Istidamah al-Mawarid al-Tabi'iyyah in Artificial Intelligence Era: Study on Water Resource Governance for Data Centers

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Abstract. Data center water consumption grows in step with artificial intelligence workloads, and the Annual and Sustainability Report published by PT DCI Indonesia for fiscal year 2025 shows this pattern at facility scale in Indonesia. This study asks whether Islamic legal doctrine can supply a normative ceiling that secular efficiency-based regulation currently lacks. This is a normative-juridical study using statutory, comparative, and conceptual approaches. Comparative analysis covers the water governance regimes of Singapore, the Netherlands, and the United States. Conceptual analysis draws on istidamah al-mawarid al-tabi'iyyah, maqasid al-syari'ah (hifz al-nafs), la darar wa la dirar, and mizan. All quantitative data are drawn from PT DCI Indonesia's Annual and Sustainability Report 2025; a 2026 projection for the E2 Surabaya facility is calculated from the company's own disclosed water-to-electricity ratio. Disclosed water usage across DCI's facilities rose 161% between 2023 and 2025, from 233,586 m³ to 610,833 m³. Applying DCI's 2025 water-to-electricity ratio to E2 Surabaya's 9 MW installed capacity projects approximately 134,700 m³ of water consumption for April-December 2026 under a full-load scenario. None of the three secular regimes examined impose an absolute consumption ceiling comparable to what la darar wa la dirar would require, pointing toward a hybrid governance model combining an absolute threshold, waqf-linked conservation financing, and mandatory pre-approval harm assessment.

Keywords: Artificial Intelligence; Data Center; Islamic Environmental Law; Istidamah Al-Mawarid Al-Tabi'iyyah; Water Governance.

1 Introduction

PT DCI Indonesia's Annual and Sustainability Report 2025 records water usage rising from 233,586 m³ in 2023 to 376,116 m³ in 2024, then to 610,833 m³ in 2025, a 161% increase across two years [1]. Electricity usage over the same period rose from 127,572,458 kWh to 264,030,977 kWh, a 107% increase. Water consumption outpaced electricity consumption, a pattern that runs against the usual assumption that cooling efficiency upgrades should slow water demand relative to computing load. These figurecome from a single facility operator in Surabaya, but they sit inside a much larger global trend that has developed largely without a corresponding governance response.

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Artificial intelligence workloads require sustained, high-density computation, and high-density computation generates heat that most data centers remove through water-based cooling [2]. Training and running large AI models at scale has turned water, alongside electricity, into one of the two resource inputs that determine whether a data center can keep operating during periods of drought or grid stress. Large technology companies have begun disclosing consumption figures at a scale that makes the underlying pressure visible: Google reported 6.4 billion gallons of water used across its data centers in 2023, and Microsoft reported 2 billion gallons in the same year [3]. Both figures came from voluntary corporate sustainability reporting, not from compliance against any binding withdrawal ceiling, because no such ceiling currently applies to either company at the scale these numbers represent.

Indonesia's domestic data center sector is following a comparable trajectory, at an earlier stage but at a steep growth rate. Market research projects the domestic data center water consumption market to grow at a compound annual rate of approximately 18%, reaching an estimated 37.80 billion liters in 2025 [4]. E2 Data Center Surabaya, one of PT DCI Indonesia's facilities, carries 9 MW of total IT load and sits adjacent to Surabaya's main internet exchange at Intiland Tower, offering direct connectivity to major cloud providers. The 2025 Annual and Sustainability Report does not disaggregate water usage by individual facility within DCI's portfolio, so no directly reported figure yet exists for E2 Surabaya specifically. This study addresses that gap using a calculation, not an assumption, applying DCI's own 2025 company-wide water-to-electricity ratio to E2 Surabaya's 9 MW capacity under a full-load scenario for April to December 2026. Table 1 sets out this calculation step by step.

Table 1. Projection Method for E2 Surabaya Water Consumption, April to December 2026.

