient-data-centres-in-the-apec-region.pdf?sfvrsn=3076e0e9_2
   Promoting Energy Efficient and Resilient Data Centres in the APEC Region, APEC Energy Working Group February 2023
   Waste heat recovery improvement: ***The main barrier to waste heat recovery and reuse in data centres is that the heat collected from data centres, although plentiful, is low quality. Thus, increasing the operating temperature of data centres makes it possible to recover more high-quality heat.***

   To promote green computing initiatives throughout the entire lifecycle of a data centre, the ***HKC Government*** *collaborated with the industry actively, to research, develop and promote best practices and technologies for energy-smart data centres, i.e. the Green Data Centres Practice Guide.* ***The HKC Government would consider expanding the scope of regulation regarding the energy efficiency standards of building services installations.***

3. https://www.datacenterdynamics.com/en/news/germany-to-pass-energy-efficiency-act-demanding-heat-reuse-in-data-centers/
   The eventual ***German law*** *requires data centers to meet targets for PUE (power usage effectiveness) and* ***sets a quota for the reuse of waste heat from facilities.***

4. https://www.whitecase.com/insight-alert/data-center-requirements-under-new-german-energy-efficiency-act
   German Parliament *passes Energy Efficiency Act (EnEfG). One of the main emphases of the law concerns data centers: inter alia* ***waste heat requirements****, energy efficiency standards, and the information obligations that are imposed on data centers.*

5. https://www.techtarget.com/searchdatacenter/tip/Data-center-heat-reuse-How-to-make-the-most-of-excess-heat

*In addition, governments, like those in **France and Denmark**, may require new data centers to conduct feasibility studies for **using excess heat to benefit local communities in order to obtain building permits**.*

6. https://www.ramboll.com/extract-heat-from-data-centres/will-data-centers-be-required
   *Pressure is mounting on data centres and district heating companies to utilize excess heat and **include feasibility of heat extraction as a key criterion when selecting geographical locations**.*

7. https://www.jsa.net/eus-pursuit-of-sustainability-impact-of-the-energy-efficiency-directive-on-data-centres/
   *The **European Commission** has brought forward a new initiative to enhance sustainability in EU data centres, introducing an EU-wide scheme aimed at rating their sustainability. This move seeks not only to boost energy efficiency but also to address critical areas such as reducing energy and water consumption, while pushing for the adoption of renewable energy sources **and the innovative use of waste heat.***

8. https://venturebeat.com/data-infrastructure/the-ripple-effect-of-regulations-how-policy-is-reshaping-the-data-center-landscape/
   *This will give regulators visibility into current performance and opportunities for improvement. Once baseline data is collected, **Booth expects the E.U. will then incentivize further reductions through subsidies or penalties. Data centers with a Power Usage Effectiveness (PUE) over 1.5, for example, may face fines until that metric is lowered. Others may receive funds to install more efficient equipment.***

Technology like liquid cooling is becoming a pre-requisite and is enabling heat reuse

As technology progresses, CPUs and GPUs are being designed to run at higher performance levels, which leads to increased Thermal Design Power (TDP) – the maximum amount of heat a computer chip can produce that the cooling system is designed to dissipate. As these chips become more powerful, they consume more power and, in turn, generate more heat. To maintain the same form factor, that is, to fit these high-performance chips into the same sized chassis, the heat density (measured in kilowatts per chassis) increases.

Liquid cooling becomes essential because it is more efficient at transferring heat than air. Air cooling becomes less practical for high-end systems, especially those geared toward artificial intelligence (AI) and machine learning (ML), because the amount and velocity of air needed to cool these systems adequately would be unfeasible. Air simply cannot transfer enough heat away from the components to maintain temperatures within safe operating limits.

Sources:

https://www.us.jll.com/en/trends-and-insights/workplace/liquid-cooling-enters-the-mainstream-in-data-centers

Liquid cooling enters the mainstream in data centers

Soaring artificial intelligence workloads are pushing traditional air-cooling systems to the brink. To combat this challenge, both chipmakers and data center operators are turning to a more efficient solution: liquid cooling.

