

TECHNICAL PAPER · No. 02

Climate-Adjusted *LEED Difficulty* in Retail Buildings

*A technical analysis of global LEED v4 BD+C retail
Platinum peers — and the PENTA case.*

ISSUED

AUTHOR/PEER SET

SOURCES

APRIL 2026 ISG n = 15 · v4 BD+C Retail Platinum penta_analysis.xlsx · NASA POWER

Platinum is a *tier*, not a context.

LEED Platinum is commonly communicated as a single sustainability tier, but project context can make that tier more or less difficult to achieve. This paper develops a peer-relative climate exposure view for global LEED v4 BD+C retail Platinum projects, using `penta_analysis.xlsx` and NASA POWER 1991–2020 climate normals.

The analysis identifies 15 global retail Platinum projects under LEED v4 BD+C, then enriches each project with city-level cooling degree days, relative humidity, and surface shortwave irradiance.

15

GLOBAL V4 BD+C RETAIL
PLATINUM PROJECTS

12

V4 BD+C: CORE & SHELL
SUBSET

1

MENA V4 BD+C: CS
RETAIL PLATINUM

The main finding is that PENTA Retail Center is *not a points outlier*, but it is a *context outlier*. It has the highest annual cooling-degree-day burden and highest mean solar irradiance in the 15-project peer set. In a peer-relative Climate Exposure Index, PENTA ranks effectively at the top of the cohort — just behind The Food Hub in Abu Dhabi on the humidity component. When gross floor area is incorporated as a scale proxy, PENTA ranks second globally and first in MENA.

METHODOLOGICAL IMPLICATION

LEED Platinum claims should be normalized by building type, rating system, project scope, and climate exposure before being compared.

Three questions — *one* peer set.

This paper asks three questions:

1. How rare is LEED v4 BD+C retail Platinum certification globally?
2. How does PENTA compare with its true peer group after controlling for rating-system scope?
3. Does climate exposure change the interpretation of PENTA's 82-point Platinum result?

The analysis is intentionally conservative. It does not claim to measure actual building energy performance, operational carbon, or tenant-level outcomes. It evaluates certification context using observable directory fields and external climate-normal data.

2.1 · LEED PROJECT DATA

Source: `penta_analysis.xlsx`, primarily Sheet2, containing 216,487 global project rows.

Fields used:

ProjectTypes	CertLevel
PointsAchieved	
LEEDSystemVersionDisplayName	
GrossFloorArea	UnitOfMeasurement
RegistrationDate	CertDate
Country	City

Primary peer filter:

```
ProjectTypes contains "Retail"
AND CertLevel = Platinum
AND LEEDSystemVersionDisplayName
contains "LEED v4 BD+C"
```

Returns **15 global projects**. Stricter Core & Shell subset (LEED v4 BD+C: CS) returns **12**.

2.2 · CLIMATE DATA

NASA POWER point-based daily data, 1991-01-01 through 2020-12-31. City-level coordinates assigned per peer project (listed city or nearest recognizable district).

Parameters:

T2M (C)	temperature at 2 m
RH2M (%)	relative humidity
ALLSKY_SFC_SW_DWN	surface shortwave irradiance (W/m2)

NASA POWER DAV provides analysis-ready solar and meteorological data derived from satellite observations and assimilation models, applied to sustainable infrastructure and building-related analyses.

A transparent, *reproducible* index.

3.1 · CLIMATE METRICS

Daily NASA POWER data reduced into 1991–2020 annual-normal metrics per peer city:

```
CDD18           = annual sum of max(T2M - 18 C, 0)
HDD18           = annual sum of max(18 C - T2M, 0)
Mean temperature = annual mean T2M
Mean relative humid. = annual mean RH2M
Mean solar exposure = annual mean ALLSKY_SFC_SW_DWN
Hot days         = annual count of days where T2M >= 30 C
```

CDD18 proxies cooling demand. Solar irradiance proxies solar heat-gain pressure and envelope exposure. Relative humidity proxies latent cooling complexity. These do not replace building simulation — they provide comparable climate context across peer cities.

