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Original research article

Justice illuminated: Applying mid-level normative principles to energy justice in solar photovoltaic development across urban and rural Sweden

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ABSTRACT

This paper examines how distributive, procedural, and recognition justice concerns arise in solar photovoltaic development in Sweden and proposes a case-based approach for strengthening three-tenet energy justice analysis with targeted mid-level normative principles. We compare three contrasting projects: a 55 kW rooftop installation on an urban church, a 21 MW solar park owned by a housing association on municipal farmland, and a planned utility-scale solar park of about 600 MW on 490 ha of rural forest. Empirically, the study draws on 13 semi-structured interviews and project documents. Interviews were coded iteratively and synthesized through joint review. The cases show that justice concerns shift with scale, ownership, and decision process. The rooftop installation generates limited local burdens but raises recognition issues and broader distributive questions about access to grid capacity and support schemes. The community solar park is widely supported locally yet raises procedural concerns about expedited leasing and distributive concerns about the returns on public land. The utility-scale project foregrounds concentrated local burdens alongside distant benefits and illustrates how consultation can remain formally inclusive while offering limited influence under information and agenda-setting asymmetries. We demonstrate how making the evaluative standard explicit through mid-level principles—such as affectedness-based inclusion, contestability, sufficiency, fair opportunity, and participatory parity—supports clearer diagnosis, disciplined comparison across cases, and more transparent justification of normative judgments in energy justice research and practice.

1. Introduction

In global efforts to mitigate climate change and promote sustainable development, the transition to renewable energy sources plays a crucial role. Among these, solar energy—harnessed through photovoltaic (PV) systems—has emerged as a particularly promising option due to its potential to reduce fossil fuel dependency, mitigate greenhouse gas emissions, and minimize spatial and ecological impacts. Yet, the integration of PV systems into urban and rural landscapes is not merely a technical or economic endeavor but also a socio-political one, raising significant questions of justice at each stage of the solar supply chain [1]. Existing research has examined the economic and environmental performance of solar energy, exploring its potential to support sustainable urban and rural development [2–4], as well as factors shaping the social acceptance of solar projects [5–9]. In regions where solar deployment has accelerated, a growing body of work investigates issues of justice, including equitable access to solar technologies and the distribution of

their benefits and burdens across different social groups and ecosystems [10–15].

However, recent critiques in this journal note that much energy justice research applies the three core tenets—distributive, procedural, and recognition justice—superficially, with limited engagement with their theoretical bases or interactions [16,17]. For solar energy in particular, theoretical engagement remains uneven: PV development raises characteristic questions about land-use conflicts between agriculture and energy, unequal access to technologies, and uneven environmental and economic impacts, yet many studies still rely on high-level tenet language without making explicit which normative standards are being used or how they interact [18–20]. PV also differs from other renewables in scale, ownership, and spatial effects [5,8,11], while much existing work emphasizes quantitative analyses [21–24] or focuses on narrow configurations such as household adoption [25], energy communities [26], or single projects [13]. By contrast, fewer studies examine the lived experiences of stakeholders—landowners, developers,

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policymakers, and residents—through systematic use of mid-level moral theories that can clarify what is at stake in concrete cases.

Addressing this gap, the present study examines the justice implications of PV installations across urban and rural contexts in Sweden and develops an explicit analytic workflow for deepening the three-tenet framework with targeted mid-level normative principles. We conduct a qualitative, comparative case study using semi-structured interviews and document analysis across three contrasting cases: a rooftop PV system on a city church, a medium-scale solar park owned by a housing association, and a planned utility-scale solar park exceeding 400 ha. Starting from the three-tenet structure and a bounded repertoire of established work in distributive, procedural, and recognition justice, we introduce specific mid-level principles—such as affectedness-based inclusion, contestability, sufficiency and fair opportunity, and participatory parity—where the tenet vocabulary under-specifies the evaluative standard needed for the case. The aim is to make the justificatory standards explicit and contestable in settings where more than one defensible conception of justice may apply. Empirically, this yields a context-sensitive account of how justice concerns manifest in three contrasting PV developments within a single regulatory and political setting; theoretically, it shows how tenet-based energy justice assessments can be strengthened through transparent specification of the principles doing the evaluative work. For transparency, we summarize the research design and analytical workflow in the Methods section (Fig. 1).

This paper is set up as follows. Section 2 situates the study in the energy justice literature, clarifies the three-tenet framework, and defines the role of mid-level normative principles in moving from tenet labels to explicit evaluative standards under conditions of normative plurality. Section 3 describes the qualitative comparative case study design, materials, and the two-stage analytic procedure that separates descriptive reconstruction of stakeholder accounts from an explicit authorial normative assessment, and summarizes the workflow in Fig. 1. Section 4 presents the results and analysis across the three cases, organized by distributive, procedural, and recognition justice, and in each case distinguishes stakeholder claims from a clearly demarcated normative assessment using the relevant mid-level principles. Section 5 discusses

the theoretical and practical implications of applying mid-level principles to strengthen three-tenet analysis and draws out recommendations for PV siting, permitting, and adaptive governance. Section 6 concludes by summarizing the empirical patterns and the methodological contribution, outlining limitations, and indicating directions for future research.

2. Theory and background

The energy justice literature commonly distinguishes three dimensions—distributive, procedural, and recognition justice—often called the three-tenet approach [16,27–29]. While additional perspectives such as the ethics of care [30] and restorative justice [31,32] have been proposed, this study focuses on the established tripartite framework given its prominence in international (e.g., [33] and Swedish debates [18]). This provides a coherent and policy-relevant structure for analysis. We treat the three dimensions as conceptual categories guiding normative evaluation and, where needed, supplement them with targeted mid-level theories drawn from a bounded repertoire in distributive, procedural, and recognition justice. Below we outline the three dimensions and then specify how mid-level normative principles function in our analysis; the particular principles are introduced at the points where the tenets under-specify the evaluative standard needed for the case.

2.1. Mid-level normative principles and their role in three-tenet energy justice analysis

This paper uses the term mid-level normative principles to denote normative standards that sit between (a) highly general justice “tenets” or families of concerns (distributive, procedural, recognition) and (b) all-things-considered judgments about particular empirical cases. The three tenets are useful as organizing categories, but they do not by themselves specify (i) *who* must be counted as a relevant moral subject in a given decision, (ii) *what* counts as an acceptable form of inclusion or respect, or (iii) *which* distributions, procedures, or recognitional relations should be treated as decisive when multiple justice considerations compete. Mid-level principles provide that further specification in a way that remains general enough to guide assessment across cases but specific enough to discipline interpretation in concrete settings.

In our usage, a principle counts as *mid-level* if it meets three conditions. First, it is more determinate than the tenets: it specifies a criterion, threshold, or test that can be used to evaluate real-world arrangements (for example, an affectedness-based inclusion rule, a contestability requirement, a sufficiency threshold, or participatory parity as a recognitional standard). Second, it is less comprehensive than a full “ideal theory” of justice: it does not aim to settle all questions of justice, but instead targets a limited subset of issues that recur in practice (such as who is owed voice, what kind of appeal mechanisms are required, or when material burdens trigger compensation). Third, it is action-guiding under institutional constraints: it can be connected to feasible design features in policy or permitting (for example, specifying who must be consulted, what kinds of reasons must be answered, what constitutes meaningful uptake of local knowledge, or what forms of benefit-sharing are warranted under particular burden profiles).

