2
2
3
4
4
4
6
6
6
6
7
7
8
9
10
10
10
12

# Audit Report - Solar Farm #475

### Overview

GCA: Fatima Khaziyeva

Location: 1900 W 27th St, Pueblo, CO 81003, USA

Coordinates: 38.2950996594734, -104.63141395851636

Solar Panels: **Quantity**: 20

Brand and Model: VSUN400-108BMH by VSUN Solar

Warranty: 30 years

System Wattage Output: 8.00 kW-DC | 5.80 kW-AC

Installation and Operations:

Installation Date: After June 25th, 2024

PTO Date: N/A Short ID: 475

Carbon Footprint & Production:

**Average Sunlight per day:** 5.1060 hours **Adjusted Weekly Carbon Credits =** 0.0729

**Weekly Total Carbon Debt = 0.0487** 

**Net Carbon Credit Earnings Weekly = 0.0242** 

**Protocol Fees:** \$17,639.17

Final Cost of Power: \$0.1845 per kWh

# Solar Farm Site Profile

Tests performed by GCA	Results	Reference
Inspected the Residential Solar Energy System Purchase Agreement to verify the legal name of the entity owning the solar farm.	Owner: Solar Farm #475	Residential Solar Energy System Purchase Agreement
Inspected the Residential Solar Energy System Purchase Agreement, and conducted on-site verification to ensure the geographic coordinates of the solar farm are accurate.	38.2950996594734, -104.63141395851636	Residential Solar Energy System Purchase Agreement & Screenshot of GCA phone location
Inspected the Plan sets, and conducted an on-site physical verification to corroborate the size of the solar farm as stated in the documents.	8.00 kW-DC   5.80 kW-AC	Planset p.1 & Audit Pictures
Inspected the Property Ownership Document, and conducted on-site verification to confirm the address and the zip code of the property.	1900 W 27th St, Pueblo, CO 81003, USA	Property Ownership & Residential Solar Energy System Purchase Agreement
Conducted on-site verification to visually confirm the installation of solar panels on the property	There are two sections of panels. First section with 12 panels and the second section with 8 panels. For a total of 20 panels.	Audit Pictures
Conducted on-site verification to visually assess the general condition and features of the property.	The solar panels are new and in good condition. They are located on the rooftop of the garage.	Audit Pictures

### Solar Panel details

Tests performed by GCA	Results	Reference
Inspected the document and conducted on-site verification to confirm the brand and model of the solar panels installed	VSUN400-108BMH by VSUN Solar	Planset [p.10] Audit pictures
Inspected the Manufacturer Warranty Document to verify the warranties provided for the solar panels	30-year warranty by VSUN Solar	Planset [p.10]
Inspected the Installation Approval by Pueblo Regional Building Department and conducted on-site verification to confirm the installation method of the solar panels	Installed professionally, adhering to industry norms.	Inspection and Permit document

### Calculation of the Expected Carbon Credit Production

Conducted calculations based on the specifications of the solar panels, historic data from WattTime and NASA, and any expected degradation to determine the expected carbon credit production per megawatt hour of electricity produced. For an in-depth understanding of these calculations, reference is made to the 'Assumption Documentation'.

Coordinates: 38.2950996594734, -104.63141395851636

**Average Sunlight per day:** 5.1060 hours **Carbon Credit Production per MWh:** 0.3922

### Calculations:

http://95.217.194.59:35015/api/v1/geo-stats?latitude=38.2950996594734&longitude=-104.6314 1395851636

### **Legal Documents**

Tests performed by GCA	Results	Reference
Inspected the document to verify the ownership of the electricity generated by the solar panels	Ownership of the electricity generated by the solar panels has been confirmed.	Residential Solar Energy System Purchase Agreement
Inspected the document to verify the authorization for certifying carbon credit	The document has been inspected and verified for proper authorization to certify carbon credits.	Residential Solar Energy System Purchase Agreement

Inspected the document and verified the solar farm owner's signature authorizing the list of information permitted for online publication	The solar farm owner's signature authorizing the list of information for online publication has been inspected and confirmed.	Residential Solar Energy System Purchase Agreement
Inspected the document to verify the details concerning the long-term operation of the solar panels	The document detailing the long-term operation plans and specifications of the solar panels has been inspected and verified.	Residential Solar Energy System Purchase Agreement
Inspected the document and verified the solar farm owner's signature authorizing the installation and utilization of monitoring equipment	The solar farm owner's authorization for the installation and utilization of monitoring equipment has been inspected and validated.	Residential Solar Energy System Purchase Agreement
Inspected the document and verified the solar farm owner's signature authorizing additional auditor visits.	Confirmation was obtained on the solar farm owner's signature authorizing additional auditor visits as per the inspected document.	Residential Solar Energy System Purchase Agreement