3.2 · CLIMATE EXPOSURE INDEX

A peer-relative index across the 15-project cohort:

```
CDD component      = min-max normalized log(1 + CDD18)
Solar component    = min-max normalized mean solar irradiance
Humidity component = min-max normalized mean relative humidity

Climate Exposure Index =
  100 * (0.60 * CDD + 0.25 * Solar + 0.15 * Humidity)
```

The weights reflect the centrality of cooling load for retail while keeping solar exposure and latent humidity visible. The index is not a universal physical model — it is a transparent, peer-relative screening metric.

3.3 · SIZE-CLIMATE EXPOSURE

A secondary score accounts for project scale:

```
Size-Climate Exposure = Climate Exposure Index * log10(area_sqm)
```

Logarithmic scaling avoids letting very large projects dominate linearly, while still recognizing that climate exposure at a larger retail asset is more consequential than the same exposure in a small fit-out or branch.

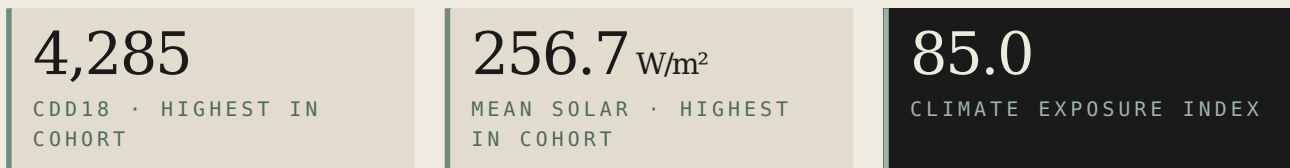
4.1 · GLOBAL PEER SET

The global LEED v4 BD+C retail Platinum peer set contains **15 projects**. PENTA is the sole Saudi project. In the stricter LEED v4 BD+C: Core & Shell subset, there are **12 projects** — PENTA is the only MENA project.

PENTA's useful comparison group is therefore *not* all LEED Platinum projects, and not even all retail Platinum projects. The meaningful peer group is retail, Platinum, LEED v4 BD+C, and preferably Core & Shell when making scope-specific claims.

4.2 · CLIMATE EXPOSURE RESULTS

PENTA's climate profile is extreme within the peer set:



The Food Hub (Abu Dhabi) scores 85.1 on the composite index — narrowly above PENTA because its humidity component is higher. ENOC Fuel Station (Dubai) scores 82.1. The top three climate-exposure projects are all in the Gulf.