We introduce mid-level principles because the three-tenet vocabulary is frequently *under-specified* in precisely the situations our cases raise. For example, calling a process “procedurally just” is not informative unless one specifies an inclusion rule (who must be included), an influence condition (what counts as meaningful influence), and an accountability condition (what avenues for challenge or revision exist). Likewise, “recognition justice” requires more than noting whether groups were consulted; it requires a standard for whether affected parties were positioned as peers whose perspectives could shape framing and design. Mid-level principles make these standards explicit, thereby reducing interpretive latitude and allowing readers to scrutinize the

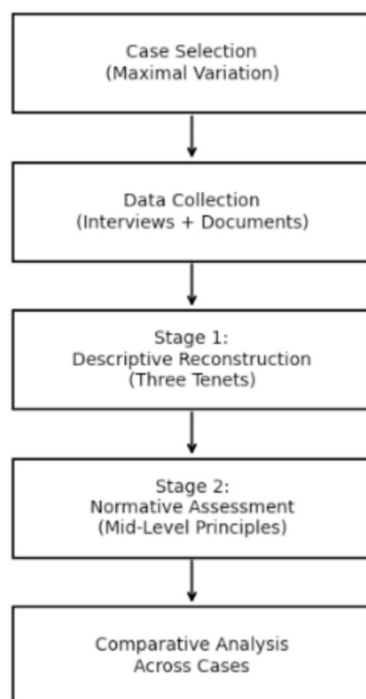


Fig. 1. Overview of the research design and analytical workflow.

normative basis of the analysis rather than infer it.

This also explains why the tenets should not always be applied with the same *intensity* across contexts. Mid-level principles help specify when the demands associated with a tenet are strong, weak, or partially satisfied. An affectedness-based inclusion principle, for instance, supports the claim that low-stakes rooftop decisions with negligible external impacts may permissibly involve limited consultation, while large-scale landscape transformations generate robust participation and justification demands. Similarly, contestability clarifies that “having a meeting” is not equivalent to a procedurally just process if affected parties lack credible avenues to challenge decisions or to trigger reconsideration when relevant concerns arise. In other words, mid-level principles do not replace the three tenets; they provide criteria for *how far* each tenet’s demands extend in a given decision context and how to adjudicate cases where distributive, procedural, and recognition considerations pull in different directions.

Methodologically, we treat these mid-level principles as a bounded repertoire of established normative resources within distributive, procedural, and recognition justice. We begin with the three-tenet structure and introduce a specific principle where (i) stakeholder claims, conflicts, or institutional arrangements raise a justice-relevant question that the tenet does not itself resolve, and (ii) the principle is conceptually appropriate and sufficiently established in the relevant normative literature. The principle then structures the normative diagnosis (for example, by identifying what would count as adequate inclusion or parity) and clarifies what mitigation or revision would be required if injustice is identified (for example, changes in consultation format, benefit-sharing arrangements, or appeal mechanisms). Where contextual constraints limit what is warranted, we clarify how the principle applies under those constraints rather than redefining it *ad hoc*. In this way, the analysis moves transparently from tenets to specified evaluative standards to case-level judgments.

Recent scholarship has argued that tenet-based categorization, while analytically useful, can obscure substantive disagreement within each tenet and can mask underlying normative uncertainty [34]. As van Uffelen, Taebi, and Pesch note, distributive, procedural, and recognition justice function as placeholders that require further normative substantiation through more specific principles of justice [34]. Moreover, different and sometimes incompatible justice conceptions may be morally defensible in a given controversy, leading to divergent evaluations under the same tenet label [35]. Disputes framed as epistemic disagreements about facts may therefore reflect competing conceptions of justice rather than simple informational deficits [35]. Similarly, recent work emphasizes that justice operates both as an evaluative concept and as an organizing principle embedded in institutional practice [36], meaning that energy conflicts unfold under conditions of normative plurality rather than moral consensus. Our contribution is not to add a further dimension to the framework, but to make the operative justificatory standards explicit. By specifying which mid-level principles are doing the evaluative work in a given case, we render the normative basis of judgment visible and contestable. This approach does not eliminate normative plurality; rather, it structures it by linking case-level evaluations to articulated and defensible principles within the distributive, procedural, and recognition family.

2.2. The three tenets of energy justice: distributive, procedural, and recognition

Distributive justice concerns the fair allocation of resources, benefits, and burdens [28,37–39]. It asks who should receive what and why, using criteria such as need, merit, or equality. Relevant moral subjects include individuals, groups, institutions, future generations, and people abroad affected by national energy choices. Its scope spans spatial and temporal scales: global transitions shift burdens through outsourced extraction or waste, and some accounts include non-human animals and ecosystems. Relevant goods include land, infrastructure, energy access,

and relational goods such as security and cultural continuity, while burdens may involve visual intrusion, pollution, or loss of livelihood. In solar development, key issues are who captures electricity or financial returns and who bears costs such as land appropriation or landscape change. Assessment requires mapping current distributions, evaluating fairness, and identifying more equitable alternatives.

Procedural justice concerns the fairness of the processes through which allocations are made [29,40,41]. It requires transparency, inclusivity, impartiality, and legitimacy so that stakeholders can meaningfully influence decisions that affect them. The scope extends beyond present local actors to future generations, distant communities, and potentially non-human entities. In solar development, this entails providing affected communities—especially those facing land-use or aesthetic impacts—with a genuine voice. Processes dominated by policymakers, industry actors, or wealthier groups without meaningful consultation risk illegitimacy even when outcomes appear fair. Procedural justice also requires accessible information, serious consideration of relevant concerns, and credible avenues for appeal; without these, affected parties lack recourse and legitimacy is undermined.

Recognition justice concerns the fair acknowledgment and respect of different social groups, identities, and perspectives in decision-making [42–44]. While procedural justice addresses formal inclusion, recognition focuses on whether groups are treated with equal respect and whether their histories, cultural identities, and experiences are substantively considered. Recognition includes long-term marginalization, place-based cultural relationships, and—in some worldviews—the moral standing of non-human animals and ecosystems. In solar development, this means that historically marginalized communities must not only be included but have their perspectives shape outcomes rather than being tokenized or dismissed. Failures occur when resistance from disadvantaged groups is treated as irrational, or when economic or environmental arguments override cultural or place-based attachments.

The three dimensions often overlap—particularly procedural and recognition justice—but can also diverge in ways that intensify or reduce justice claims *cf.* [16]. When distributive and recognition concerns are minimal, procedural shortcomings may carry limited moral weight; for example, rooftop systems with negligible local impacts may not require extensive safeguards. By contrast, large rural solar parks that alter landscapes, encircle homes, and concentrate benefits while externalizing burdens demand strong procedural protections. Unequal access to financial, legal, or informational resources further affects fairness, since participation requires the capacity to engage, not merely formal standing. The dimensions are conceptually intertwined: changes in one recalibrate how others are assessed. Recent philosophical work treats procedural justice as a practical mechanism for mediating conflicts between distributive and recognition claims—especially when incommensurable—and for translating normative principles into workable decision processes [45].