### Carbon Footprint Assessment & Calculations

In the assessment of the carbon footprint of the solar farm using monocrystalline technology, the harmonized emission result of 40g CO2-eq/kWh was applied. This figure is anchored in assumptions such as ground-mount application, solar irradiation of 2,400 kWh/m²/yr, a performance ratio of 0.8, and a panel lifetime of 30 years. For an in-depth understanding of these assumptions, reference is made to the 'Assumption Documentation'.

Tests performed by GCA	Results	Reference
Conducted independent calculations to assess the weekly minimum carbon payment required	The carbon payment plan is an automated process, subtracted directly from the farm's weekly carbon credit production. This system does not involve any actual monetary transfers. Additionally, a crucial safeguard is in place whereby an owner cannot default on these carbon payments, as auditors will not certify any farm whose debt payments exceed its capacity to offset.  Adjusted Weekly Carbon Credits = 0.0729 Weekly Total Carbon Debt = 0.0487 Net Carbon Credit Earnings Weekly = 0.0242	Detailed calculations [p1]

### Disaster Risk Assessment

In the disaster risk assessment of the solar farm, a conservative failure rate of 1% within the first 10 years of operation in the United States was adopted. This rate is derived from extensive research on historical failure rates and professional surveys, coupled with a conservative approach to accommodate unforeseen circumstances. Consequently, the per-year failure rate is calculated to be 0.17%. For a comprehensive explanation of the underlying assumptions and methodology, refer to the detailed information provided in the 'Assumption Documentation'.

### **Technical Innovations**

Upon physical inspection, it was observed that the solar farm employs standard commercial solar panels and does not feature any distinct technological innovations.

### **Communication Channels**

The owner has acknowledged receipt and understanding of the established protocols for post-audit communication. This includes a comprehensive system for reporting any incidents, abnormalities, or significant changes that may occur following audit activities. Additionally, the owner confirms having received an updated list of contacts designated for post-audit communication purposes. A commitment has been made to adhere strictly to these protocols

and to promptly report any valuable changes or findings in accordance with the outlined procedures. The full details of these declarations and compliance are documented in the referenced 'Residential Solar Energy System Purchase Agreement'.

### GCA information

This audit report has been prepared and finalized by an auditor who has fully complied with and signed the required clauses as outlined in the 'Auditor Disclosure and Declaration Document'. These clauses include the auditor's non-ownership of solar farms, non-possession of Glow tokens unless staked, non-ownership of unretired carbon credits, restriction on owning stocks or tokens outside of broad market exposure index funds, absence of business conflicts of interest, and adherence to the Glow International Code of Conduct. Additionally, the auditor has agreed to maintain a low community profile, with an undertaking to retire if they exceed a threshold of 5,000 social media followers/friends, ensuring unbiased and impartial auditing. The full details of these declarations and compliance are documented in the referenced 'Auditor Disclosure and Declaration Document'.

### Conclusion

The audit confirms that the solar farm's location and specifications match the owner's reported information. The audit confirms that the solar farm meets these specifications, qualifying it for Glow Labs' incentive protocol.

The on-site inspection and monitor box installation was fully completed by Jared Morgan, on October 15th, 2024.

# Appendix - Calculations

carbon debt per KWh	value	details			
carbon footprint (CO2 g/KWh)	40	see assumption document			
convert grams to metric tons	0.00004	conversion			
solar irradiation (total h/y)	2400	see assumption document			
performance ratio	0.8	see assumption document			
panel lifetime (y)	30	see assumption document			
total carbon debt per KWh	2.304				
adjustment due to uncertainty	35%	see assumption document			
total carbon debt adjusted per KWh	3.1104				
Adjusted carbon debt	value	details			
annual interest rate	0.17%	see assumption document			
Commitment (y)	10	see assumption document			
total adjusted carbon debt per KWh	2.343				
weekly production	value	details	weekly Carbon debt	value	details
Power Output (MWh)	0.0080	based on solar production (see planset doc)	total carbon debt adjusted (KWh)	3.1104	calculated above
Hours of Sunlight Per Day	5.1060	based on NASA data API	Power Output (MWh)	0.0080	based on solar production (see planset doc)
Weekly Power Production (MWh)	0.2859		convert to KW	8.0000	conversion
Carbon Offsets per MWh	0.3922	based on WattTime data API	Total Carbon Debt produced	24.8832	
Weekly Carbon Credits	0.1121		disaster risk assessement per year	0.0017	see assumption document
adjustment due to uncertainty	0.3500	see assumption document	Commitment (y)	10.0000	see assumption document
Adjusted Weekly Carbon Credits	0.0729		Adjusted Total Carbon Debt	25.3019	
			Weekly Total Carbon Debt	0.0487	
NET Carbon Credit Earnings weekly	0.0242				