Step	Calculation	Result
Company-wide water-to-electricity ratio, 2025	610,833 m^3 divided by 264,030,977 kWh	2.31 L/kWh
E2 Surabaya installed IT load	Reported capacity	9 MW
Assumed operating hours, April to December 2026 (full load)	9 months, 30.4 days each, 24 hours per day	approximately 6,566 hours
Projected electricity consumption at full load	9,000 kW multiplied by 6,566 hours	approximately 59,097,600 kWh
Projected water consumption	59,097,600 kWh multiplied by 2.31 L/kWh	approximately 134,700 m^3

Source: Author's calculation based on the water-electricity ratio of PT DCI Indonesia 2025

This calculation uses no figure external to DCI's own 2025 disclosure and the publicly stated IT load capacity of E2 Surabaya. It assumes full-load operation throughout the projection window, which represents an upper-bound scenario rather than an average-case estimate; actual 2026 consumption may fall below this figure if the facility operates below full load during its initial months.

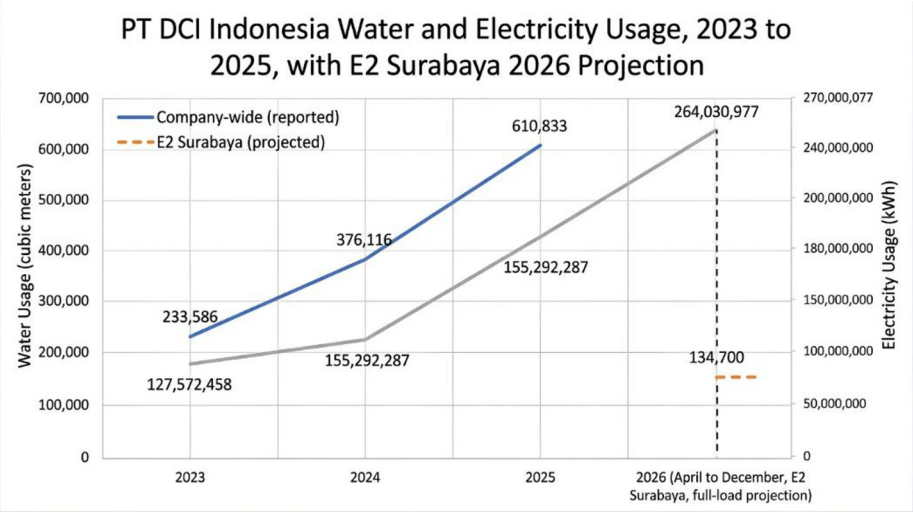


Fig. 1. PT DCI Indonesia Water and Electricity Usage, 2023 to 2025, with E2 Surabaya 2026 Projection

Two bodies of scholarship address the underlying problem from separate directions, and neither, on its own, accounts for the pattern visible in DCI's disclosed numbers [1]. One body of work is regulatory and comparative. It documents Singapore's 2019 moratorium on new data center approvals as a case of an absolute administrative ceiling [5], the Netherlands' practice of negotiating water-use agreements directly between regional water authorities and hyperscale operators as a case of accommodation handled agreement by agreement, and the United States' devolved, state-level drought contingency planning as a case of localized deference with no unifying federal standard [6]. Within this literature, a live debate concerns whether efficiency metrics such as Water Usage Effectiveness are sufficient on their own to manage rising data center water demand, or whether some form of absolute limit is eventually unavoidable [7].

The second body of work is doctrinal rather than regulatory. Scholarship on *fiqh al-bi'ah* (Islamic environmental jurisprudence) has developed water and natural resources as objects of ecological trusteeship, grounding this trusteeship in *maqasid al-syari'ah* and operationalizing it through maxims such as *la darar wa la dirar*. This literature has rarely been tested against a specific, contemporary infrastructure case, and almost never against the particular water-intensity profile of artificial intelligence data centers, where consumption growth is driven by computing scale rather than by conventional industrial output. The result is a conceptual gap between two mature but separate literatures: one measures efficiency without asking whether efficiency is the right unit of concern, and

the other articulates trusteeship without yet applying it to the infrastructure generating the fastest-growing water demand of the current decade.

DCI's own disclosed numbers illustrate why closing this gap carries practical weight, not just theoretical interest. A facility can adopt a genuinely more efficient cooling technology, as DCI states it has done through its chilled-water system, and still register a 161% increase in absolute water consumption over two years. Efficiency ratios measure water used per unit of computation; they do not measure, and are not designed to measure, total volume withdrawn from a shared watershed. When the scale of computing demand grows faster than the efficiency gains applied to it, an efficiency-compliant facility and a rapidly water-depleting facility can be the same facility, reported through the same set of metrics, in the same year.