In the analysis that follows, we work with the three-tenet framework in an explicitly iterative way. We use the distributive, procedural, and recognition tenets as organizing categories and draw on a bounded repertoire of well-established mid-level normative principles (as defined in Section 2.1)—for example, fair equality of opportunity and sufficiency for distributive assessment; affectedness-based inclusion rules, contestability, and feasibility constraints for procedural assessment; and participatory parity and status subordination for recognition-based assessment. As the empirical case analysis proceeds, we introduce particular mid-level principles where the three-tenet vocabulary underspecifies the relevant evaluative standard, and we clarify how these principles apply under the stakes, institutional constraints, and uncertainty features of each case. We thus do not fix an exhaustive list of principles *ex ante*, as in a deductive theory-testing design. Instead, we make transparent how additional normative resources are selected and applied in a disciplined, case-sensitive way when the empirical material calls for further conceptual precision. This case-sensitive, abductive use of normative theory is elaborated further in the Methods section and

made explicit in Fig. 1. As noted above, the three tenets are analytically useful but often normatively under-specified [34–36]. In the analysis that follows, we therefore retain the three-tenet framework while making explicit which additional normative principles guide evaluation in each case.

3. Method and materials

Utilizing the three-tenet justice framework in a qualitative, comparative case study design, we combine semi-structured interviews and document analysis with an explicitly two-stage analysis that distinguishes stakeholder accounts from authorial normative assessment.

The study has an interpretive–explanatory aim: to examine how distributive, procedural, and recognition justice concerns manifest in contrasting PV configurations and how targeted normative principles or theories can clarify these concerns. This design, combined with maximal variation in case selection, enables a nuanced and comparative exploration of the justice implications of Sweden's solar energy transition. Sweden is a particularly relevant setting for such an inquiry, not only because of its ambitious national objectives for energy transitions but also due to its political tradition of linking environmental policy to broader commitments to social justice and welfare [46]. The three selected cases represent a spectrum of PV installations in Sweden in terms of scale, ownership model, and geographic context (see Table 1). They correspond to Nilson and Stedman's [8] categorization of solar energy systems—rooftop, community, and utility-scale—and were selected to reflect the diversity of social and spatial settings in which solar power is currently being developed.

Although Case 3 has not yet commenced operation, we include it because all justice-relevant procedural steps have already taken place. The developer has submitted the complete permit application, the County Administrative Board has received all required documentation, and two rounds of stakeholder consultation have been conducted. Since our analysis focuses on how opportunities for inclusion, transparency, deliberation, and responsiveness are enabled during the development process, these procedural stages constitute the critical moments for assessing justice. Including an ongoing utility-scale project also broadens the analytical scope, as access to such cases at this stage is uncommon. The incompleteness of the project limits the empirical assessment of distributive outcomes; for this case, we therefore examine anticipated or potential distributive implications as reflected in permitting materials and stakeholder accounts.

To support a justice-oriented analysis across different forms of solar development, we employed a maximal-variation strategy in selecting cases. The aim was not representativeness but to capture meaningful contrasts in scale, ownership structure, and social–spatial context that theory suggests may give rise to different justice considerations. Case access was facilitated through two ongoing research collaborations: one with a major Swedish landowner involved in numerous completed and

proposed PV developments, and another with one of Sweden's largest solar developers. Within these collaborations, we specified the characteristics needed for analytical variation—ranging from building-mounted systems, to mid-sized community-oriented parks, to utility-scale installations—and were then provided access to projects that met these criteria. Other available projects were not excluded on conceptual grounds but because they did not expand the variation necessary for comparative analysis. We therefore prioritized cases that represented the clearest contrasts: a small rooftop system in an urban district, a community-owned medium-scale park on municipal land, and a planned utility-scale park exceeding 400 ha. This ensured that the study examined justice dimensions under markedly different development conditions within a shared national regulatory context.

During the period in which the three cases were initiated (2018–present), Sweden's regulatory framework for PV development and environmental permitting has remained substantively stable. Although small adjustments occurred—such as modifications to national subsidy schemes for rooftop solar and administrative refinements to Environmental Code practices—the core legal and procedural requirements governing siting decisions, stakeholder consultation, and permitting have not changed. The municipalities, County Administrative Boards, and developers involved in our cases therefore operated under comparable procedural conditions. As a result, contrasts across cases primarily reflect differences in scale, ownership structure, and stakeholder configuration rather than temporal regulatory variation.

Case 1 involves a 55 kW rooftop system installed in 2018 on a church in a socioeconomically deprived urban area. District-wide energy mapping identified the building as highly suitable, and its architectural value shaped a design in which panels are not visible from the street. The Church of Sweden, which owns a large national portfolio of land and buildings, implemented the project as part of its broader environmental and social sustainability commitments. Case 2 examines a 21 MW solar park covering 44 ha of former municipal farmland in a peri-urban area. Operational since 2020, it is owned by a local branch of a national housing association together with 60–70 association members. Initially intended to demonstrate solar potential and supply members with clean electricity, the project has expanded to include shareholders from elsewhere in Sweden. The original developer remains involved in operations and educational outreach. Case 3 concerns a planned utility-scale solar park of approximately 600 MW on 490 ha of forested land in rural Sweden. The developer is seeking voluntary environmental permits under the Environmental Code, exceeding formal requirements. Site selection reflected solar resource, grid access, low ecological value, and limited residential proximity. If realized, it will be among Sweden's largest ground-mounted installations and is intended for long-term ownership and operation.

Semi-structured interviews were conducted with stakeholders across these cases, including landowners, governmental officers, industry representatives, and community members. A total of 13 interviews were

Table 1
Comparative overview of the three photovoltaic (PV) cases across key analytical dimensions.

Attribute	Case 1: Rooftop PV	Case 2: Community Solar Park	Case 3: Utility-Scale Solar Park
Scale	55 kW	21 MW (44 ha)	~600 MW (490 ha)
Location	Urban district, socioeconomically deprived	Peri-urban farmland	Rural, forested land
Ownership model	Church (non-profit organization)	Housing association (cooperative ownership)	Private developer (for-profit) with corporate landowner
Year/stage	Installed 2018	Operational since 2020	Under permitting (application submitted; two consultation rounds completed)
Primary purpose	Reduce energy costs; environmental stewardship	Local renewable supply; collective participation	Large-scale electricity production for national grid
Key stakeholders interviewed	Church staff, solar developer, municipal officer	Housing association, municipal officer, solar developer	Developer, municipal and county officials, neighbors
Main justice-relevant features	Small scale; minimal burdens; internal decision-making; symbolic recognition issues	Public land lease; mixed procedural qualities; strong local benefits	Large landscape transformation; disputed burdens; asymmetrical benefits; extensive permitting
Regulatory context	Standard building-permit and grid-connection rules	Municipal land lease; standard environmental procedures	Voluntary Environmental Code permitting (Ch. 9 §6); extensive consultations

conducted (see Table 2 for an overview of participants), each lasting 1 to 1.5 h and conducted online or in person, based on participants' preferences. Stakeholders offered perspectives on fairness in project development, decision-making processes, and the distribution of benefits and burdens. We first analyzed each transcribed interview separately, before iteratively discussing and analyzing each case, and finally the three cases together.