FIG. 01 · CLIMATE EXPOSURE RANKING

LEED v4 BD+C Retail Platinum peer set — composite climate exposure

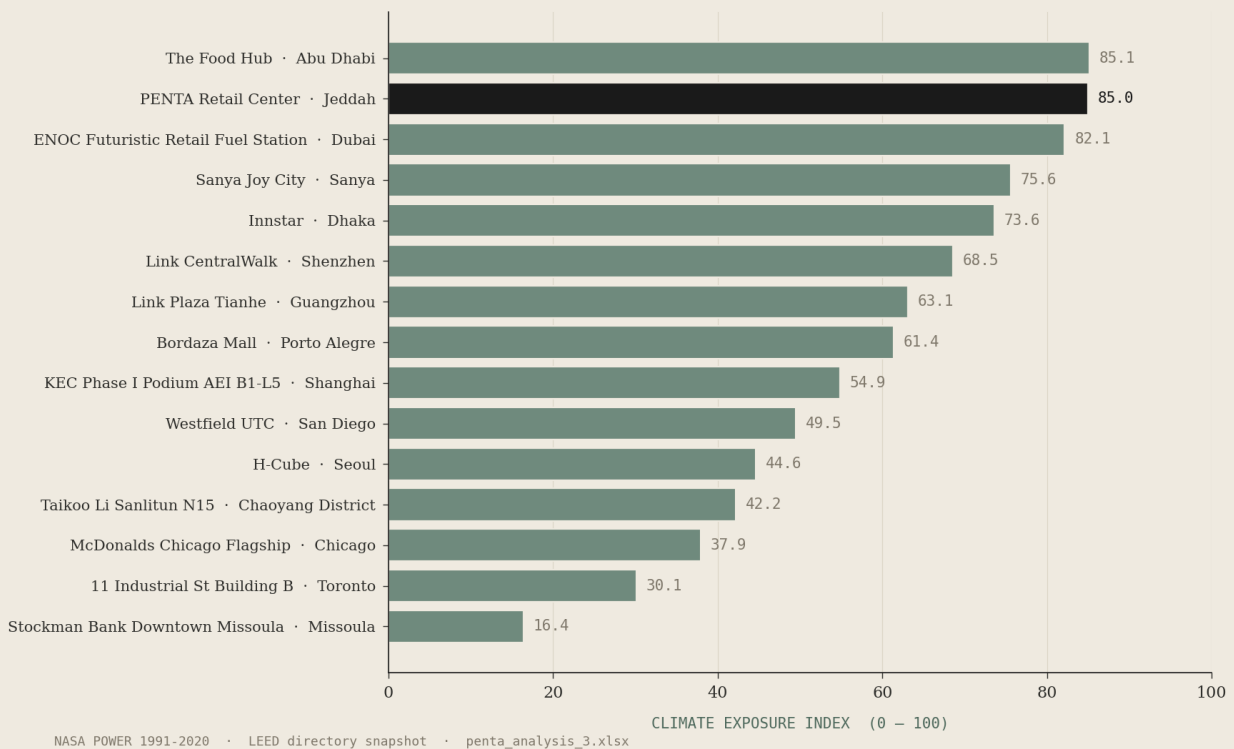


FIG. 01 · PEER-RELATIVE CLIMATE EXPOSURE INDEX

Why PENTA is *distinctive*.

The CDD-versus-solar chart shows why PENTA is distinctive. It sits at the upper right of the peer group, combining the cohort's highest cooling-degree-day burden with the highest mean solar exposure.

FIG. 02 · CLIMATE BURDEN SCATTER

Cooling demand vs. solar exposure across 15 retail Platinum peers

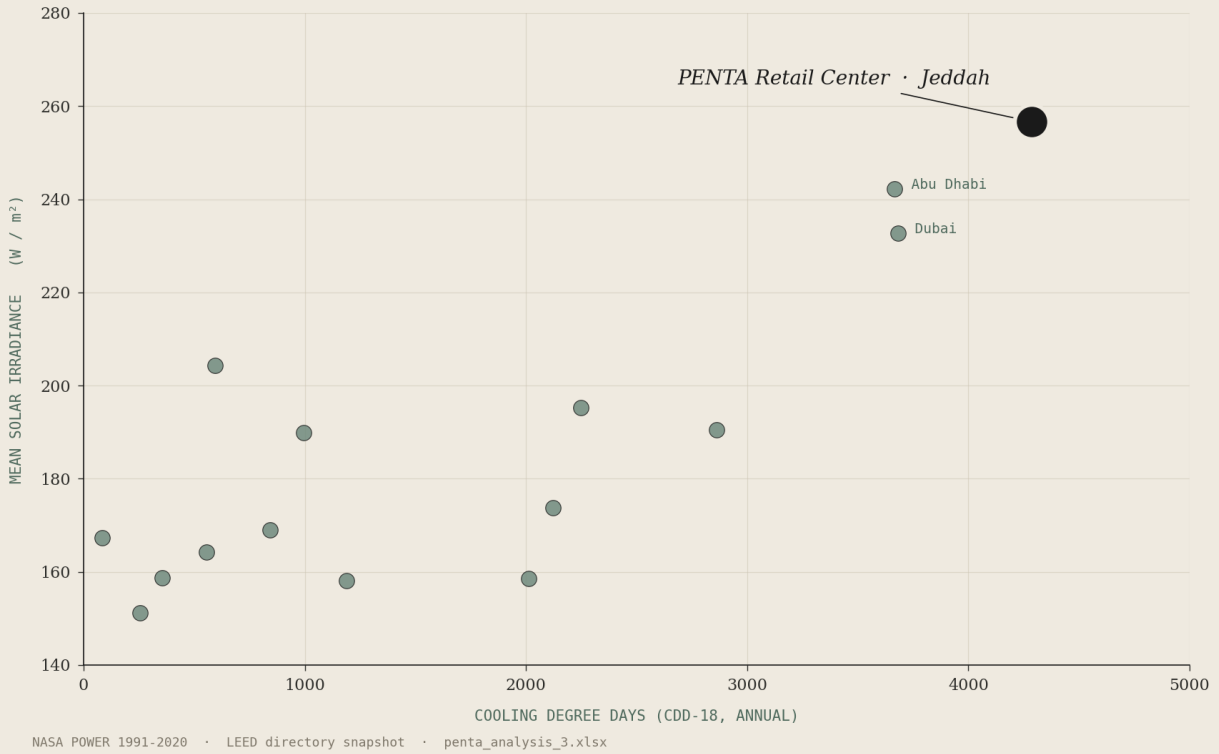


FIG. 02 · CDD18 × MEAN SOLAR IRRADIANCE, V4 BD+C RETAIL PLATINUM PEERS

CONTEXT FINDING

PENTA clears LEED v4 BD+C retail Platinum in the harshest CDD × solar quadrant of the global peer set.