Islamic legal doctrine approaches this same water through a different set of questions. Rather than asking how much water was used per unit of output, *istidamah al-mawarid al-tabi'iyyah* asks whether water has been held as *amanah* (a trust) on behalf of a community and of future users who depend on the same watershed. *Maqasid al-syari'ah*, through the specific objective of *hifz al-nafs* (preservation of life), treats water access as directly bound to the preservation of life rather than as an externality to be priced into an efficiency calculation. The maxim *la darar wa la dirar* shifts the burden of proof: instead of permitting withdrawal until harm is demonstrated after the fact, it requires an operator to show, before approval, that no harm will result. *Mizan* frames the entire arrangement as a balance to be maintained among the operator's commercial interest, the community's subsistence need, and the watershed's capacity to recover, rather than as a negotiation between two parties or a limit imposed from a single administrative center.

This study places these doctrinal principles against the same set of numbers used to describe DCI E2 Surabaya's water consumption, rather than treating the two as separate exercises running in parallel. Reading a 161% two-year consumption increase through the lens of *la darar wa la dirar* produces a different research question than reading the same number through a Water Usage Effectiveness ratio: the doctrinal question asks whether harm has occurred, or is likely to occur, to other water users, independent of whatever efficiency claim accompanies the increase. That distinction, between measuring efficiency and assessing harm, organizes the remainder of this study.

Three research questions follow. First, how do the water governance regimes of Singapore, the Netherlands, and the United States respond to industrial and data center water demand, and at what point does each regime stop short of imposing an absolute consumption ceiling (RQ1)? Second, what does Islamic legal doctrine, namely *istidamah al-mawarid al-tabi'iyyah*, *maqasid al-syari'ah*, *la darar wa la dirar*, and *mizan*, contribute to this analysis that efficiency-based secular regulation does not already provide (RQ2)? Third, what hybrid governance model follows from combining these doctrinal principles with the regulatory instruments examined under RQ1, and how does the disclosed and projected DCI and E2 Surabaya data test the practical shape of that model (RQ3)?

2 Method

This study uses normative-juridical legal research, conducted through the analysis of legal materials and documentary sources rather than through field observation, interviews, or survey instruments [8]. The research question concerns the interpretation of legal doctrine and its integration with comparative regulatory frameworks, which places the inquiry within the domain of doctrinal legal analysis rather than empirical social research [9]. No primary field data collection was undertaken for this study, and every quantitative figure discussed in the Result and Discussion section traces back to a single published corporate document, PT DCI Indonesia's Annual and Sustainability Report 2025, a limitation stated explicitly rather than obscured.

Three analytical approaches structure the research, applied to three tiers of legal materials [10]. The statutory approach is applied to primary legal materials consisting of the regulatory instruments of Singapore's Public Utilities Board, including the 2019 moratorium on new data center approvals; Dutch regional water authority frameworks governing negotiated water-use agreements; United States state-level drought contingency planning statutes; and the Qur'an and Hadith as primary sources of Islamic law. The comparative approach places these three regulatory regimes alongside one another and against the doctrinal framework developed from Islamic legal sources, in order to identify where secular regulatory instruments converge with, or diverge from, the precautionary logic embedded in la darar wa la dirar. The conceptual approach (pendekatan konseptual) is applied to secondary legal materials, consisting of fiqh al-bi'ah scholarship, contemporary Islamic finance literature on waqf-based conservation financing, and academic journal articles analyzing the three regulatory regimes, together with tertiary materials such as legal dictionaries used to clarify technical and doctrinal terminology where needed [11].

Data collection follows standard library research technique: the primary, secondary, and tertiary legal materials described above were identified, read, and organized according to the three analytical approaches [12], then cross-referenced against the empirical and projected figures already presented in Table 1 of the Introduction. Analysis proceeds through qualitative-deductive legal reasoning, in which the regulatory logic identified under the statutory approach is compared against the doctrinal principles identified under the conceptual approach, and both are read against the disclosed and projected DCI and E2 Surabaya figures, in order to construct the hybrid governance model that answers RQ3 in the Result and Discussion section.