All interview transcripts were coded manually, without dedicated qualitative software. The second author conducted an initial iterative coding in Word by adding coarse codes as comments directly in each transcript. Coding began from the three justice categories in the analytical framework (distributive, procedural, and recognition) and was expanded inductively as additional themes emerged. The second author then extracted relevant coded passages into a separate working document, where these excerpts were further organized and refined into a thematic structure for each interview and, subsequently, into a consolidated structure for each case under each justice tenet. Both authors read and discussed the coded material and the emerging structure. Where we differed, these differences concerned how passages should be categorized rather than how they should be interpreted; disagreements were resolved through discussion, and we therefore did not calculate intercoder reliability statistics. A second cycle, led by the first author in dialogue with the second author, further refined the themes (e.g., participation, transparency, burdens, recognition claims, and perceived fairness) and supported the synthesis into within-case narratives and cross-case comparison.

Document analysis served primarily to triangulate and contextualize the interview material rather than as a separately coded dataset. Because interviews were analyzed first, document reading was focused on deepening, corroborating, or qualifying themes already identified, and on clarifying key procedural steps, decisions, and justifications in each case. For Cases 2 and 3, this involved close reading of planning- and permitting-related materials (e.g., municipal land-lease and planning documents, Environmental Code documentation, consultation materials, and relevant correspondence), selected because they shaped key decisions and/or documented stakeholder inputs. For Case 1, the available documentary material was comparatively limited; we therefore relied mainly on accessible internal church documents (e.g.,

Table 2
Overview of participants, including case, role, and organization.

Participant	Case	Role	Organization
P1	Case 1	Energy and building manager	Church (solar installation owner)
P2	Case 1	Project manager	Solar company A
P3	Case 1	Vicar	Church
P4	Case 1	Safety manager	Municipality C
P5	Case 2	Energy manager including solar park maintenance	Housing association (solar park owner)
P6	Case 2	Built environment manager	Municipality D
P7	Case 2	Communication manager	Solar company A
P8	Case 3	CEO	Solar company B (applying for permission for solar park)
P9	Case 3	Project manager	Solar company B
P10	Case 3	Governmental officer, permission process	County
P11	Case 3	Governmental officer, ecology expert	Municipality E
P12	Case 3	Neighbor	
P13	Case 3	Neighbor	

strategy and project descriptions) and other obtainable materials to supplement interview accounts, rather than applying the same selection logic as in the other cases. Across cases, documents were used to enrich the case narratives along the three justice dimensions and to support the comparative analysis.

Analysis proceeded in two stages. First, we reconstructed stakeholders' justice-related claims and experiences as they appear in interviews and documents, organized under the three tenets (distributive, procedural, and recognition). Second, we conducted an explicitly normative assessment by applying a bounded repertoire of mid-level principles to the empirically described configurations, including identifying potential injustices not articulated by participants. Iteration occurred within analysis and writing (e.g., refining thematic groupings and checking the fit between a principle and the described configuration), not through returning to the field. We therefore describe the approach as a two-stage, case-based normative analysis rather than a return-to-field abductive design. In the Results section, we present stakeholder accounts first and then provide clearly demarcated "Normative assessment" paragraphs for each case. Fig. 1 is a reader aid that summarizes the research steps and the two-stage analytic workflow.

Finally, our analysis is shaped by our positionality as researchers based in Sweden working at the intersection of ethics, environmental governance, and energy policy. This background informs both our familiarity with Swedish regulatory debates and our sensitivity to particular justice concerns (e.g., grid access, participation rights, and rural–urban divides). The identification of potential injustices that are not articulated as such by stakeholders should therefore be read as a theoretically informed interpretation rather than as a neutral discovery and remains open to critique and revision. Taken together, triangulation across interviews and documents, iterative coding followed by joint review and consensus discussions, and the continued movement between data and mid-level principles support robustness and internal validity, while the explicit documentation of our reasoning pathway underpins theoretical, rather than statistical, generalizability.

4. Results and analysis

While the justice perspectives *within* each case are important as such, we wish to understand how *different aspects* of justice are played out across the different categories of solar energy. Below we present the results according to the three dimensions of justice – distributive, procedural, and recognition – that have guided the analysis. For each dimension, we illuminate problems, experiences, differences, and themes that stand out across the categories of rooftop solar, community solar, and utility solar.

4.1. Distributive justice

To examine how justice concerns vary across solar configurations, we begin with distributive justice and how allocations reflect motivations, ownership, and scale. The cases differ fundamentally in these dimensions. Case 1 is non-profit and, like Case 2, is locally driven, sized to usage, and described by interviewees as beneficial to involved stakeholders. Case 3 is profit-based, aligned with corporate and national goals to expand renewable generation, and sized for profitability and efficiency. Distributive issues are therefore more complex in Case 3, where some stakeholders are likely to benefit while others receive little or nothing. In each case, we first summarize stakeholders' distributive claims and then provide a clearly demarcated normative assessment that applies the relevant mid-level distributive principles.

In Case 1, distributive concerns appeared largely irrelevant at the local organizational level, according to interviewees. As the energy and building manager (P1) notes, the church is non-profit; investments like the rooftop system were financed from internal funds to reduce purchased energy and costs as part of a long-term efficiency program. Internal regulations also provide shared direction, including energy

efficiency [47]. As P1 put it: “As a church, we should act to preserve God’s creation. [...] If we can do it in a non-profit way, we should.” Key stakeholders—the energy manager (P1), the vicar (P3), and the developer (P2)—supported the project, and none described the outcome as distributively unjust.

Normative assessment (Case 1): Applying principles of distributive justice, Case 1 raises potential concerns not articulated by interviewees. The church’s connection to the grid draws on a scarce shared resource (grid capacity), which can generate first-mover advantages for well-resourced actors and thereby constrain later opportunities for households or smaller organizations to connect PV. This dynamic can conflict with fair equality of opportunity [37] insofar as institutional actors are better positioned to secure access to public resources and support schemes. It can also sit uneasily with need-based distribution [48,49] and sufficiency-based concerns [50,51] if resource-constrained actors remain below a minimally adequate threshold of energy autonomy while others accrue cumulative gains through net metering or related arrangements. Even if no participant experiences the outcome as unjust, the case can therefore be interpreted as participating in broader patterns of unequal access to grid capacity and public support. Finally, accounts of complicity and collective harm suggest that actors may still have reasons to avoid or mitigate participation in ethically problematic structural processes even when their individual contribution is causally insignificant [52,53].