4.3 · SIZE-ADJUSTED CLIMATE EXPOSURE

When project size is incorporated, PENTA ranks **second globally** and **first in MENA**.

RANK	PROJECT	CITY	SIZE-CLIMATE EXPOSURE
1	Sanya Joy City	Sanya, CN	382.8
2	PENTA Retail Center	Jeddah, SA	345.0
3	Link CentralWalk	Shenzhen, CN	341.0
4	Innstar	Dhaka, BD	329.9
5	Link Plaza Tianhe	Guangzhou, CN	316.7

FIG. 03 · SIZE-ADJUSTED CLIMATE EXPOSURE

Climate exposure scaled by gross floor area

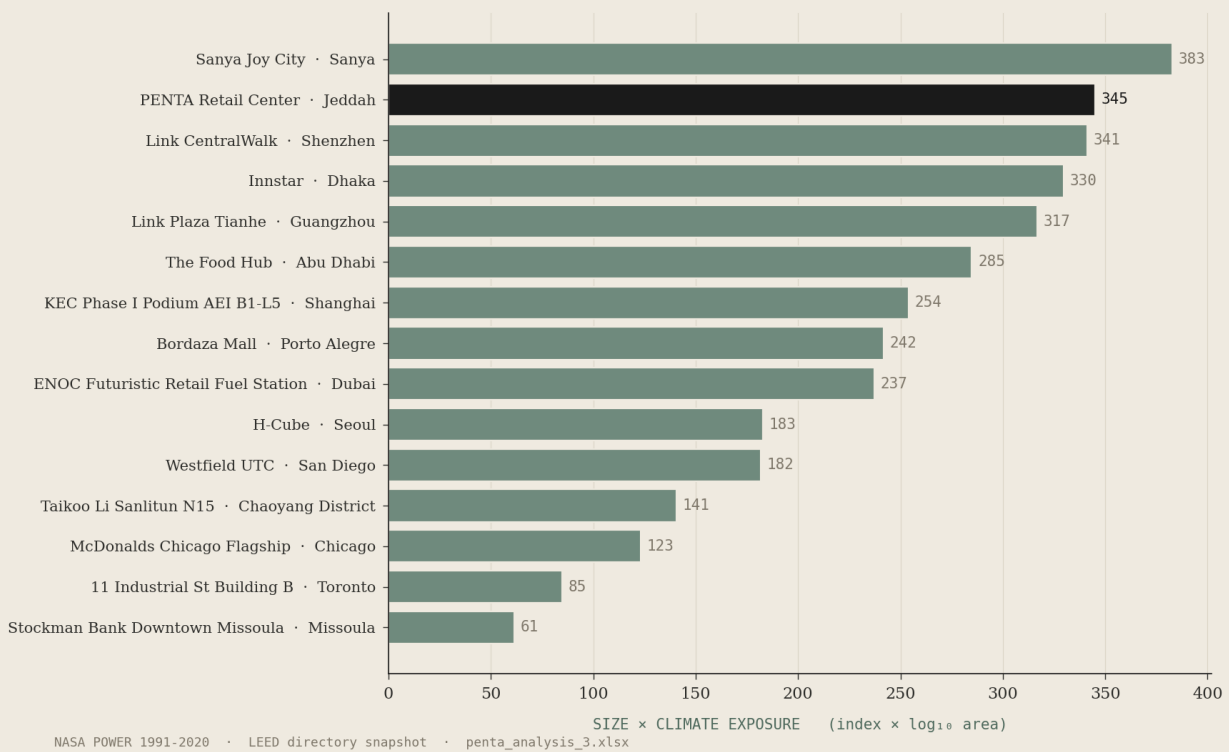


FIG. 03 · SIZE-CLIMATE EXPOSURE · CLIMATE INDEX × LOG₁₀(AREA)

PENTA is not the largest project globally and not the highest-scoring project globally. Its distinction is that it combines **high climate exposure, meaningful retail scale, MENA location, and Platinum under LEED v4 BD+C: Core & Shell**.