3 Result and Discussion

Three sets of findings answer the three research questions posed in the Introduction. The first set compares how Singapore, the Netherlands, and the United States regulate industrial and data center water demand, read against the full water and electricity dataset disclosed in PT DCI Indonesia's Annual and Sustainability Report 2025. The second set applies the four Islamic legal principles introduced earlier to the same dataset, asking what those principles reveal that a Water Usage Effectiveness ratio does

not. The third set combines both lines of analysis into a hybrid governance model, tested against DCI's position as Indonesia's largest integrated data center operator.

3.1 Secular Water Governance Regimes and the DCI Dataset

Table 2 reproduces the full environmental disclosure from PT DCI Indonesia's Annual and Sustainability Report 2025, extending the water and electricity figures already introduced in the Introduction with the report's hazardous waste data.

Table 2. Environmental Aspect Disclosure, PT DCI Indonesia, 2023 to

Description	Unit	2023	2024	2025
Electricity Usage	kWh	127,572,458	155,292,287	264,030,977
Water Usage	m^3	233,586	376,116	610,833
Hazardous Waste Produced	ton	84.32	0.175	56.92

Source: PT DCI Indonesia, Annual and Sustainability Report 2025.

Water usage climbed 61% from 2023 to 2024 and a further 62% from 2024 to 2025, compounding to the 161% two-year increase noted earlier [1]. Electricity usage climbed at a slower compound rate of 107% across the same period. Hazardous waste output moved in neither direction consistently, falling to 0.175 tons in 2024 before rising to 56.92 tons in 2025, a pattern the report does not explain and that this study does not attempt to interpret beyond noting its irregularity relative to the steadier water and electricity trends.

The report also breaks water usage down by type, distinguishing industrial withdrawal from wastewater output. Table 3 reproduces this breakdown.

Table 3. Water Usage by Type, PT DCI Indonesia, 2023 to 2025

Type of Water	2023	2024	2025
Industrial	233,586	376,116	610,833
Wastewater	115,545	144,864	229,673
Type of Water	349,131	520,980	840,506

Source: PT DCI Indonesia, Annual and Sustainability Report 2025.

Total water flow through the facility, industrial withdrawal combined with wastewater output, rose from 349,131 m^3 in 2023 to 840,506 m^3 in 2025, a 141% increase [13]. Wastewater itself grew more slowly than industrial withdrawal, rising 99% across the same period compared to the 161% rise in industrial water. Read as a ratio, wastewater fell from 49.5% of industrial withdrawal in 2023 to 37.6% in 2025, meaning a growing share of the water drawn into the facility did not return as measurable wastewater output. Evaporative loss through cooling operations is one plausible explanation for this gap, consistent with the report's own description of a chilled-water cooling system, though the report does not itself quantify evaporative loss as a separate category.

These figures describe PT DCI Indonesia at the company level, not E2 Surabaya alone, and the scale of the company matters to how the E2 Surabaya figures should be read. Industry mapping of Indonesia's data center sector places PT DCI Indonesia Tbk

as the largest integrated data center provider in the country, with total capacity exceeding 100 MW spread across multiple locations, and with public company status following its listing. E2 Surabaya's 9 MW of installed IT load represents roughly 9% of that total portfolio capacity, meaning the company-wide water figures in Tables 2 and 3 already reflect consumption across a footprint several times larger than the single facility this study projects for 2026.

Read against that scale, the 134,700 m³ projection calculated in Table 1 describes only one node in a larger network, not the full extent of DCI's operations. If comparable facilities elsewhere in DCI's portfolio operate at similar water intensity per megawatt, the company-wide trend documented in Table 2 gives a more accurate sense of aggregate exposure than any single-facility projection can. This matters for how RQ1 should be answered: a regulatory regime built around facility-by-facility review, as both the Dutch and American models effectively are, may systematically understate the water demand of an operator whose footprint spans a dozen or more sites [14].

Singapore's approach avoids that particular blind spot by regulating at the level of new approvals rather than individual facility performance. The 2019 moratorium on new data center approvals stopped additional capacity from entering the market altogether, rather than asking each new facility to justify its water use against an efficiency benchmark [15]. This is an administrative ceiling applied before construction, not a performance standard applied after operation begins, and it sidesteps the aggregation problem identified above because it constrains total sector capacity directly rather than summing facility-level compliance reports.