In Case 2, all interviewed stakeholders describe the solar park and its benefits in positive terms. Recognizing that individual members (including those in rental buildings) faced both practical and economic barriers to investing in rooftop solar, the owner built the park as a “*short cut, allowing [members] to buy shares in a solar park instead*” (P5). The solar developer, the current owner and manager of the park, and the municipality that owns the land all describe ways in which they benefit from the project. While the municipality has benefitted in other ways—including positive publicity and a sense of civic pride, as noted by the solar company representative (P7): “*There is a sense of pride that when the sun shines, the entire city is powered by solar power*”—none of the interviewed stakeholders framed the project as distributively unjust.

Normative assessment (Case 2): Applying distributive principles, the land-lease arrangement raises questions about how benefits from public resources are shared. The municipality contributed a valuable asset (land) yet may have captured less material benefit than private actors who gained both financially and reputationally. The expedited, non-competitive character of the lease—emphasized by P6—suggests that an open tender might have generated higher compensation, which could in turn have supported broader public purposes, including measures that expand access to renewable electricity for underserved groups. On this interpretation, the case illustrates how widely supported renewables can still produce distributively problematic outcomes when public value is transferred at below-competitive rates or without robust mechanisms for ensuring that benefits flow beyond project participants.

In Case 3, distributive concerns are more explicitly articulated by stakeholders. While the for-profit, utility-scale solar park is not built yet, interviews and documents indicate asymmetric impacts: the solar company and corporate landowner stand to gain financially, whereas nearby residents and the wider community receive no compensation—financial or otherwise, consistent with Swedish practice.¹ From a distributive justice perspective, this marks a clear divide between beneficiaries and the adversely affected, acknowledged by all parties.

¹ The land in Case 3 is privately owned, and the corporate landowner receives lease payments from the developer. By contrast, neighboring residents—who may experience landscape changes, reduced recreational access, or other localized burdens—do not receive compensation, as Swedish permitting practice does not provide for systematic neighbor compensation in renewable-energy siting. As the municipality does not own the land, it does not receive lease revenue in this case.

Neighbors (P12, P13) call the project deeply unjust, citing falling property values and the loss of a forest used for recreation: “*Justice? For whom? It’s not fair on us... We have invested everything we have and three years of work to build a house... And then we are informed that we are going to get a 490-hectare solar industry as a neighbor.*” The project manager (P9) concedes uncertainty about restricting residents’ land use (e.g., mushroom or berry picking), yet no mitigation has been proposed. Residents also challenge the project’s environmental rationale: “*How can anyone say it is good for the environment? A permanent clearing... all the animals, where are they going to live?*” (P12). Although the company does not plan to fence the park initially, neighbors still perceive a major loss relative to the current forest. Finally, a municipal officer and ecologist (P11) warns that siting in cheaper, less desirable areas risks shifting costs onto low-income parts of the municipality and deepening spatial and socioeconomic inequalities (relating to the concept of environmental racism [54]):

“The powerful and affluent, regardless of where they live, if it’s in the city or by the sea, probably have a different agenda and influence and opportunity to act, compared to those who earn less and live inland. Because land prices are having an impact [on renewable energy projects], it becomes a segregated society.”

Normative assessment (Case 3): Normatively, Case 3 presents a tension between localized burdens and broader societal benefits. On the one hand, the expected distribution is asymmetrical: developers and landowners capture financial gains while proximate residents bear concentrated burdens (landscape transformation, perceived property value loss, and diminished access to valued environments), without compensation under prevailing Swedish practice. On the other hand, interviewees plausibly invoke transition-related constraints—such as the greater economic viability of large-scale parks and wider benefits via additional renewable generation and potentially lower electricity prices—which can matter under distributive principles that give weight to aggregate welfare or intergenerational considerations [46]. In addition, alternative distributive principles can shift the diagnosis. A luck-egalitarian interpretation, for example, can weaken compensation claims where burdens are framed as foreseeable option luck associated with residence near industrial forest and where repurposing was foreseeable [55–57]. However, this line of reasoning is limited where background inequalities, cumulative siting patterns, or unequal political and economic influence systematically place burdens on less advantaged communities (as suggested by P11’s segregation concern and the environmental racism framing [54]). The case therefore illustrates how different defensible distributive principles can yield different verdicts about when burdens warrant compensation or benefit-sharing and on what grounds.

4.2. Procedural justice

In our analysis, procedural justice becomes increasingly salient across the three cases. In Case 1, procedural dimensions are largely internal and small-scale. In Case 2, decision-making involved both formal and informal consultations, making procedural elements more visible. In Case 3, the complexity and scale of the project foreground issues of participation, information sharing, and responsiveness to stakeholder input. For each case, we first summarize stakeholders’ accounts of procedural fairness and then provide a clearly demarcated normative assessment applying relevant mid-level procedural principles.

In Case 1, a vicar who was initially engaged in the process was later excluded. According to our interview with the person in charge, this appears to have been an administrative oversight rather than an intentional act of exclusion. The project was handled as an internal decision within the church organization, and no interviewee framed this exclusion as a serious procedural failure. From stakeholders’ perspectives, the process was largely seen as routine, with limited stakes beyond the congregation and church administration.

Normative assessment (Case 1): Applying mid-level procedural principles, the exclusion of the vicar prompts an assessment of who has a claim to inclusion and why. Procedural fairness does not require maximal participation; inclusion is typically owed to those whose interests are meaningfully affected by a decision [58]. In small-scale, internal decisions with limited external impacts—such as a rooftop PV installation—high-intensity participation may be unnecessary if it adds little to fairness, transparency, or legitimacy [48,59]. What matters is that those whose interests are genuinely at stake have meaningful opportunities for influence and that the process remains open and contestable in appropriate ways [60]. On this interpretation, given the limited stakes and internal character of the decision, the vicar's exclusion does not necessarily constitute a procedural injustice, even if it may reasonably be perceived as disappointing or disrespectful.

Compared to Case 1, the decision in Case 2 engaged substantially higher stakes, as the municipality was considering leasing a large tract of land for thirty years. There were also clear stakeholders involved, including the public, competing companies, and public agencies. Stakeholders give divergent accounts of how transparent and inclusive the process was. While the park owner (P5) and the solar developer (P7) describe the process as straightforward, the municipality representative (P6) offers a different narrative of the internal decision-making. The solar park was seen as a prestigious project for the municipality, contributing to local renewable energy visions. For this reason, the land-lease agreement was approved through an individual delegated decision by the Chair of the Municipal Executive Committee (“the mayor”) together with a small group of senior officials, rather than through the ordinary committee or council procedure—something that generated criticism from opposing political parties for lacking transparency and inclusion. As P6 says: “*Decisions made by the chairman are often for urgent matters. And of course, the solar developer argued that this was urgent. But given how long time this park will exist, the opposing parties argued that it wasn't that urgent – it could have waited a month [and allowed for a more transparent process].*” These accounts suggest that some actors experienced the process as efficient and unproblematic, whereas others viewed it as opaque and overly concentrated in the hands of a few decision-makers.

Normative assessment (Case 2): Applying principles of procedural justice, the expedited delegated decision raises concerns about transparency, inclusiveness, and contestability. A procedurally just process need not be maximally participatory, but it should provide reasonable opportunities for relevant stakeholders—including the broader public and potential competing developers—to understand, question, and, where appropriate, challenge decisions that allocate valuable public resources over long time horizons [41,61,62]. On this basis, the delegated procedure can be interpreted as procedurally fragile: it enabled a widely supported project, but narrowed the space for contestation and alternative proposals, thereby weakening perceived legitimacy even if the substantive outcome is viewed positively by many participants.