		Protocol fees calculations	Address:	1900 W 27th St, Pueblo, CO 81003, U	SA		
First Year Electricity Old Price	value	details	Coordinates:	38.2950996594734, -104.6314139585			
Electricity Price (paid by user) (in kW)		see electrical usage bill (august 2024)	API Link:	http://95.217.194.59:35015/api/v1/geo		950996594734&longitude=-104.63141	139585163
convert kW to mW		conversion	input average_sunlight	5.1060074794521			
Hours of Sunlight Per Day		based on NASA data API	input average_carbon_certificates	0.3921625320254			
Power Output (MWh)		B based on solar production (see planset doc)	system size from planset:	8.00 kW-DC   5.80 kW-AC			
number of days	365.25		# of panels:	20			
First Year Electricity Old Price	\$2,753.12	2					
Lifetime Old Electricity Value	value	details					
First Year Electricity Old Price	\$2,753.12	2 calculated above					
Escalator Rate	2.65%	see escalator reference for CO: https://www.solarreviews.com/blog/average-electricity-cost-increase-per-year					
Cashflow Discount		see assumption document					
Continous Growth Rate LN(escalator * discount)	9.04%						
Commitment (years)	10		_				
Present Value	\$17,639.17						
Protocol fees	\$17,639.17						
	Dotailed E	inergy Cost Calculation - August 2024					
Total kWh usage	658						
Total Kyvii usage	658	1	+				
		Charges and Fees	1				
Energy Charge 500 kWh	\$0.09999						
Energy Charge 158 kWh	\$0.13004		1				
Average Price per kWh	0.11502		7				
Base Price of usage (usage x Average Price)	75.680		1				
			7				
	Fee amount		1				
General Rate Sch Adj	-\$2.98	3					
Clean Air Clean Jobs	\$2.92						
Transmission Cost Adj	\$5.47						
Energy Cost Adj	\$24.67						
Purch Cap Cost Adj	\$1.29						
Demand Side Mgt Adj	\$3.35	3					
Renew Energy Std Adj	\$2.28	3					
Elect Vehicle Rider	\$0.13	3					
Taxes and fees: Local and state taxes and fees	\$8.61						
Total Fees	45.74	1					
Total Cost (Base Price + Total fees)	121.420						
Total Price per kWh (total cost / Total kWh use)	0.1845						
888-890-5554	Service address: 19	900 W 27TH ST PUEBLO,CO					
Usage history	August bi						
Aug 658 kWh	Rate Schedule RS1- Meter: EL18392897	I-Residential Service (CO860)					
Jul 681 kWh	Kilowatt Hours						
Jun 556 kWh	Reading	8/8/24 18408 Kilowatt Hours (kWh) 7/9/24 -17750 Kilowatt Hours (kWh)					
May 514 kWh Apr 672 kWh		658 Kilowatt Hours (kWh)					
Apr 6/2 kwh	Delivery and di	listribution: Costs to bring energy to your address. \$84.73 07/09/24 - 08/08/24, 30 days.					
Feb 614 kWh	Customer Charge Energy Charge 500						
Jan 549 kWh	Energy Charge 500 Energy Charge 158	36.// 0 kWh @ \$0.09999 \$50.00 kWh @ \$0.13004 \$20.55					
Dec 447 kWh	General Rate Sch A Clean Air Clean Job	\$\text{Win \\mathre{\matri{\matri{\matri{\min}}}}}}}} \endots \aligne{\mathre{\mathre{\mathre{\mathre{\mathre{\mathre{\mathre{\mathre{\mathre{\matri{\matri{\matri{\min}}}}} \endots \aligne{\mathre{\min}}}} \endots \aligne{\mathre{\min}}} \endots \aligne{\mathre{\min}}} \endots \aligne{\min}} \endots \endots \endots \endots \endots \endots \endots \endots \endots					
Nov 334 kWh Oct 635 kWh							
Oct 635 kWh	Energy supply: Billing Details for 0	: Cost of electricity. \$25,96 07/09/24 - 08/08/24, 30 days.					
Aug 1,116 kWh	Energy Cost Adi 65	58 kWh @ \$0.03749 \$24.67 ¶ 658 kWh @ \$0.00196 \$1.29					
	Purch Cap Cost Adj EGCRR 658 kWh @	g 658 kWh @ \$0.00196 \$1.29 @ \$0.00 \$0.00					
	Other costs: Cre	redits, adjustments and other charges. \$7.55					
Messages	Billing Details for 0	07/09/24 - 08/08/24, 30 days. Adj \$10.69 @ 3.03% \$3.35					
	Renew Energy Std .	Adj \$114.04 @ 2% \$2.28					
	Low Income Progra	am Funding Fee \$1.00 5.0002 \$0.13					
	EASBC EASBC	\$0.79 \$0.79					
	Taxes and fees:	s: Local and state taxes and fees. \$8.61					
	Billing Details for 0 Franchise Fee \$117.4	07/09/24 - 08/08/24, 30 days.					
	Undergrounding Fe	ee \$117.45 @ 0.5% \$0.59					
	Actual charges						