The Netherlands takes the opposite structural position. Regional water authorities negotiate withdrawal volumes with hyperscale operators on a case-by-case basis, an approach that gives each negotiation room to account for local watershed conditions but that also means no single agreement captures the cumulative demand of an operator with facilities spread across multiple water authority jurisdictions [16]. A company with the multi-site footprint described in the industry mapping above could, under this model, negotiate separately with each relevant regional authority without any single authority holding a complete picture of the company's aggregate water demand.

The United States compounds this fragmentation further by devolving water governance to individual states, each running its own drought contingency planning process with no federal coordination tying the states together [17]. Commentary within this literature increasingly debates whether efficiency improvements alone can resolve the resulting water pressure, without resort to any binding cap.7 The DCI dataset offers a partial answer to that debate: efficiency investment, in the form of the chilled-water system described in the sustainability report, coincided with a 161% increase in industrial water withdrawal, not a decline in it.

Indonesia's current regulatory position resembles the American model in its lack of a unifying national ceiling, but without the state-level drought contingency infrastructure that at least gives the American system some minimum planning architecture. Given that PT DCI Indonesia alone accounts for more than 100 MW of installed capacity across multiple sites, a regulatory gap at the national level does not describe a marginal case; it describes the water governance framework applicable to

the country's largest data center operator, and by extension to a large share of the sector's aggregate water demand [18].

Figure 2 sets out these four regulatory postures side by side, positioned along a spectrum from absolute restriction to full deference, with Indonesia's current position marked as unresolved.

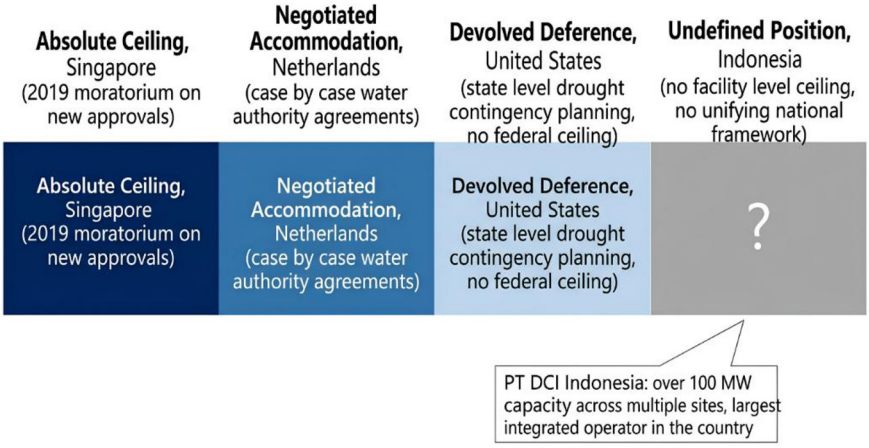


Fig. 2. Regulatory Spectrum: Absolute Ceiling to Undefined

Table 4 summarizes the comparative regulatory logic discussed above, isolating the specific dimension each regime leaves unaddressed.

Table 4. Comparative Water Governance Logic, Three Jurisdictions

Jurisdiction	Regulatory Instrument	Underlying Logic	Dimension Left Unaddressed
Singapore	2019 moratorium on new data center approvals	Absolute ceiling on new sector capacity	Water use by facilities already approved before 2019
Netherlands	Negotiated water authority agreements	Case by case accommodation	Aggregate demand across an operator's multiple sites and jurisdictions
United States	State level drought contingency planning	Localized deference, no federal standard	Coordination across state lines for multi-state operators
Indonesia (current)	No facility level or national ceiling identified	Undefined	Aggregate demand from operators such as PT DCI Indonesia, spanning over 100 MW across multiple sites

Source: Authors' synthesis of three regulatory regimes: Singapore PUB (2019), Netherlands (Waterschap), USA (state-level drought planning)

None of the three established regimes examined here resolves the aggregation problem identified in the DCI dataset: an operator's water footprint measured at the level of an individual facility, or even at the level of a single negotiated agreement, can understate the operator's total demand once its full multi-site portfolio is taken into account. This gap is the starting point for the doctrinal analysis that follows.