4.4 · POINTS VS. CLIMATE EXPOSURE

PENTA scored 82 points — near the lower end of the Platinum band. This should not be read as weakness. In the 15-project cohort, 8 projects scored between 80 and 82 points. *The category itself is selective.*

FIG. 04 · POINTS × CLIMATE EXPOSURE

Platinum result plotted against peer-relative climate exposure

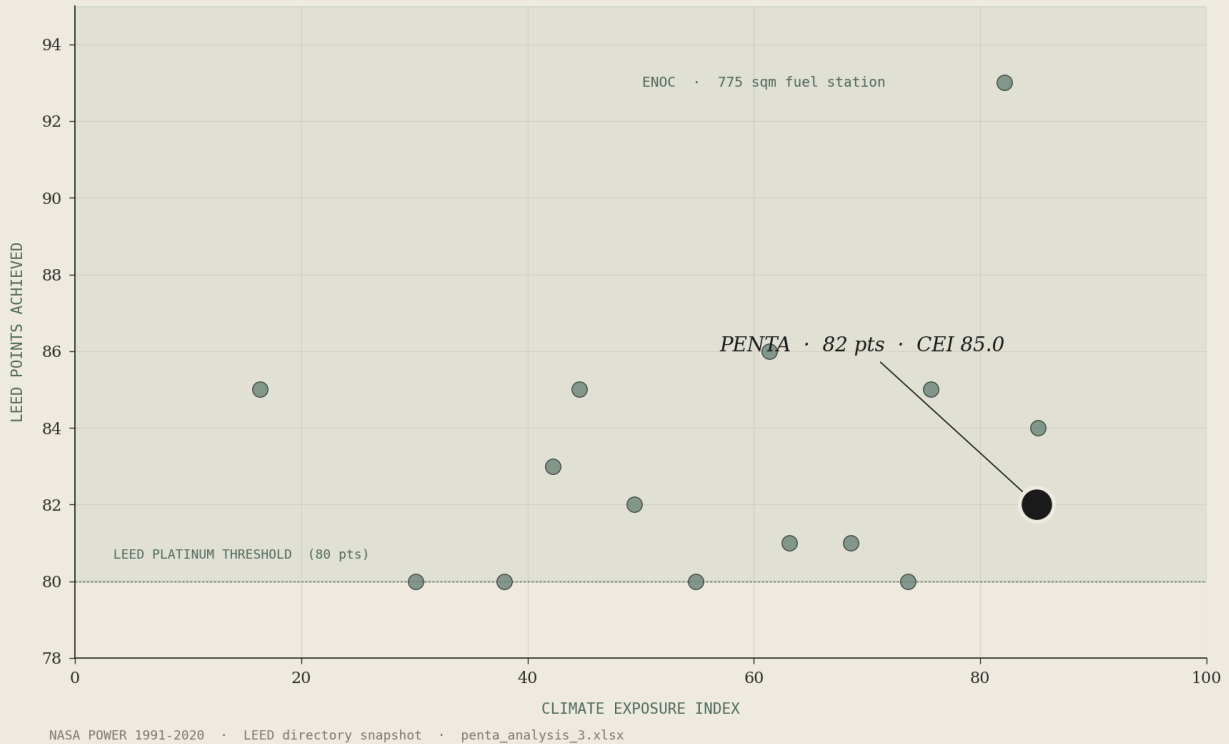


FIG. 04 · LEED POINTS × CLIMATE EXPOSURE INDEX

ENOC scored much higher at 93 points — but it is a 775 m² fuel station/convenience retail project. PENTA's context is different: **11,450 m², Core & Shell, Jeddah**, and the highest cooling and solar exposure values in the cohort.

4.5 · CERTIFICATION VELOCITY

PENTA also has the fastest registration-to-certification interval in the 15-project peer set.

<p>192_d PENTA REG → CERT</p>	<p>610_d COHORT MEDIAN</p>	<p>3.2× FASTER THAN MEDIAN</p>
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This is a process metric, not a physical construction-duration metric. It may reflect documentation readiness, late-stage registration, integrated certification delivery, or mature sustainability execution before formal registration.

Context changes the *meaning* of the score.