With rack densities set to grow beyond 70kW, the only viable solution for cooling these high-performance servers currently is liquid cooling — primarily direct-to-chip or immersion cooling, according to Andrew Green, Regional Data Center Practice Lead, Work Dynamics, JLL.

Leading the charge is data center operator Equinix, which plans to deploy liquid cooling in 100 of its data centers across 45 cities.
Similarly, Digital Realty has launched a high-density colocation offering powered by liquid cooling, handling workloads of up to 70 kilowatts (kW) per rack.

The marginal costs of expanding the existing liquid cooling infrastructure to include heat reuse are limited to additional piping, heat exchangers for transferring heat to secondary systems, and control mechanisms for managing the flow and temperature of the recycled heat. Given that the core cooling infrastructure — which represents the bulk of the investment — is already required for operational purposes, **retrofitting it for heat recovery becomes a cost-effective solution, leveraging existing investments to achieve greater energy efficiency and sustainability**.

Why does software-driven optimization result in direct energy savings ? (i.e., A)

Software-driven optimization in data centers reduces actual power consumption primarily through the strategic management of server utilization. By monitoring the workloads, the optimization software identifies servers operating at low utilization rates. These underutilized servers are inefficient, as they still consume a significant amount of power simply by being on — even if they are not performing any substantial tasks. This includes power drawn by the motherboard, peripheral slots, fans, and power supply units, which can add up to about 15% of the server's potential power consumption, even when it is not handling any workload. On top of these 15%, there is also the cost of cooling these components.

The optimization software then consolidates workloads, stacking them onto fewer servers that run at higher utilization. This process is akin to concentrating work into a smaller, more efficient workspace. As the tasks are transferred off low-utilization servers, those servers can be completely shut down, eliminating their idle power consumption entirely. This approach not only decreases the number of active physical machines, thus reducing power usage but also enhances the overall efficiency of the data center.
By only running servers that are actively needed and at optimal capacity, the data center can significantly cut down on wasted energy, contributing to both lower operating costs and a reduced environmental impact.

Estimated potential for reduction in actual power consumption ranges between 4% and 36%.

Sources:

https://cc-techgroup.com/data-center-energy-consumption/
On average, a typical server's utilization is between 5% and 15%, despite requiring full power to run

Hardware Report:
Energystar, https://www.energystar.gov/sites/default/files/asset/document/DataCenter-Top12-Brochure-Final.pdf

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What applications does high-quality waste heat have? (i.e., B)

To estimate the value of this high-quality heat reuse, one common approach is to consider the equivalent power consumption saved through heat reuse. This estimation takes into account factors such as the efficiency of heat extraction from the data center, the commercial value of the heat produced, and the cost of the electricity input.

The linked report shows that an average of 17,5% of the data center energy cost can be reduced by using heat-capture. In addition, the report shows that the market potential is the full global market.

See https://www.greendctech.com/wp-content/uploads/2024/06/GreenHorizon-Report-Heat-Capture-Market-Potential-07.05.2024-Signed.pdf

Sources:

1. https://greenmountain.no/why-green-mountain/heat-reuse/
   Since we are close to zero emissions from powering and cooling the data centers, our next goal is to implement true circularity projects. We want to reuse the waste heat from our data centers to benefit other industries. Currently, Green Mountain participates in two different heat reuse projects: ***Land-based lobster farm and Land-based fish farm***

2. https://www.opencompute.org/documents/2024-02-22-ocp-heatreuse-wp-policies-vfinal-docx-2-pdf
   Policies to Accelerate Data Center Heat Reuse: Achieving Economic and Climate Change Goals, February 2024

   Heat reuse presents an opportunity for both data center owners and end users of the reclaimed heat. Data centers can monetize their heat by selling it to end users for their CO_2 avoidance. The price of the heat will depend on various factors, including the energy savings of the end user's infrastructure and the avoided operational expenses associated with cooling the data center. For the end users, the heat has a zero-carbon footprint, allowing them to avoid emissions that would have been generated to create the heat.