3.2 Islamic Doctrinal Contribution Applied to the DCI Dataset

The four principles introduced in the Introduction, istidamah al-mawarid al-tabi'iyyah, maqasid al-syari'ah, la darar wa la dirar, and mizan, address the gaps identified in Table 4 by asking a different question than any of the three secular regimes ask. Where Singapore asks whether new capacity should be approved at all, the Netherlands asks what volume a specific facility may withdraw, and the United States asks whether a given state's drought plan has been followed, istidamah al-mawarid al-tabi'iyyah asks whether the water drawn by any of these arrangements has been treated as amanah, a trust held on behalf of the watershed's other users, independent of which regulatory instrument happens to apply [19]**.**

Applied to the DCI dataset, this principle does not treat the 161% rise in industrial water withdrawal as a number to be judged efficient or inefficient. It treats the number as a claim on a shared resource that must be justified against the interests of everyone else who depends on the same watershed, a justification that neither the moratorium model, the negotiated model, nor the devolved model requires as a matter of course. The 100 MW multi-site footprint documented earlier makes this justification harder to satisfy at the level of a single company than it would be for a smaller operator, precisely because the trust obligation compounds across every site the company operates, not just the one under review.

Hifz al-nafs, the preservation of life objective within maqasid al-syari'ah, gives this trust obligation a specific point of reference: the water access of communities living near each facility [20]. DCI's own disclosure states that water treatment is handled by the surrounding industrial estate, which means the company's water relationship runs through an intermediary rather than directly through a municipal or community water authority. From a hifz al-nafs standpoint, this intermediary arrangement does not resolve the question of community water access; it relocates the question to the industrial estate's own water allocation decisions, a layer of the supply chain that the sustainability report does not describe and that this study's normative-juridical method, relying on the report alone, cannot examine further [21].

La darar wa la dirar addresses this same gap by placing the burden of proof on the party best positioned to demonstrate the absence of harm before withdrawal begins, rather than after [22]. None of the three secular regimes in Table 4 apply this sequencing consistently: Singapore's moratorium restricts new entry but does not require a harm assessment from facilities approved before 2019; the Dutch model negotiates volume but does not require the operator to prove the absence of harm as a precondition of negotiation; the American model reviews compliance against a drought plan that, being state specific, cannot account for harm accruing across state lines. A rule built on la

darar wa la dirar would require PT DCI Indonesia to demonstrate, before any expansion at E2 Surabaya or at any other site, that the community and ecosystem served by the same watershed will not be harmed by the additional withdrawal implied by the Table 1 projection.

Mizan supplies the frame that holds the other three principles together at the scale relevant to an operator the size of PT DCI Indonesia. Balance, in this context, is not a balance struck once between one operator and one regulator, as the Dutch model implies, but a balance maintained across every site an operator controls, weighed against every community and watershed those sites draw from. A company with over 100 MW of capacity spread across multiple locations tests this principle more severely than a single small facility would, because the mizan obligation does not shrink simply because the demand is distributed across several sites rather than concentrated in one [23].

Table 5 maps each doctrinal principle against the specific regulatory gap it addresses, drawing directly on the comparative analysis in Table 4.

Table 5. Doctrinal Principles Mapped Against Secular Regulatory

Islamic Principle	Core Question	Secular Gap Addressed
Istidamah al-mawarid al-tabi'iyyah	Has water been treated as a trust owed to other watershed users?	Aggregate multi-site demand invisible to facility level or single agreement review
Maqasid al-syari'ah (hifz al-nafs)	Has community water access been preserved, including through intermediary arrangements?	Water treatment delegated to an industrial estate, outside direct regulatory or community view
La darar wa la dirar	Has the absence of harm been demonstrated before withdrawal, not after?	Post approval compliance review under all three regimes, none requiring pre-approval harm proof
Mizan	Is balance maintained across every site an operator controls, not just the one under review?	Case by case or state by state review that does not aggregate an operator's full footprint

Source: Author's synthesis from the fiqh al-bi'ah literature and Table 4

Figure 3 illustrates how these four principles relate to one another and to the water governance outcome they jointly inform, with mizan positioned as the organizing frame around the other three.

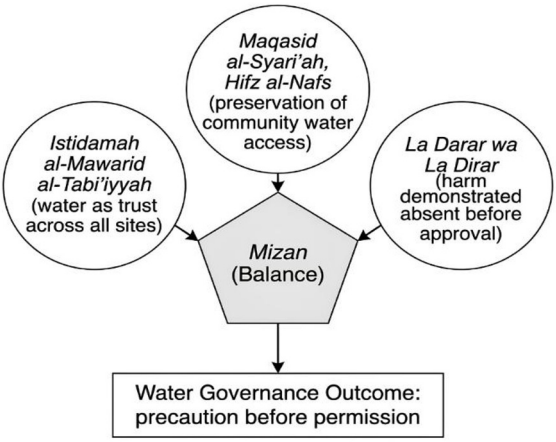


Fig. 3. Doctrinal Framework: Mizan as Organizing Principle.