The analysis supports three technical conclusions.

FIRST · BREADTH DESTROYS MEANING

Broad LEED Platinum comparisons are often misleading. PENTA's claim becomes meaningful only after narrowing by retail project type, rating system, and scope. Under broad retail Platinum framing, PENTA is one of 509 global rows. Under LEED v4 BD+C framing, it is one of 15. Under LEED v4 BD+C: Core & Shell, it is one of 12 globally and the only one in MENA.

SECOND · CLIMATE CHANGES THE READ

Climate context materially changes the interpretation of PENTA's score. An 82-point Platinum in Jeddah is not directly comparable to an 82-point certification in a milder climate. PENTA has the highest CDD18 and solar exposure in the peer set, which makes its threshold result more notable than the raw point total suggests.

THIRD · NORMALIZED CLAIMS

PENTA is a strong case for *normalized sustainability claims*. Instead of saying “LEED Platinum retail,” the market should disclose:

- Rating system
- Certification scope
- Building type
- Project scale
- Climate exposure
- Certification vintage

NET EFFECT

Under this framework, PENTA's certification is a context-normalized outcome, not an unqualified “green” badge.

The *precise* picture.

The analysis yields three findings at successively stricter levels of normalization — system, climate, and scale.

6.1 · SYSTEM-LEVEL FINDING

PENTA Retail Center is Saudi Arabia's first LEED v4 BD+C Platinum retail project and, in the workbook snapshot, the only MENA LEED v4 BD+C: Core & Shell retail Platinum project.

6.2 · CLIMATE-ADJUSTED FINDING

Among the fifteen global LEED v4 BD+C retail Platinum peers, PENTA has the highest 1991–2020 cooling-degree-day burden and the highest mean solar irradiance based on NASA POWER city-level climate data.

6.3 · SCALE-ADJUSTED FINDING

On a peer-relative index combining climate exposure and project size, PENTA ranks second globally and first in MENA among LEED v4 BD+C retail Platinum peers.

§ 07 · LIMITATIONS

1. Project rows are LEED directory records and are not guaranteed to map one-to-one with unique physical developments.
2. Retail classification depends on the workbook's ProjectTypes field; misclassifications at registration carry through to the cohort.
3. NASA POWER provides city-coordinate climate normals, not project-site microclimate.
4. CDD18, solar irradiance, and relative humidity are climate proxies, not whole-building simulation outputs.
5. The Climate Exposure Index uses transparent but judgment-based weights; alternative weightings are explored in the supporting analysis workbook.
6. Gross floor area is a scale proxy, not measured energy-use intensity.
7. LEED points capture design and documentation performance; they are not operational performance data.

These limitations define the level of inference available from directory data. PENTA's result is best understood as a high-context, high-climate-exposure Platinum certification case, not as a measurement of operational performance against every peer.

The case for *rigor*.

PENTA's strongest analytical value is that it forces a more rigorous way to compare sustainability claims. The raw statement “LEED Platinum retail” is too broad. Once the analysis controls for retail type, LEED system, Core & Shell scope, climate exposure, and scale, PENTA becomes a much more distinctive case.

CENTRAL FINDING

PENTA is not exceptional because it has the highest LEED score. It is exceptional because it clears the LEED v4 BD+C retail Platinum threshold in one of the highest cooling and solar exposure contexts in the global peer set, while operating at a meaningful retail-center scale.

That is a narrower and more technically grounded way of describing the certification event than a single-label “green” summary.

DATA OUTPUTS

- [penta_peer_climate_enrichment.csv](#)
- [penta_two_paper_supporting_analysis.xlsx](#)
- [charts/climate_exposure_ranking.png](#)
- [charts/cdd_vs_solar_peer_scatter.png](#)
- [charts/size_climate_exposure_ranking.png](#)
- [charts/points_vs_climate_exposure.png](#)

REFERENCES

- NASA POWER Daily API documentation — power.larc.nasa.gov/docs/services/api/temporal/daily/
- NASA POWER parameter documentation — power.larc.nasa.gov/docs/tutorials/parameters/
- NASA Earthdata POWER DAV — earthdata.nasa.gov/data/tools/power-dav
- Primary LEED dataset — [penta_analysis.xlsx · Sheet2](#)

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Normalize the *context*,
and the Platinum threshold
means something again.

A technical paper from ISG · April 2026