   Heat reuse can contribute to decarbonizing buildings and industry. Specific opportunities include:

   - ***Space heating, including district heating****. Data center heat can be collected and distributed to nearby residential complexes or other industrial buildings in cooler climates for heating purposes. Concentrated districts comprising of data centers as well as industrial and residential buildings allow for an efficient network to facilitate heat transfer.*
   - ***Pharmaceuticals*** *– Heating, dehumidification or process heat needed in pharmaceutical processing, which occurs in laboratories and clean rooms with strict 24/7 environmental controls. The reused heat is filtered, preventing concerns of contamination.*
   - ***Food and beverage*** *– Many food and beverage manufacturing processes, including pasteurization, cooking, packaging, and cleaning, require hot water at temperatures produced by data centers. Heat is applicable to large, centralized fish, meat, and chicken processing as well as large breweries, high-volume greenhouses, and vegetable packing. Breweries can also harness heat for the beverage production process.*

- ***Commercial processing cooling and refrigeration*** *– Medical and research laboratories, hospital campuses, and large retail and office buildings require large amounts of mechanical cooling for seasonal and year-round cooling with high load factor (more so in the southern U.S.) that can be met with hot-water driven absorption. These needs would be most compatible with data centers sized from 1 to 10 MW.*
- ***Bio-ethanol production*** *– Bio-ethanol plants need sustained heat energy for the distillation and drying processes after sugars from the biomass input are fermented into ethanol. Heat from data centers has already been employed for bioethanol production within district heating grids in Europe.*
- ***Water distillation, desalination, and water treatment*** *– Repurposed data center heat can help power many water treatment projects.*
- ***General hot water pre-heating*** *– Data center heat can be used to preheat water for a wide variety of uses — space heating, domestic hot water generation, laundry, cleaning dishwashers, and pools. Pre-heating reduces end-user needs for fossil fuels to heat the water to its final desired temperature. This is a good match for large hot water users, such as hotels and resorts. In the hotel industry, water heating is the largest single end-use for energy, making up almost a third of total energy use. These opportunities include industrial laundry operations.*

Topic: Patent securitization status

What is the probability of being granted world-wide patent rights?

Through dialogue with our patent attorney, he points out that it is very likely that our patent will be granted internationally in all relevant regions.
This is also strengthened by a positive assessment of the patent from the European Patent Office.

Sources:

1. The support from the European Patent Office strengthens our message that the likelihood of international approval of the patent family is very high. See the "International Preliminary Report on Patentability" from European Patent Office: https://www.greendctech.com/wp-content/uploads/2024/06/P30684PC00_IPRP_Complete.pdf

2. Felipe Funega, Patent Laywer at Håmsø writes:
   "I understand this question relates to an assessment of how likely it is to achieve patent approvals in the further international patenting process.
   For clarity: This question relates to the international patent application no. PCT/NO2024/050031 (Håmsø ref. P30684PC00). This international application is currently at the international phase. The international search report and written opinion have been issued."

"Likeliness of patent approvals in the further international patenting process
From the outcomes we have seen so far, I can see that this patent family is progressing better than many other patent families do at this stage. A patent grant has already been achieved in Norway. I see no patent related reason to consider stopping or reducing the process."

See also a formal report from the Patent Attorney here: https://www.greendctech.com/wp-content/uploads/2024/05/Figurati_statement-from-Hamso_06052024.pdf

How can it be secured that no competing technologies with similar functions take over? (competing patents)?

Our Patent Attorney (Filipe Funenga, Håmsø) are currently working with the International Preliminary Examining Authority ("IPEA") which are investigating whether they can find any patents that are already granted or have filed an international patent application before we have (i.e. "Patent Pending").

Our Novelty, and thus the date from when potential settlements will count from, dates back to when our International Patent Application was submitted, 12.02.2024.

PCT Application no. PCT/NO2024/050031
Filing date: February 12, 2024
Title: "SYSTEM FOR AND METHOD OF HARNESSING HEAT GENERATED FROM RUNNING AT LEAST ONE VIRTUAL OPERATIVE SYSTEM INSTANCE"
Inventor(s): Rettedal, Richard; Knudsen, Bjørn; Birkeland, Christopher; Chauncy-Lie, Mat

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/NO2024/050031

6. ☒ With regard to top-up searches (Rules 66.1*ter* and 70.2(f)):
   - ☒ A top-up search was carried out by this Authority on 31.05.2024 (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
     - ☐ Additional relevant documents have been discovered during the top-up search.
   - ☐ No top-up search was carried out by this Authority because it would serve no useful purpose.

7. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* *If item 4 applies, some or all of those sheets may be marked "superseded".*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-24
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-24
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-24
	No:	Claims	

Figure 1: The written opinion from the International Preliminary Examining Authority ("IPEA")

The conclusion from International Preliminary Examining Authority is that all claims 1 -24, have Novelty, Inventive steps and Industrial applicability!

What duration do you anticipate for the patent's lifespan? What is the legally defined lifespan)?

As per the following figure, the Norwegian Patent was granted on the 25.03.2024 and **will be in force for 20 years from the date when the patent was filed (10.02.2023), i.e. until 2043. (See figure 3)**

The same will be in effect regarding the International Patent grant, which is a number of National Patent grants, as well as an EU collective one.
The international patent was filed on the 12.02.2024 and thus will be in effect until 2044. (See figure 4)

It is normal that patents are renewed, so the lifespan can be extended beyond 20 years.

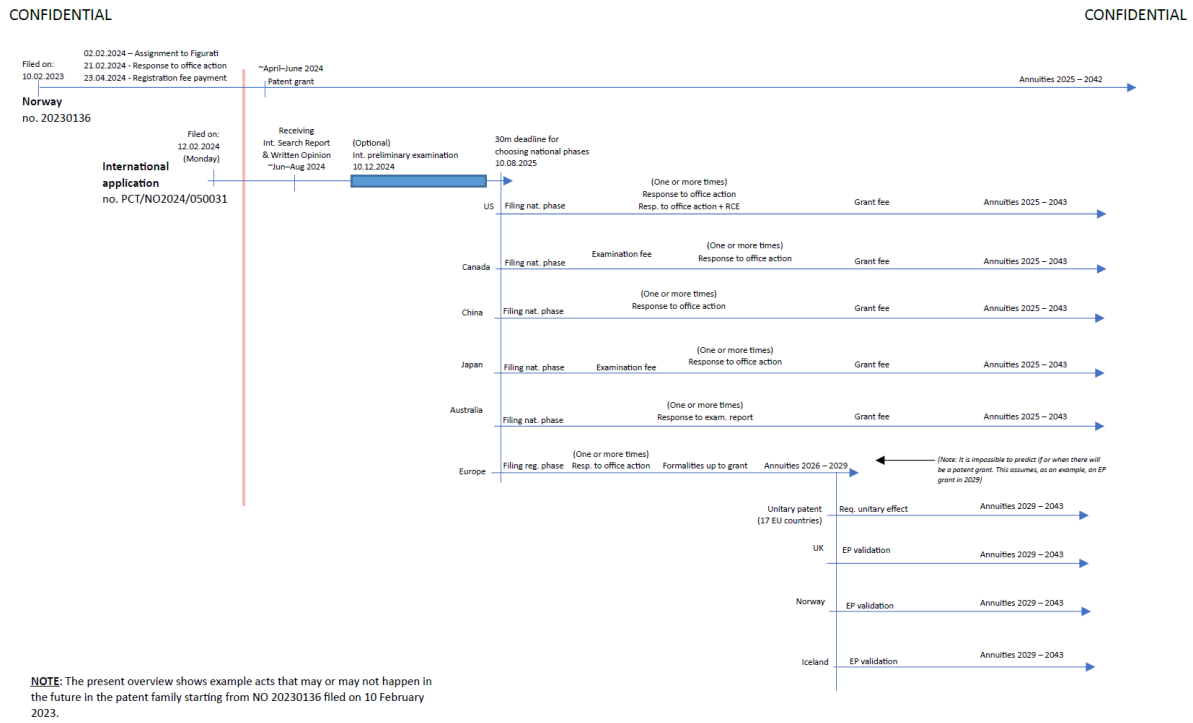

Figure 2: Timeline for Norwegian and International Patent Grants.

(12) **PATENT**

(11) **347793** (13) **B1**

(19) NO

NORWAY (51) Int Cl.