# Appendix - Protocol fees - Proof of payment

### **Transaction hash:**

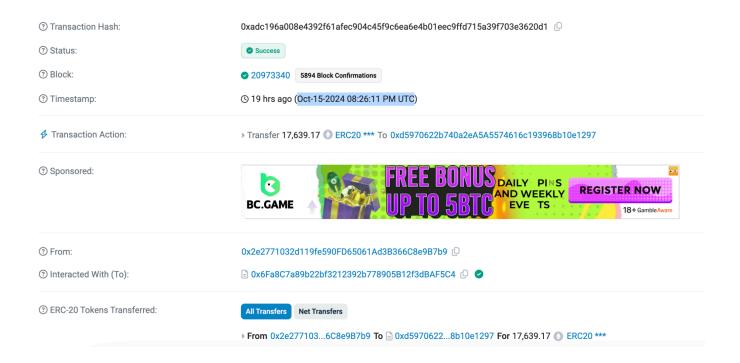
0xadc196a008e4392f61afec904c45f9c6ea6e4b01eec9ffd715a39f703e3620d1

### **Etherscan link:**

https://etherscan.io/tx/0xadc196a008e4392f61afec904c45f9c6ea6e4b01eec9ffd715a39f703e3620d1

**Amount paid:** 17,639.17 USDG

Date of payment: Oct-15-2024 08:26:11 PM UTC



# Appendix - Evidences Obtained From Solar Farm Owner

The GCA has successfully completed a thorough review and verification process for the following critical documents:

- 1. Residential Solar Energy System Purchase Agreement
- 2. Planset
- 3. Mortgage Statement
- Two recent Utility Bills
- 5. City Permit
- 6. Inspection Document

The owner of the solar farm has mentioned that the utility company does not provide a PTO document. Obtaining the PTO is not a requirement for the farm to participate in the Glow ecosystem.

- The absence of a PTO does not prevent the solar farm from being part of the Glow ecosystem, as it does not infringe on any fundamental operational requirements set by Glow.
- The GCA's role is not to verify compliance with the city's regulations.

# Appendix - Drone Footage

To ascertain the additionality of the solar farm, the GCA procured drone footage BEFORE the solar panels were installed. This step was vital to confirm that the farm had not previously produced power, aligning with Glow's strict requirement that only new solar farms are eligible for incentives.

David Armenta Photography, a local company, was contracted by the GCA to capture pre-installation photos. The drone footage before installation was obtained on June 25th, 2024.

After the solar panels were installed, the GCA acquired new drone footage. This subsequent step ensured that the panels were correctly installed and that their quantity matched the specifications outlined in the plansets.

The drone footage after installation was obtained by Jared Morgan on October 15th, 2024.

# Appendix - Cost of Power Verification

The determination of the protocol fee involves the homeowner submitting a utility bill, which outlines their power expenses. To ensure the integrity of this fee calculation, the GCA cross-reference the utility bill with publicly available data from the utility provider regarding local power rates.