Case 3 presents a more expansive and diffuse decision context, given that the proposed solar park would border an entire community—encircling some houses and standing adjacent to others. A wide range of stakeholders is involved: local residents, the landowner, the entrepreneur seeking to build and operate the park, public agencies, people living elsewhere who will benefit from the energy produced while avoiding the impact of having a similar park near their own homes, potential future generations, and non-human animals, to mention just a few. Interviewees describe an extensive but uneven participatory landscape. The solar company has voluntarily chosen a more thorough permitting process (following Chapter 9, Section 6 of the Swedish Environmental Code (SFS 1998:808)), which requires consultations with several governmental agencies and with the local community, including neighbors. The CEO (P8) explains: “*It's an extremely important part for us to choose a democratic way forward and not use 12:6 [permitting process following Chapter 12, Section 6 of the Swedish Environmental Code (SFS 1998:808)], which is sort of used for anything [and which does not require*

consultations with neighbors]. [We want to] include everyone and people get to be part of the consultation, and [we] include those aspects as well.” Although the voluntary process is more resource-intensive, it would eventually grant the company legal security from new demands (e.g., adjustments), if the solar park were to get permission.

Yet, several gaps remain. Some stakeholders are absent from the formal process, including groups within the local community and less easily represented interests such as future generations and non-human animals and ecosystems affected by the land-use transformation. Although these actors cannot participate in consultations, environmental ethics and justice theory increasingly recognize them as morally relevant. Interviews also point to power asymmetries in how consultations are organized and experienced. Formal requirements mandate that consultations be held but not how they are conducted, leaving the solar company to determine the format. The company hired experienced experts (including P9) to ensure the process proceeded efficiently. While the company, municipality, and permitting agency all described the dialogue as “*constructive*” (P10) and “*professional*” (P11), community representatives struggled to participate on equal terms. The company's control over the consultation format, combined with its expertise and prior experience, gave it a distinct advantage. Neighbors (P12, P13), who had no prior experience with such meetings, initially believed they had been invited to share input on the project—a “*just*” opportunity to contribute. However, once the meeting began, they quickly sensed that “*the decision had already been made*” and that the session served mainly as “*a symbolic step*” or “*sales pitch party*,” rather than a genuine forum for deliberation or collaboration.

Normative assessment (Case 3): Normatively, Case 3 illustrates how formally inclusive processes can still fall short when affected parties lack meaningful influence due to knowledge asymmetries and agenda control. Although the developer voluntarily opted for a more demanding permitting route, the interviews suggest that the consultation format and the company's expertise can limit the extent to which local residents can shape the decision or secure responsiveness to their concerns. On a contestability-based view, inclusion is insufficient if affected parties lack credible avenues to trigger reconsideration or to contest decisions under conditions they can reasonably navigate [60]. The case also highlights procedural challenges of representing diffuse or future-oriented interests (future generations and non-human nature) in land-use decisions under uncertainty; while such interests may be morally relevant, institutional procedures rarely provide robust proxies for them, complicating legitimacy claims [37,61,63]. Finally, perceived gaps between institutional neutrality and felt decision power—exemplified by neighbors' frustration with the CAB's role—illustrate how procedural legitimacy depends not only on formal rules but also on intelligibility, accessibility, and the practical ability to make one's claims count [40,61].

A further theme concerns how procedural aspects continue to matter throughout the lifespan of a solar installation, not only during initial decision-making. The solar park in Case 2, operational since 2020, illustrates how processes extend beyond construction and require new forms of collaboration. The original developer remains involved in maintenance, guided tours, and education, reflecting a continuing procedural relationship. One post-decision issue was solar glare, which created traffic safety risks and required mitigation. As the municipal representative (P6) recalls: “*No one wanted to claim responsibility really. However, we had a constructive dialogue with the solar developer and they eventually placed containers to block out the solar glare from the motorway.*” According to the solar company representative (P7), the entire sector has gained experience since the park's construction, particularly regarding biodiversity and social considerations. The park owner has remained receptive to new initiatives, including summer grazing by a local sheep farmer and a research collaboration monitoring biodiversity within the park. These post-installation adaptations demonstrate empirically how responsibilities can be unclear even in well-managed projects and how ongoing dialogue is needed.

As noted, the solar park in Case 3 is still not built, but the company

nonetheless presents ambitious plans for long-term maintenance if approved, with a 50-year land lease envisioned. Similar to Case 2, they plan for sheep grazing, research collaborations, and measures to enhance biodiversity, while acknowledging significant uncertainty about the environmental effects of large solar parks in Sweden. A municipal ecologist (P11) involved in the permitting process echoes this uncertainty, noting that “we don’t have any answers until in the future [about the impact of solar parks]. We must make qualified guesses and decisions based on that. Uncertainty is part of my job... You try to make a professional judgment based on current knowledge. If you realize along the way that you made mistakes, then you must do the right thing next time or address the errors.” This reflection underscores both the epistemic limits of environmental decision-making and the need for adaptive governance as part of procedural justice. Future generations cannot participate in current decisions yet will live with their outcomes; procedural justice must therefore find ways to account for their interests even amid uncertainty and evolving knowledge [37,61,63].

Normative assessment (procedural justice over the project lifecycle): The Case 2 glare episode and subsequent adaptations illustrate that procedural justice is not exhausted at the siting decision; it also concerns ongoing responsibilities for monitoring, mitigation, and revision as conditions and knowledge change. On this view, procedural fairness includes clarity about who is accountable for addressing new harms, and the availability of workable mechanisms for mid-course correction when unforeseen impacts arise. For long-lived installations (such as the planned 50-year lease in Case 3), these requirements extend to adaptive governance under uncertainty, including credible review points and responsiveness to emerging evidence and affected interests [37,61,63].

4.3. Recognition justice

Recognition justice in our material concerns whether stakeholders are treated as morally relevant agents whose identities, roles, and place-based attachments are taken seriously, rather than merely being included procedurally or compensated materially. Across the three cases, interviewees describe quite different experiences of being seen, heard, or sidelined. For each case, we first summarize stakeholders’ recognition-related experiences and then provide a clearly demarcated normative assessment applying relevant mid-level recognition concepts.

In Case 1, interviewees did not report distributional injustice, but the vicar (P3) described a clear sense of being sidelined despite having initiated the project together with their congregation. Inspired by a nearby housing association, they first proposed the installation and linked it to broader work on social sustainability and integration in the local community: “If they [the housing association] can be part of the energy transition, we [the church] also want to be part of the transition.” The church council, including the vicar, took formal steps to advance the project, commissioning an energy mapping to assess suitability. Once the project moved forward, however, control shifted to the solar developer (P2) and the church’s energy and building manager (P1). From that point on, the vicar and congregation were no longer involved. As P3 recalled: “We received no information or were given no opportunity to participate in any decisions—it was as if we were completely shut off.” The vicar emphasized that they were “grateful” for the final installation yet also said “it was a shame to not be invited to participate in the process.”