Read together, the four principles in Table 5 and Figure 3 do not add a fifth regulatory instrument alongside the three already examined under RQ1. They change the default assumption each instrument operates from. Singapore's moratorium restricts entry by default; the Dutch and American models permit withdrawal by default, subject to negotiation or state level review. A regime built on la darar wa la dirar permits withdrawal only once harm has been ruled out [24], a default distinct from all three secular models and one that carries particular weight for an operator whose aggregate footprint, as documented in Table 4, already exceeds what any single facility level review is designed to capture.

3.3 A Hybrid Governance Model Tested Against the DCI Dataset

The gaps identified in Table 4 and the doctrinal responses mapped in Table 5 point toward three governance components, each addressing a specific limitation rather than replacing the secular instruments already in place. The first component is an absolute consumption threshold, following the logic of Singapore's 2019 moratorium but applied at the level of aggregate company capacity rather than only at the point of new facility approval [25]. Calibrated this way, the threshold would apply to PT DCI Indonesia's full multi-site footprint, not solely to E2 Surabaya, closing the aggregation gap identified in Table 4 without requiring Singapore's more restrictive step of halting new approvals altogether.

The second component is a waqf-linked conservation financing mechanism,[26] under which an operator's contribution scales with its aggregate footprint rather than with any single facility's disclosed figures. For a company the size of PT DCI Indonesia, with capacity exceeding 100 MW across multiple sites, this contribution would necessarily exceed what a single-facility calculation such as the Table 1 projection would suggest, because the financing obligation under istidamah al-mawarid al-

tabi'iyyah attaches to the trust relationship the company holds across its entire portfolio, not to any one site in isolation.

The third component is a mandatory harm-impact assessment required before approval, built directly on la darar wa la dirar, and applied cumulatively across an operator's full site portfolio rather than facility by facility. Under current practice, as documented in Table 4, review happens after the fact and at the level of an individual facility or agreement. A cumulative pre-approval requirement would instead ask PT DCI Indonesia to demonstrate, before any further expansion, that its aggregate withdrawal across all sites, projected using the same method applied to E2 Surabaya in Table 1, will not compromise water access for communities served by the same watersheds.

Table 6 summarizes these three components against the regulatory gap and doctrinal principle each one answers.

Table 6. Hybrid Governance Model, Components and Doctrinal Grounding

Component	Regulatory Gap Addressed (Table 4)	Doctrinal Grounding (Table 5)	Point of Application
Absolute consumption threshold	Aggregate multi-site demand exceeding facility level review	Istidamah al-mawarid al-tabi'iyyah	Company-wide capacity, not single facility
Waqf-linked conservation financing	No standing conservation obligation tied to portfolio scale	Istidamah al-mawarid al-tabi'iyyah, mizan	Scaled to aggregate footprint
Mandatory pre-approval harm assessment	Post approval, facility by facility review under all three secular regimes	La darar wa la dirar	Cumulative, applied before expansion approval

Source: Author's integration of Table 4, Table 5, and the principles of istidamah al-mawarid al-tabi'iyyah, maqasid al-syari'ah, la darar wa la dirar, mizan

Two risks qualify this model, and both become more visible once the analysis is scaled to an operator the size of PT DCI Indonesia rather than to a single facility. The first risk concerns the institutional capacity of waqf bodies to manage financing obligations calculated against a multi-site, over 100 MW portfolio, a scale considerably larger than most existing Indonesian waqf institutions have managed to date. The second risk is jurisdictional arbitrage, and the multi-site structure documented in this study's data makes this risk concrete rather than hypothetical: an operator already spanning multiple locations within Indonesia could concentrate future expansion in provinces with weaker enforcement of the proposed threshold, without needing to cross a national border to do so, unlike the Johor or Arizona cases discussed in comparative literature on cross-border arbitrage [27].