H05K 7/20 (2006.01)
G06F 9/50 (2006.01)
G06F 1/20 (2006.01)
G06F 1/32 (2006.01)
G06F 9/455 (2006.01)

Norwegian Industrial Property Office

(21)	Application nr.	20230136	(86)	International Filing Date and Application Number
(22)	Date of Filing	2023.02.10	(85)	Date of Entry into National Phase
(24)	Date of Effect	2023.02.10	(30)	Priority
(41)	Publicly Available	2024.03.25		
(45)	Granted	2024.03.25		

(73) Proprietor: Figurati AS, Gosenstien 17b, 4041 HAFRSFJORD, Norge
(72) Inventor: Richard Rettedal, Porsahagen 6, 4316 SANDNES, Norge
Bjørn Knudsen, Gosenstien 17B, 4041 HAFRSFJORD, Norge
Christopher Birkeland, Tastatunet 8, 4027 STAVANGER, Norge
Matt Chauncy-Lie, Muségata 73, 4010 STAVANGER, Norge
(74) Agent or Attorney: HÅMSØ PATENTBYRÅ AS, Postboks 9, 4068 STAVANGER, Norge

(54) Title: **SYSTEM FOR AND METHOD OF HARNESSING HEAT GENERATED FROM RUNNING AT LEAST ONE VIRTUAL OPERATIVE SYSTEM INSTANCE**

(56) References Cited:

US 2016123620 A1, US 2020037473 A1, WO 20210800787 A1, CA 3108958 A1
CHONGLIN, GU et al, Power Metering for Virtual Machine in Cloud Computing-Challenges and Opportunities, IEEE Access, 2014.09.19, (Epoque Accession No. XP034249342), doi: 10.1109/ACCESS.2014.2358992
DAYARATHNA, MIYURU et al, Data Center Energy Consumption Modeling: A Survey, IEEE Communications Surveys & Tutorials, Vol. 18, No. 1, 2017.01.27, (Epoque Accession No. XP011560214), doi: 10.1109/COMST.2015.2481183
ABDUL, S.H. et al, Towards Prediction of Power Consumption of Virtual Machines for Varying Loads, 2018 28th International Telecommunication Networks and Applications Conference (ITNAC), 2018.11.21, (Epoque Accession No. XP011597195), doi:10.1109/ATNAC.2018.8615319
BEREZOVSKAYA, J. et al, Reinforcement learning approach to implementation of individual controllers in data centre control system, 2022 IEEE 20th International Conference on Industrial Informatics (INDIN), 2022.07.25, (Epoque Accession No. XP033499864), doi:10.1109/INDIN51773.2022.9976179

Figure 3: The frontpage from the Granted Norwegian Patent, showing the date of effect.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P30684PC00	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/NO2024/050031	International filing date *(day/month/year)* 12.02.2024	Priority date *(day/month/year)* 10.02.2023
International Patent Classification (IPC) or national classification and IPC INV. G06F9/50		
Applicant GREEN DATA CENTER TECHNOLOGIES AS		

Figure 4: The frontpage from the International Patent filing, showing the international filing date.

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Topic: Royalty payment stream

Market timing: When do you expect to generate first royalty income?

We expect commercial software products that are in breach of the patent will be in effect in between 18 and 36 months.
The argument is that this we see indicators that software for optimization energy is already being developed by several players, however the providers likely do not know that they are in breach of our patent.
Even if this software is not already in development, it takes less than 36 months to develop such software from scratch, **a timeline which any professional product company can accelerate, likely down to a year.**

A sensible average for a timeline where such technology (which will be in breach of the patent) will be available in the marketplace, is 24 months.

Sources:

1. https://www.linkedin.com/pulse/untapped-potential-software-data-center-energy-efficiency-wong-tfksf/

