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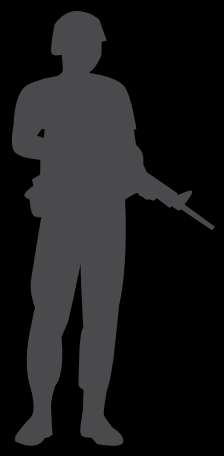
THE **PRIMARY** ISSUE

BUY THE NUM-BERS

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HASH RECON

BY JOE RODGERS



We're less than 30,000 blocks out from the halvening and the stakes couldn't be higher. For many Bitcoin mining operators, this will make or break the bets made during this Bitcoin epoch. Did I grow too fast? Can I handle a catastrophic drop in hashprice? Will my operations get rekt by my current energy contract? Bitcoin itself remains indifferent. The halvening is inevitable, encoded by Satoshi at Bitcoin's genesis and enforced by nodes across the world. The blocks will continue to flow and there will be blood. The big question many are asking is how to weather this looming battle. Perhaps the better question is where to be positioned on the board when the battle happens. It's one thing to know how to build and operate an efficient fleet of bitcoin miners, but the critical success factor remains energy cost. It comes down to your position on the map. In order to find the higher ground, you must perform hash recon.

This halvening event will challenge even the most battle-hardened veterans. They will need to optimize their operations at all costs. For inexperienced operators, energy cost might seem like a variable that you can overlook. They solely focus on stacking as much hashrate as possible and tend to altogether forget about efficiency — the energy consumed per hash produced. In the long run, energy cost is the most important variable. Sure, your dollars per terahash are important, the bitcoin price is important, and so is network hashrate. It's all important. But energy cost is the kingmaker. Afterall, the 7-year-old, legendary Antminer S9 is still profitable today with cheap enough energy.

At the heart of miners' considerations are two foundational elements: mining revenue and energy expenses. These two variables are used to quickly run the numbers on mining profitability. It's important to note that this does not take into account the additional operating costs like labor and other associated expenses that go into running a mine. It remains a useful formula for keeping the lights on.

Mining operators come in many different sizes, and the easiest way to distinguish them is based on how much power they are using. Here in the U.S., the Energy Information Administration (**EIA**) is responsible for monitoring energy trends and categorizes consumption and power costs into Residential, Commercial, and Industrial customer power rates. We will focus on how mining operators would profit on the applicable rates across each of these three categories:

RESIDENTIAL:

<30 kW

— Encompassing home miners with 1 to 10 bitcoin mining machines. Typical homes cannot handle much more energy than this and would require additional electrical infrastructure being installed. Residential scale has the highest energy rates within the same state.

COMMERCIAL:

30 kW–1 MW

— Covering small to medium-sized business and bitcoin mining operators with 10 to 300 mining machines. The Commercial scale range is characterized by energy consumption that is larger than Residential but not quite Industrial scale. This range is typically up to 1 MW in size. While commercial-scale miners have better rates than residential customers within the same state, they are not big enough to successfully negotiate with power companies.

INDUSTRIAL:

>1 MW

— Operations with more than 300 mining machines. Industrial-scale operators are large enough consumers of power that they can negotiate energy costs via power purchase agreements and acquire energy at the lowest cost within the same state.

Despite these variations in scale, all three categories of mining operators are united by a common need for cost-efficient power. While some miners may be limited by geographical constraints, enterprising miners are actively exploring regions with affordable energy rates — we'll call that jurisdictional arbitrage — while others are trying to scale into situations where they are large enough to have a seat at the table to negotiate lower rates.

WAR GAME

Now that we have a better understanding of what different scale operations look like, let's run the numbers. Since we don't have the benefit of a crystal ball, we will simulate a war game using the following data points:

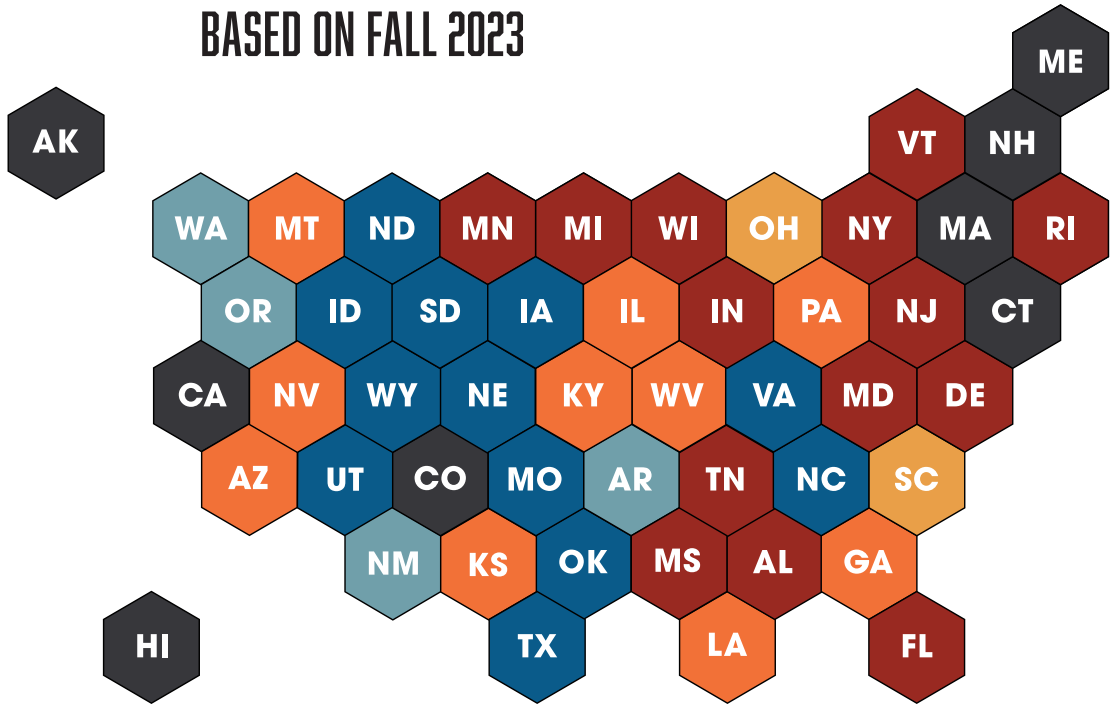
- BTC Price at $30,000.
- Network Hashrate at 400EH/s.
- Bitmain Antminer S19j Pro 100TH/s at 3kW per unit.
- Residential Scale: 10 Bitcoin Miners.
- Commercial Scale: 100 Bitcoin Miners.
- Industrial Scale: 1000 Bitcoin Miners.
- Energy Rates at 2023 YTD (EIA).

Let's apply our simple mining profitability formula (mining revenue minus power cost) to see how mining operators would handle this scenario across the U.S.

State	Residential Cents/kWh	Residential Energy Cost	Residential Monthly Profit	Commercial Cents/kWh	Commercial Energy Cost	Commercial Monthly Profit	Industrial Cents/kWh	Industrial Energy Cost	Industrial Monthly Profit
North Dakota	10.17	$2,233	$169	8.25	$18,117	$5,902	6.68	$146,693	$93,495
Utah	10.8	$2,372	$30	8.3	$18,227	$5,792	6.93	$152,183	$88,005
Idaho	10.37	$2,277	$125	8.33	$18,293	$5,726	6.23	$136,811	$103,377
Oklahoma	11.66	$2,561	-$159	8.76	$19,237	$4,782	6.12	$134,395	$105,792
Nebraska	10.5	$2,306	$96	8.84	$19,413	$4,606	7.24	$158,990	$81,197
Texas	14.39	$3,160	-$758	8.9	$19,544	$4,474	6.4	$140,544	$99,644
Missouri	11.59	$2,545	-$143	9.33	$20,489	$3,530	7.57	$166,237	$73,950
Wyoming	10.75	$2,361	$41	9.37	$20,577	$3,442	6.88	$151,085	$89,103
Virginia	14.55	$3,195	-$793	9.38	$20,598	$3,420	8.76	$192,370	$47,818
Iowa	12.15	$2,668	-$266	9.6	$21,082	$2,937	6.05	$132,858	$107,330
North Carolina	13	$2,855	-$453	9.65	$21,191	$2,827	7.02	$154,159	$86,028
South Dakota	11.67	$2,563	-$161	9.82	$21,565	$2,454	7.9	$173,484	$66,704
Washington	10.79	$2,369	$32	10.1	$22,180	$1,839	6.29	$138,128	$102,059
Oregon	12.32	$2,705	-$304	10.33	$22,685	$1,334	7.14	$156,794	$83,393
Arkansas	11.99	$2,633	-$231	10.38	$22,794	$1,224	6.62	$145,375	$94,812
New Mexico	13.6	$2,987	-$585	10.47	$22,992	$1,027	5.94	$130,442	$109,745
Ohio	14.81	$3,252	-$850	10.63	$23,343	$675	7.33	$160,967	$79,221
South Carolina	14.27	$3,134	-$732	10.92	$23,980	$38	6.66	$146,254	$93,934
Louisiana	11.92	$2,618	-$216	11.06	$24,288	-$269	6.37	$139,885	$100,302
Arizona	13.57	$2,980	-$578	11.17	$24,529	-$511	7.64	$167,774	$72,413
West Virginia	13.87	$3,046	-$644	11.17	$24,529	-$511	7.16	$157,234	$82,954
Colorado	14.07	$3,090	-$688	11.18	$24,551	-$533	8.36	$183,586	$56,602
Georgia	13.44	$2,951	-$550	11.29	$24,793	-$774	6.58	$144,497	$95,691
Kansas	13.86	$3,044	-$642	11.32	$24,859	-$840	8.43	$185,123	$55,065
Pennsylvania	18.19	$3,995	-$1,593	11.36	$24,947	-$928	8.05	$176,778	$63,410
Nevada	17.2	$3,777	-$1,375	11.54	$25,342	-$1,323	9.59	$210,596	$29,591
Illinois	17.18	$3,773	-$1,371	11.65	$25,583	-$1,565	8.57	$188,197	$51,990
Montana	11.88	$2,609	-$207	11.7	$25,693	-$1,674	8.07	$177,217	$62,970
Kentucky	12.49	$2,743	-$341	11.74	$25,781	-$1,762	6.86	$150,646	$89,542
Tennessee	12.3	$2,701	-$299	11.88	$26,088	-$2,070	6.39	$140,324	$99,863
Deleware	15.16	$3,329	-$927	11.95	$26,242	-$2,223	8.16	$179,194	$60,994
Minnesota	13.91	$3,055	-$653	11.98	$26,308	-$2,289	8.95	$196,542	$43,646
Florida	15.34	$3,369	-$967	12.11	$26,594	-$2,575	9.78	$214,769	$25,419
Wisconsin	16.51	$3,626	-$1,224	12.49	$27,428	-$3,409	8.24	$180,950	$59,237
Mississippi	13.78	$3,026	-$624	13.04	$28,636	-$4,617	7.22	$158,551	$81,636
Alabama	14.65	$3,217	-$815	13.19	$28,965	-$4,946	6.86	$150,646	$89,542
Indiana	15.58	$3,421	-$1,019	13.24	$29,075	-$5,056	8.85	$194,346	$45,842
Michigan	18.12	$3,979	-$1,577	13.24	$29,075	-$5,056	8.1	$177,876	$62,312
Maryland	15.94	$3,500	-$1,099	13.31	$29,229	-$5,210	9.86	$216,526	$23,662
New Jersey	17.12	$3,760	-$1,358	13.69	$30,063	-$6,044	11.58	$254,297	-$14,109
Rhode Island	27.54	$6,048	-$3,646	16.81	$36,915	-$12,896	19.3	$423,828	-$183,641
New York	21.88	$4,805	-$2,403	16.83	$36,959	-$12,940	6.98	$153,281	$86,907
Vermont	20.42	$4,484	-$2,082	17.65	$38,759	-$14,741	11.31	$248,368	-$8,180
Maine	27.37	$6,010	-$3,609	17.83	$39,155	-$15,136	12.32	$270,547	-$30,360
Massachusetts	31.54	$6,926	-$4,524	20.05	$44,030	-$20,011	17.98	$394,841	-$154,653
Conneticut	32.61	$7,161	-$4,759	20.66	$45,369	-$21,351	15.47	$339,721	-$99,534
Alaska	23.16	$5,086	-$2,684	20.75	$45,567	-$21,548	19.17	$420,973	-$180,786
California	27.85	$6,116	-$3,714	21.62	$47,478	-$23,459	16.84	$369,806	-$129,619
New Hampshire	30.95	$6,797	-$4,395	21.93	$48,158	-$24,140	16.23	$356,411	-$116,223
Hawaii	43.8	$9,618	-$7,217	41.47	$91,068	-$67,049	37.65	$826,794	-$586,607