Figure 4 sets out the sequencing of the three components as a licensing pathway, positioned against the aggregate portfolio scale relevant to an operator such as PT DCI Indonesia.

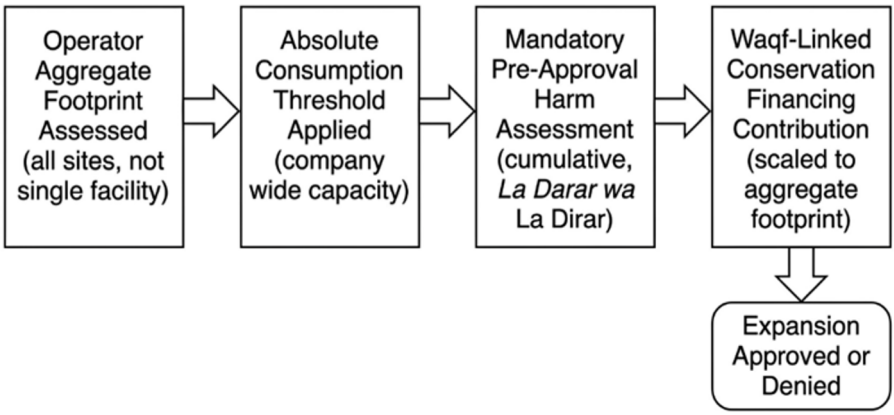


Fig. 4. Hybrid Governance Model: Sequential Licensing Pathway

Tested against PT DCI Indonesia's disclosed figures, this hybrid model does not ask whether E2 Surabaya's projected 134,700 m³ for 2026 is efficient. It asks whether that figure, added to whatever comparable demand exists across the rest of the company's over 100 MW portfolio, has been justified in advance against the interests of the communities and watersheds the full portfolio touches. That reframing, from a single facility's efficiency ratio to a company's aggregate trust obligation, is this study's answer to RQ3, and it depends on reading the doctrinal principles developed under RQ2 directly against the scale of operation documented under RQ1.

4 Conclusion

Three regulatory postures, an absolute ceiling in Singapore, a negotiated accommodation in the Netherlands, and a devolved deference in the United States, each leave a different dimension of data center water demand unaddressed, and none of the three is built to capture the aggregate footprint of an operator whose capacity spans multiple sites, as PT DCI Indonesia's own disclosure demonstrates. The most notable finding here is not that DCI's water consumption grew, but that it grew fastest in the same period the company invested in more efficient cooling technology: the chilled-water system described in the 2025 sustainability report accompanied a 161% increase in industrial water withdrawal between 2023 and 2025, rather than a slowdown in it. Efficiency and absolute consumption moved in the same direction, not opposite ones, which suggests that a regulatory model built solely on efficiency reporting would have approved this trend rather than questioned it. Islamic legal doctrine responds to this finding by asking a question none of the three secular regimes ask as a matter of course, namely whether the water drawn by an operator's full portfolio, not just one facility,

has been treated as amanah owed to the surrounding watershed and its other users. Read through istidamah al-mawarid al-tabi'iyyah, hifz al-nafs, la darar wa la dirar, and mizan, the hybrid model proposed in this study, an absolute consumption threshold calibrated to company-wide capacity, a waqf-linked conservation financing obligation scaled to that same footprint, and a mandatory pre-approval harm assessment applied cumulatively, offers a governance architecture that neither the Singaporean, Dutch, nor American models currently provide on their own. This model, and the doctrinal reasoning that produced it, is this study's central contribution.

This study is limited by its reliance on a single published source, PT DCI Indonesia's Annual and Sustainability Report 2025, for every quantitative figure discussed, a constraint that follows directly from the normative-juridical method chosen rather than from any attempt to set aside the value of field verification. The projected 134,700 m^3 figure for E2 Surabaya remains an upper-bound estimate calculated from the company's own reported ratios rather than a measured outcome, and the more than 100 MW multi-site capacity figure used to frame the aggregation problem in the Result and Discussion section comes from industry mapping rather than from DCI's own audited disclosure, a gap that independent verification would still need to close. Future research should test the hybrid governance model proposed here against other Indonesian data center operators identified in the same industry mapping, extend the comparative regulatory analysis beyond the three jurisdictions examined in this study, and, where field access becomes available, verify the aggregate multi-site water figures that this study was only able to estimate from public disclosure.

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