This sense of being overlooked extended beyond the installation itself. P3 wanted a small display in the church so members could follow solar production, but this suggestion was not acted upon. They also invited P1 to speak at a church gathering about the project, but P1 declined: “I tried to get the energy manager to come to one of our social gatherings at church and talk [about the solar installation], but they didn’t want to. It wasn’t part of his job.” For the congregation, such engagement “would be so natural to offer.”

Normative assessment (Case 1): Applying mid-level recognition concepts, Case 1 can be interpreted as involving a denial of social esteem and parity of participation [42,43,64]. The vicar and congregation were

central to initiating the project and connecting it to local moral commitments, but once the project became technical, their role was implicitly reduced to that of passive beneficiaries. Their standpoint was not treated as equally relevant in shaping how the installation was implemented or communicated. Even without any intention to marginalize them, the structure of the process can be interpreted as producing status subordination [40], insofar as their identities and contributions were not acknowledged as co-defining the project. The case thus illustrates how a project with a broadly welcomed outcome can still embody recognition injustice when it fails to register and affirm the social meaning and identity work invested by local actors.

In Case 2, interviewees described a more positive pattern. The housing association representative (P5), the municipal officer (P6), and the developer (P7) all emphasized that the project design and implementation took account of local conditions and concerns. P5 highlighted the need to “hit a balance in scale and investment,” explaining that park size was calibrated so that members with limited resources could still participate under the non-profit shareholder model, and that additional locations were considered as interest grew. P7 described the developer’s approach as grounded in early communication and responsiveness: “If there is a solar development in the local area, one wants to feel involved. Then I think as a solar developer you need to listen and be responsive.” She gave concrete examples of accommodating seemingly small but important requests from neighbors, such as planting particular vegetation along the fence or leaving an opening to maintain access to a favored mushroom spot.

Normative assessment (Case 2): Applying recognition-focused standards, Case 2 can be interpreted as moving closer to mutual recognition and participatory parity [42–44,64]. Local actors are not treated as obstacles or passive recipients but as partners whose situated knowledge and everyday practices shape aspects of the project. The fact that some adjustments are materially modest but symbolically important supports the view that recognition is not reducible to distribution or formal inclusion: affirming people’s identities and concerns as legitimate can itself be a justice-relevant good. In this sense, Case 2 contrasts with Case 1 by illustrating how recognition can be fostered through attentive listening, adaptive design, and ongoing relational engagement, even within a technically driven infrastructure project.

In Case 3, rural neighbors and local officials described a more ambivalent picture. The developer and landowner acknowledged that the project would be burdensome for some residents, but framed these burdens as acceptable in view of broader societal benefits. The CEO (P8) characterized the project as potentially “not... a pleasant experience” for nearby residents, while stressing that “we have a responsibility to look after each other. We need electricity. Then we must produce it somewhere too.” P9 described a neighbor who had moved to the countryside to avoid infrastructure and now faced a major facility next door: “That person had moved to the countryside to limit the connection to society and technology, and now this person would become the neighbor [to the park]. It feels very bad.” Neighbors (P12, P13) themselves emphasized loss of valued surroundings and ways of life, expressing that the project felt “deeply unjust” and at odds with their reasons for living there.

Recognition issues also surfaced at a global scale. P8 and P9 invoked Sweden’s geography and political stability as reasons to concentrate large-scale solar production domestically rather than in “unstable” regions: “It had been fantastic if we could use Morocco and Tunisia and Algeria for solar power production, but unfortunately, they don’t have the same economic or political stability... Instead, here in the north, we are sparsely populated and have space. Then we should use it.” By contrast, the vicar from Case 1 (P3) reflected on the hidden burdens of global supply chains, noting that “they mine for dangerous things so that we can have our batteries here. Again it becomes so unjust. There are no easy solutions.”

Normative assessment (Case 3): Applying recognition-focused concepts, Case 3 can be interpreted as an instance of qualified recognition. Local residents’ concerns are heard and acknowledged, but are consistently subordinated to national and transnational energy goals and do

not substantively reshape project design. This pattern aligns with Fraser's account of status inequality and misframing, where some ways of life and standpoints are treated as less authoritative in public justification [43,65]. Honneth's account similarly suggests a failure of recognition, insofar as rural residents' self-understanding as stewards of a particular landscape is not affirmed and their objections are positioned as obstacles to a larger technical and economic project [42,66]. At the global level, the contrast between P8's framing of "unstable" solar exporters and P3's concern with extractive harms illustrates how some perspectives—often associated with the Global South—remain at the margins of deliberation about just transitions [32,44].

Taken together, the three cases indicate that recognition justice is not automatically secured by fair procedures or acceptable distributions. Even when material benefits are widely shared (Case 2) or when outcomes are locally welcomed (Case 1), the ways in which actors are seen, heard, and positioned can still embody injustice. Conversely, explicit acknowledgment of burdens (Case 3) is not sufficient when those acknowledgments do not translate into meaningful influence over design or framing. Using the ideas of social esteem, status subordination, and participatory parity [41,42,59], we can distinguish more precisely how recognition succeeds or fails across rooftop, community-scale, and utility-scale solar, and how these patterns interact with the distributive and procedural dynamics described above.

5. Discussion and recommendations

In this paper, we respond to concerns about superficial use of the three tenets by bringing targeted and well-established normative theories to bear on three PV cases and by making our justificatory standards explicit. We deepen and broaden analysis within the distributive, procedural, and recognition framework by using mainstream theories selected for case-sensitive fit. It also offers a replicable path—moving from narrow case readings toward more general, revisable principles—for linking empirical findings to mid-level normative concepts while keeping theory central to practice. In this way, the contribution of our Swedish cases is positioned within a broader scholarly landscape.

While our analysis focuses deliberately on three Swedish cases rather than aiming for representativeness across countries, it is useful to situate the findings in relation to emerging international research on energy justice in solar and broader energy-transition contexts. Recent empirical work shows that justice outcomes vary substantially across governance regimes, institutional capacities, and socio-economic structures. For example, Zhao and He [68] demonstrate that China's New Energy Demonstration City policy significantly improved urban energy justice by expanding employment and development opportunities, underscoring how large-scale policy interventions can redistribute benefits in ways not available in decentralized Scandinavian settings. Comparable studies in the United States, India, and parts of Europe also highlight that distributive, procedural, and recognition patterns are shaped by national regulatory traditions, property regimes, and local planning institutions. These findings reinforce that our contribution is not to generalize across countries but to develop a theoretically explicit, mid-level interpretive approach that can be used in other contexts where scholars conduct similarly situated analyses.