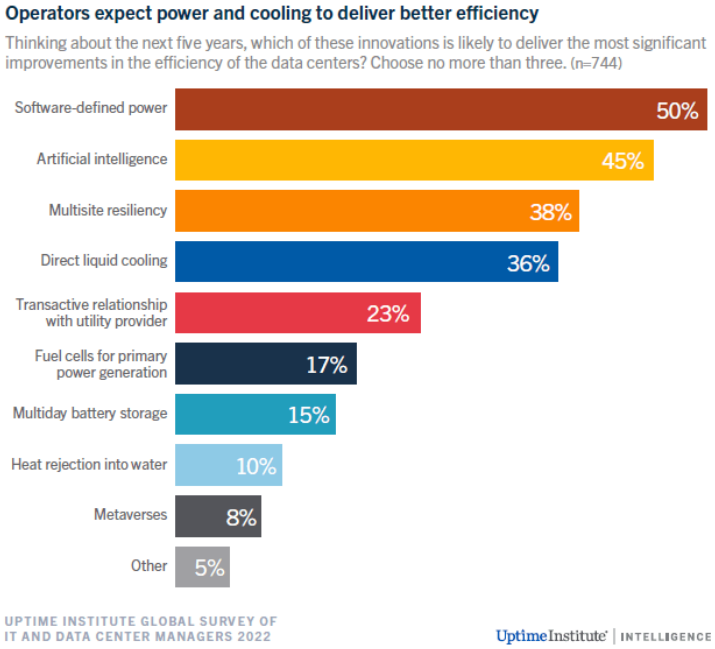
*"**In an era where every watt of electricity counts, the role of software in optimising energy usage is paramount**. Think of software as the conductor of an orchestra, fine-tuning each instrument to create a harmonious performance. Software algorithms can schedule tasks in a way that makes the best use of available resources, minimise idle time, and even predict and pre-empt computational bottlenecks."*

2. *https://www.mrlcg.com/resources/blog/the-role-of-efficient-software-in-powering-sustainable-data-centers/*

"In the ever-evolving landscape of technology, the significance of data centers cannot be overstated. They serve as the backbone of the digital world, handling immense amounts of information that drive our modern society. However, with this monumental task comes an equally substantial energy demand, leading to concerns about the environmental impact of these data behemoths.

*As the world gravitates towards sustainable practices, the spotlight is increasingly turning towards the role of software in making data centers more energy-efficient and environmentally friendly. While hardware advancements often steal the limelight in discussions about sustainability, **the software that powers these systems plays an equally vital role in optimizing operations and reducing environmental footprints**."*

3. https://venturebeat.com/data-infrastructure/data-center-ops-how-ai-and-ml-are-boosting-efficiency-and-resilience/
   "Energy costs are soaring, which means that operating data centers under budget is more challenging. ***CIOs and data center operators are concentrating on evaluating how software-designed power and AI can help exponentially reduce energy and cooling costs.****"*



Market timing: How long do you consider to be the ramp-up phase i.e., when do you expect to gain full traction in the market? Is there a customer acquisition strategy in place?

From a patent holders view (i.e. the owner of the patent who are licensing out rights for royalties):

- Traction with local policies for energy savings: ***already in place***
- Traction with local policies for heat harnessing in Scandinavia, EU, Canada, and Northern USA: ***1-2 years***
- Availability of technology in the marked that without a license will be in breach of the patent : ***2 years*** *(averaged 1,5-3 years)*
- Full traction of policies for enforcement of energy savings and heat harnessing in all relevant regions: ***4 years*** *(averaged 3-5 years)*
- Full royalty traction in the market from after the technology is available: ***4 years*** *(averaged 3-5 years)*

Thus, we believe that within 2 years there will be technology in the marketplace which will be in breach of the patent without a license. Over the following 4 years the sales of royalties will be ramped-up until full market penetration has been achieved.

Yes, we have defined the following Customer Acquisition Strategy for the Patent-holder.
Note! this is a proposed Customer Acquisition Strategy for the Patent-holder who has purchased the world-wide patent right from Green Data Center Technologies and are enforcing royalties on technology that are being delivered in the market.

1. Target Customers are identified as those that ultimately receive an invoice for electricity consumed in a data center. This includes Data Center Operators, Cloud Service Providers, and other organizations with large-scale IT-infrastructure.
2. We have identified a marked need for reducing total power consumption and proving efficiency.
3. The software optimalization solution can provide up to 30% reduction in power consumption, along with higher capabilities of the surplus heat generated from the data center.
4. We believe an optimal customer acquisition strategy is to pursue the market with a two-folded strategy where the first part consists of having trusted advisors that sell the technological and commercial benefit that comes with having a license, and the second part consisting of consultants that explore and investigate companies (the “Microsoft”-approach) for breach of the patent.
5. We suggest that the Patent-holder participate in specific Data Center and Cloud events in EU and US to promote the possibility to optimization of logical infrastructure for harnessing of heat to targeted customers. Being informative.
6. We suggest that the Patent-holder seek partnership with larger vendors to the Data Center industry to educate and penetrate the market quicker.
7. We suggest that the Patent-holder monitor and evaluate the different acquisition efforts and optimize our approach over time.