The GCA accessed the Standard Residential Rates from Black Hills Energy Utilities, applicable

in Colorado. For the protocol fee calculation, the rate of \$0.1845 per kWh, was applied.

### Link:

https://www.blackhillsenergy.com/billing-and-payments/rates-and-regulatory-information/colorado-rates-and-regulatory-information

# Appendix - Assumptions document

# **Assumptions Documentation**

This document outlines the assumptions and methodologies employed in the audit of solar farms. It is intended to provide a clear basis for the procedures and findings reported in the audit report. This document should be referred to for a deeper understanding of the audit findings and the underpinning rationale for the audit procedures.

# **Testing Methodologies**

### Nature of tests performed

Туре	Description
Inquiry	Engaged with relevant personnel to gather information and corroborated the details
On-site verification (Observation)	Conducted a thorough observation to verify the application and performance, as well as the physical existence of the solar farm's components
Inspection	Performed a detailed examination of documents, records, or tangible assets to validate their authenticity and relevance to the audit
Calculation	Performed calculations to ascertain various metrics pertinent to the audit scope

## **Assumptions**

### Protocol fees

Introduction: When a solar farm joins the Glow network, a protocol fee in USDC is required. This fee is distributed as rewards to carbon credit producers over four years.

Assumption: It's necessary to compute the cost of the protocol fee over a 10-year span. This calculation must encompass potential variations in electricity pricing and consider the long-term financial implications for the solar farm.

### Methodology:

First Year Electricity Price Calculation: Begin by calculating the first year of electricity price using the following formula: Previous Electricity Price in kW × Hours of Sunlight Per Day × Power Output (MW) Per Hour × number of days.

Present Value Calculation: Next, extrapolate this first-year electricity price over a 10-year period, accounting for potential escalations in electricity prices. The escalation rate is dependent on the state in which the farm is located, with data sourced from reliable industry insights. This approach assumes that electricity prices will increase over time, which is a significant factor in the economics of solar energy.

Cash Discount Application: Apply a cash discount of 11% to the present value calculation. This rate is derived from doubling the current federal rate (estimated at 5.5%), with the rationale being the relative ease of surpassing this federal rate under current economic conditions. This 11% rate is specifically for the beta period of Glow, incentivizing early solar farm onboarding. After the beta phase, the standard federal rate will be used for discount calculations.

#### References

https://www.solarreviews.com/blog/average-electricity-cost-increase-per-year

### Disaster Risk Assessment

Assumption: A conservative failure rate of 1% is assumed for solar farms within the first 10 years of operation in the United States.

Methodology: Extensive research on historical failure rates of solar farms in the United States within the first 10 years has been conducted, with a conservative multiplier applied. Furthermore, professional surveys have been conducted. Despite discussions with solar professionals indicating a failure rate far below 1% over the lifetime of the solar farm, a conservative estimate of 1% was chosen to account for unforeseen circumstances. The per-year rate is 0.17%.

### Carbon Credit Estimation Calculation

Assumption: WattTime's historical data is reliable and accurate for conducting calculations related to carbon credit production.

Methodology: Calculations were conducted based on the specifications of the solar panels and using historical data from WattTime. WattTime, a reputable non-profit organization in the emissions reduction domain, provides robust technology solutions for such assessments. Additionally, the methodology incorporates data from NASA's API to determine the expected number of sunlight hours for a solar panel in a specific location. This data is crucial for accurately estimating the average hours of sunlight per day and the average carbon offset per MWh.

To calculate the expected lifetime carbon credit production, the power capacity of the solar panels is multiplied by the sunlight hours, integrating both WattTime's and NASA's data. The script iterates over historical data from the WattTime API, combined with NASA's sunlight data, to estimate the number of credits a panel would have produced annually.

A 35% discount is then applied to the final carbon production value. This conservative approach is designed to account for any uncertainties in the calculations, ensuring that the results are within safety margins. This not only enhances the credibility of the protocol and methodology but also positions the analysis positively, especially when subjected to detailed reviews.

Real-Time Monitoring: It should be noted that for real-time monitoring of power output, NASA data is not utilized; instead, this monitoring relies on the installed equipment at the solar farm. This data can be cross-referenced with NASA's data if any discrepancies or suspicions arise, providing an additional layer of verification and accuracy.