On this basis, three implications for the use of the three tenets in future work can be drawn. First, for procedural justice, grounding inclusion in affectedness rather than maximality becomes more precise when linked to affected-interests theory. Participation is owed to those whose interests are meaningfully at stake; over-inclusion is usually harmless, but under-inclusion risks distorting outcomes [58]. At the same time, broad participation can in some contexts introduce avoidable delays or procedural complexity, particularly when highly technical or low-stakes decisions become subject to expansive consultation. Relevance thresholds thus justify limiting participation in low-stakes, technical choices while demanding more expansive inclusion under high stakes or uncertainty. Tyler clarifies why voice, neutrality, and

respectful treatment matter for perceived legitimacy, without implying that everyone must be invited into every decision [40]. Gutmann and Thompson, with Miller, explain why reciprocity, reason-giving, and impartiality must be balanced against feasibility—procedures should match stakes, evidence, and institutional capacity rather than become ritualistic [48,59]. Pettit's republican contestability adds that procedures must be reviewable in practice; participation without credible avenues of appeal is not procedurally just [60]. Taken together, these concepts specify what the procedural tenet often leaves implicit: why some exclusions are permissible, when low-intensity procedures suffice, and which kinds of appeal mechanisms are required in different PV configurations.

Second, for recognition justice, the cases show that recognition and procedure are conceptually distinct and can diverge in practice. Recognition failures arise when actors are denied standing, esteem, or parity of participation despite formal procedures [42–45]. Solar projects often translate local life projects into technical categories (noise, glare, setbacks) and thereby miss place attachments, stewardship roles, and the moral meanings of land use [44]. Fraser's notion of participatory parity and Honneth's focus on social esteem sharpen this diagnosis: justice requires that stakeholders are treated as peers whose perspectives can influence outcomes, not only that they are formally consulted [42,43]. The implication is not indiscriminate participation but demonstrable uptake of situated knowledge and identities in design choices [43]. Small, context-sensitive adjustments—modifying access points, sharing performance information, co-producing micro-amenities—can satisfy recognition claims at low cost and improve social acceptance [42,44], whereas large procedural exercises that do not alter framings when warranted risk symbolic exclusion [44]. In this way, recognition theory adds structure to the recognition tenet, distinguishing cases where procedure and recognition align from those where status subordination persists despite formal inclusion.

Third, for distributive justice, debates around siting and compensation turn on when and why claims are morally warranted. On a luck-egalitarian view, compensation is weaker when burdens predictably follow from informed residential choices in industrial zones [55,56]. Yet public infrastructure also engages shared purposes and background inequalities, so need, sufficiency, and fair opportunity remain salient [37,48,50,51]. In solar, first-mover advantages in grid access, asymmetries in subsidy uptake, and unequal capacity to engage can entrench patterned disadvantages that warrant redress [32,49]. Distributive claims extend to relational and place-based goods—everyday access to landscapes and recreational spaces—not only to income or prices [44,50]. Intergenerationally, subsidy and siting choices may improve fairness between present and future persons even if they worsen within-cohort equality [66]. Accordingly, a single compensation rule is ill-suited; a calibrated benefit-sharing menu is indicated: bill credits or community funds where burdens are diffuse; property-value safeguards, lease multipliers, or co-ownership tranches where harms are localized; and, where background disadvantage is evident, priority access to grid capacity or targeted support for small actors [32,37,48]. Here, the addition of luck-egalitarian and sufficiency-based considerations shows why seemingly similar distributions may be judged differently once responsibility, background inequality, and thresholds of adequacy are taken into account.

At the same time, our use of the three-tenet framework has clear limits. The tripartite structure can encourage cataloguing injustices into predefined boxes rather than asking whether some concerns fall outside or cut across these categories. Perspectives such as ethics of care, restorative and reparative approaches, Indigenous and Buen Vivir-inspired accounts [30–32,66,67], as well as justice issues linked to global supply chains, epistemic injustice, and deep intergenerational uncertainty, are explicitly bracketed here. We do not aim to exhaust the normative terrain. Instead, our contribution is to show how specific mid-level principles within the distributive, procedural, and recognition family re-weight and re-interpret familiar issues—such as subsidy access

in rooftop solar and the evaluation of rural burdens in utility-scale projects—rather than to provide a comprehensive inventory of injustices. Drawing in additional normative theory also does not resolve deep value conflicts such as land conflicts or “green on green” conflicts [69,70], remove uncertainty about long-term socio-ecological impacts, or substitute for context-specific political judgment and democratic negotiation. We therefore do not claim to offer a comprehensive framework or determinate answers. Rather, the theoretical enrichment does more modest work: it makes explicit which moral standards are being used, sharpens the diagnosis of familiar tensions (for example, recasting Case 1 as implicating opportunity, sufficiency, and grid-access concerns), and clarifies why certain stakeholder claims carry more or less weight under particular principles, without pretending to eliminate disagreement or deliver unique outcomes.

Last, our selection of normative concepts and our emphasis on particular potential injustices reflect our positionality as Swedish researchers working at the intersection of ethics, environmental governance, and energy policy. The interpretations offered here should therefore be understood as situated and open to contestation and revision by scholars and practitioners working in other regulatory, political, or epistemic contexts. The value of our approach lies in providing a transparent workflow rather than a new canon: specify the inclusion rule and its justification; match participation intensity to stakes and uncertainty; identify recognition criteria and supporting evidence; and describe appeal mechanisms and remedies. We present this as an illustrative procedure that others can scrutinize and adapt, not as a fixed formula that replaces context-specific judgment. In practice, this often requires collaboration between empirical energy researchers and moral or political philosophers to keep theories central rather than decorative and to translate recognition and distributive claims into concrete design adjustments and benefit-sharing arrangements.

6. Conclusion

This paper used established normative theories to deepen and broaden analysis of three Swedish PV cases within the distributive, procedural, and recognition framework. By grounding inclusion in affectedness, clarifying proportional participation and contestability, and distinguishing recognition from formal procedure, we showed how targeted theory can sharpen case interpretation without inflating participation for its own sake. Making the justificatory pathway explicit—moving from narrow case judgments toward broader, revisable principles through reflective-equilibrium-inspired reasoning—links empirical findings to mid-level normative concepts and yields standards that others can inspect and adapt.

Substantively, the cases indicate that recognition can fail even when procedures appear adequate; that distributive claims extend beyond prices to place-based and intergenerational goods; and that compensation is best handled by calibrated benefit-sharing rather than a single rule. Practically, the approach translates into clear design expectations: specify ex ante inclusion rules tied to stakes and uncertainty; evidence recognition through uptake of situated knowledge in design; ensure credible avenues of appeal; and build lifecycle review and mid-course correction into permits.

The study's scope is modest, Sweden-specific, and includes one utility-scale project still in permitting. The focus is on siting, permitting, and local operation rather than upstream supply chains, and the theoretical resources employed do not exhaust the broader normative terrain. Even so, the workflow we make explicit—linking cases, data, tenets, and mid-level theory—can be taken up, scrutinized, and modified in other contexts. Future work should test applicability across legal regimes and technologies, follow projects longitudinally to assess recognition and social license, and experiment with consultation formats under power asymmetries. Collaboration between empirical researchers and moral and political philosophers will be important for refining such workflows and for developing defensible, transparent

standards for more just solar transitions.

CRediT authorship contribution statement

Karl de Fine Licht: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Maria Håkansson:** Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT to proofread the text. After using this tool/service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Declaration of competing interest

None.

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Data availability

The authors do not have permission to share data.

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