MINING PROFITABILITY BY STATE & ENERGY RATE

BASED ON FALL 2023



Running the numbers is quite sobering, as you immediately see just how unprofitable mining is under our outlined scenario. Only 40 states are profitable at industrial rates, 18 with commercial rates, and six states at residential rates. If you run this same simulation but enforce a halvening, cutting your daily mining revenue in half, it's suddenly a doomsday scenario where no mining operation would be profitable. Of course, Bitcoin doesn't exist within a vacuum, and this doesn't account for changes in the network hashrate and the bitcoin price.

The War Game looks bleak for operators at residential scale. With outlined conditions, profitability at residential energy rates appears elusive and mining operations are likely running at a loss nationwide. While some may pursue this path to accumulate KYC-free sats, for many, this does not justify operating at a deficit.

Commercial rates offer a more promising outlook for operators, as lower energy costs extend profitability into many more states. Still, only a few states provide a profitable environment for small and medium-sized business miners, especially in the potentially challenging year of 2024.

The landscape shifts further at the industrial scale, where miners wield more influence and earn a proper seat at the table. Energy producers take notice when operators' demand approaches or exceeds 1MW, reflecting a transition from being a rounding error to a meaningful consumer. While profitability is possible in 40 states for industrial-scale miners, several states remain challenging.

The question is whether mining operators will be able to survive the battle to fight another day. Enduring an onslaught of increased competition, the halvening, and an ever-unpredictable bitcoin price will not be easy. Operators will need to find efficiencies where they can. This fundamental principle holds true: Profitability can be achieved with sufficiently low hardware and energy costs. The big headline in this whole piece is that the geographic location of your operation is probably the most critical success factor in running a mining operation. For a majority of the country, this means you should not plug in bitcoin miners. However, there are still opportunities out there if you are ambitious enough to get in the trenches and do hash recon. This is where stripes are earned and the high ground is claimed.