#### Reference:

 https://github.com/glowlabs-org/gca-backend/blob/main/watttime-scripts/carbon\_ credits\_per\_kw.py

### Carbon Footprint Assessment

Assumption: Considering the inherent variability in life cycle assessment (LCA) results for solar technologies as per ISO 14040 and 14044 standards, we have selected the highest value from NREL's harmonized data set for our conservative approach. This decision acknowledges the ISO standards' provision of a flexible framework for LCA, which can lead to a broad range of outcomes depending on the practitioner's choices. By adopting the highest value, we aim to account for the upper bound of potential environmental impacts, thereby ensuring that our audit conclusions are robust against the variability in LCA practices.

Methodology: The methodology involves utilizing the harmonized LCA results, which are refined by NREL to enhance precision and reduce variability. By adhering to a consistent set of methods and assumptions, harmonization narrows the range of greenhouse gas (GHG) emissions estimates, allowing us to base our audit on a more reliable and standardized benchmark.

It is important to note the specific harmonized greenhouse gas (GHG) emissions medians identified in our assessment. For monocrystalline Silicon (mono-Si), the harmonized GHG median is 40 g CO2-eq/kWh, and for multi-crystalline Silicon (multi-Si), it is 47 g CO2-eq/kWh. These values are calculated based on assumptions of ground-mount application, solar irradiation of 2,400 kWh/m²/yr, a performance ratio of 0.8, and a panel lifetime of 30 years. By integrating these specific medians into our assessment, we ensure a comprehensive and precise understanding of the potential environmental impacts of these solar technologies.

A 35% adjustment is then applied to the total carbon debt. This conservative approach is designed to account for any uncertainties in the calculations, ensuring that the results are within safety margins. This not only enhances the credibility of the protocol and methodology but also positions the analysis positively, especially when subjected to detailed reviews.

#### Detailed calculations:

### **Initial Calculation:**

40 grams CO2 per kWh (emissions rate).

Multiplied by 2400 hours per year (operational hours).

Multiplied by 0.8 (performance ratio).

Multiplied by 30 years (lifespan of the panels).

### **Adjusted Carbon Debt:**

Calculated by adding a 0.17% annual interest rate.

The total carbon debt is multiplied by 1.0017^10 to account for 10 years.

#### **Weekly Debt Payment:**

Determined by dividing the final carbon debt by 520 weeks (which accounts for 10 years, considering 52 weeks per year).

### Reference:

- NREL harmonized life cycle assessments (LCAs)
- Methodology Guidelines on Life Cycle Assessment of Photovoltaic Electricity
- https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc wg3 ar5 annex-iii.pdf p.7
- https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1530-9290.2011.00423.x p.9
  - Research base on solar irradiation of of 2,400 kilowatt-hours per square meter per year (kWh/m2/yr) and lifetime = 30 years
- https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1530-9290.2011.00439.x

0	The harmonized GHG medians decline to 40 g CO2-eq/kWh for mono-Si and 47 g CO2-eq/kWh for multi-Si.

### **CGA** Disclosure and Declaration Document

### CGA Personal and Professional Information

Name: Fatima Khaziyeva

Nationality: Canada

### **Declarations**

1. No Ownership of Solar Farms:

I hereby declare that I do not own or operate more than one solar farm.

2. Glow Tokens Holding:

I declare that I do not own any Glow tokens, unless staked in accordance with company policies.

3. Carbon Credits:

I confirm that I do not own any unretired carbon credits.

4. Stocks and Tokens Ownership:

I declare that I do not own stocks or tokens, except for those within broad market exposure index funds.

5. Conflict of Interest:

I confirm the absence of any business conflicts of interest that could affect my impartiality as an auditor.

6. Code of Conduct Compliance:

I acknowledge having read, understood, and agreed to adhere to the Glow International Code of Conduct.

7. Community Presence and Popularity Clause:

I acknowledge that as a Glow Certified Auditor (GCA), it is imperative to maintain a low profile within the community to ensure unbiased and fair auditing processes. I agree that:

- If I previously expressed thoughts or opinions publicly, I understand these should not influence my role as a GCA.
- I will not leverage my position or knowledge gained as a GCA to become a known figure within the Glow ecosystem, recognizing the importance of an unbiased and impartial audit process.

# Signature

The undersigned hereby agrees to the above terms and confirms that all statements made are true and accurate to the best of my knowledge.

Name: Fatima Khaziyeva

Signature: Fatima Khaziyeva

Date: October 16th 2024