Market timing: For how many years do you anticipate the lifespan (economic life) of the technology based on the current patent?

There are no indications that software will ever be out-of-scope for optimization purposes. There is also no indication that heat as a resource will be irrelevant. **Thus, we expect the lifespan of a “optimization software” as protected by the patent, to be relevant throughout the lifespan of the patent, I.e. for at least 20 years.**

Market focus: Will the patent be applicable for the entire northern U.S. and Europe? And if so, in what scale. Norway would e.g. be more rigged for applying a technology to use on harnessed heat than other countries.

Yes, but beyond that. We believe that the potential market size includes over half of all existing and future data centers starting from 2024, world-wide.

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Market focus: What is the range of customers? To what extent does these include old/existing data centers and new data centers?

We believe that the potential market size includes over half of all existing and future data centers starting from 2024, world-wide.
I.e. even if the primary market will be all new data centers in the applicable regions, the retrofitting and upgrading of data centers, will mean that existing data centers will also be potential customers.

Market focus: Which part of the market do you expect to address? Which competing technologies do you expect? How have they been incorporated in your plan?

We do not foresee any competing technologies that will optimize servers for energy efficiency without being in breach of the patent.

Technology already exists that provide heat harnessing for district heating, like closed circuit liquid cooling with an inverter to water.
However, this solution, although performing heat harnessing, only generates water with lower temperatures, making it close to impossible to sell this to other consumers than district heating.
It is not possible to accumulate several low heat circuits and generate higher temperatures, without adding more electricity. The only possibility to achieve this type of high-quality heat (i.e. hotter temperatures) without supplying more electricity is to optimize the servers that are generating the heat in the first place using software. Hence, our patent.

Royalty rate / tax rate: Have you already determined a market royalty rate for licensing out the technology?

We have considered a royalty rate of 40% (*"Portion of Potential Energy Savings Applicable for Pricing Strategy"*) of the saved energy consumption, giving more than half of the value to the customer in terms of saved electricity, while also giving them also the option to resell more-high quality heat to other purposes/industries.

Royalty rate / tax rate: Public companies with similar technologies?

All the virtualization companies have similar technologies, however as soon as there is heat harnessing in the data center, they will be in breach of the patent.
We believe that all the Virtualization companies will pursue similar optimalization software. In addition, we believe that the major Cloud Providers will also pursue similar software. See more details in the answer to the next question.

Royalty rate / tax rate: Are you aware of any competitors / peer group companies which are publicly listed?

With the patent and novelty, we do not have competitors that are allowed to optimize for heat harnessing without a license from us.
So even if all the major Virtualization companies (see sources below) are pursuing similar software solutions, they will not be competitors, but rather clients that have to pay royalties to the patent holder.

In addition, all major Cloud Providers are heavy users of the virtualization technology described above and will therefore be consumers of the optimalization technology through their Virtualization vendor. **Thus, all of these will also be in breach of the patent if not paying royalties.**
Cloud Providers that most likely, or most definite, will pursue heat harnessing are companies such as RedHat, Alibaba, Amazon, Hetzner, SAP, HP, Cloudflare, Adobe, Dell. Also, companies using Open-Source software such as: Digital Ocean, RackSpace, Cloudflare, Linode, Tencent, OVHcloud, EC cloud, Salesforce, Vultr, Scaleway.

Source:

https://www.dnsstuff.com/server-virtualization-software
List of Top Companies in Desktop Virtualization Market
Citrix systems Inc.
VMware Inc.
Microsoft Corporation
Cisco Systems Inc.
Oracle Corporation
International Business Machines Corporation
Huawei Technologies Co. Ltd.
Nutanix Inc.
Amazon Web Services
Parallels International GmbH