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Energy infrastructures in divided cities

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ABSTRACT

Within the rich literature on politically divided cities, infrastructure has rarely featured as a medium of urban contestation. Only transportation infrastructure has merited attention of late. This paper presents an in-depth investigation of energy infrastructures as instruments of separation, control and collaboration in three iconic divided cities: Berlin, Jerusalem and Nicosia. The purpose of the paper is threefold: 1) to identify the multiple ways in which geopolitical division and unification have manifested themselves in the cities' electricity (and gas) supply systems; 2) to analyse the strategic responses of service providers, politicians and users to their divided and united energy systems over time and 3) to use the cases to generate insight into energy infrastructures as conduits of separation, control and collaboration in politically contested cities. The research approach is distinctive for being socio-material (exploring the politics and agency of infrastructures), relational (appreciating the co-shaping of cities and infrastructures) and historical (covering 75 years of shifting responses to division and unification). The findings from this long-term analysis challenge simplistic distinctions between separation, control and collaboration. They point, rather, to the co-existence and even hybridisation of these three strategies at any one time and place, as well as to the limitations facing ideal types, as expressed in our terminology 'seductive separation', 'constrained control' and 'conditional collaboration'. The paper emphasises the need to see beyond and within a city to comprehend the contested geographies around energy in divided cities. It also highlights the politicised indeterminacy of infrastructures in volatile urban environments, countering popular images of them as bulwarks of stability.

1. Introduction

Politically divided cities have been a captivating and challenging theme for urban planning and governance for many years. Scholarly interest has been drawn to the way these cities present generic issues of urban contestation, conflict and control in sharp relief (Allegra et al., 2012; Caner & Bölen, 2016). Early single-city case studies and later comparative analyses have explored how political division – whether ethnic, nationalist or geopolitical in origin – has found expression in, and been reinforced by, spatial segregation, the built environment and urban planning (Bollens, 2001; Calame & Charlesworth, 2009). *Progress in Planning* published one such early milestone, authored by Kliot and Mansfeld, in 1999.

Although the built environment has been central to many of these works, infrastructure is a blind spot in the literature on divided cities. Early studies overlooked infrastructure almost entirely. Only the more recent literature has begun to explore infrastructure as a manifestation and medium of political division, challenging the popular notion and professional ethos of infrastructure as a force for connection and integration (e.g., Brand & Fregonese, 2013; Nolte & Yacobi, 2015; Rokem & Vaughan, 2018). Yet even this emergent body of work restricts the focus to transportation infrastructure, addressing mass transit, roads or bridges. The opportunity to investigate other infrastructures and to draw on the recent 'infrastructural turn' in human geography, urban studies

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and planning has not yet been seized. This wider literature is using infrastructure as a lens on the urban condition to capture the socio-technical dynamics of a city (Graham & Marvin, 2001; Pullan et al., 2007; Moss, 2014; Nolte & Yacobi, 2015). In so doing, it is opening perspectives that are socio-material (exploring the politics and agency of infrastructures), relational (appreciating the co-shaping of cities and infrastructures) and historical (embracing change and continuity over time).

Bringing these three infrastructural perspectives to bear on divided cities promises to reveal new knowledge about how political division is enabled, resisted or overcome through infrastructure but also about the significance of infrastructure to urban conflict more generally. The aim of this paper is to analyse and compare the experiences and responses of three divided cities to the impacts of division and (contested) unification on energy supply and use over time and to generate broader insight into the sociotechnical dimensions of urban planning and governance in contexts of conflict. The focus on energy infrastructure is justified not only by the dearth of studies on energy in the divided cities literature. More significantly, energy infrastructure has become prominent in debates on technopolitics, sociotechnical systems in transition, uneven geographies, urban governance, regionalism and issues of socio-material agency (e.g. Rutherford & Coutard, 2014; Graham & McFarlane, 2014; Herman& Fischhendler, 2021; Moss, 2020; Fischhendler et al., 2021; Herman & Ariel, 2024). It is also increasingly recognized that cities play a critical role in the energy transition necessary for climate change mitigation and adaptation (Bulkeley et al., 2011). Inspired by this body of work, the paper studies how energy infrastructures have been used as instruments of separation, control and collaboration and how much they resisted enrollment in these strategies of urban resilience.

The paper explores these issues with in-depth analysis of the experiences of Berlin, Jerusalem and Nicosia throughout their periods of division (and subsequent unification) since the late 1940s. The case selection is designed to include three iconic divided cities that are (or were) also frontier cities. At the same time, they each display distinctive features of divided cities. These relate to the causes of division (whether ethno-nationality, ideology and/or geopolitics), the degree of sovereign control (from formal division to disputed sovereignty), the extent of reunification (from limited collaboration to full amalgamation), their political geography (with borders running through or around the city), their scales of energy governance (from municipal to bi-national) and levels of energy dependence (from self-supply to intermittent or full interdependence).

Three research questions guide the analysis. First, how have political division and unification manifested themselves in energy infrastructure in Berlin, Jerusalem and Nicosia? Second, in what ways have urban actors on each side responded to the impacts of division, using energy infrastructure to reinforce, resist or transcend urban division? Third, what can a comparison of the three cases tell us more generally about infrastructures as conduits of separation, control and collaboration in politically contested cities?

Following an elaboration of the research design and methods, a literature review places infrastructures in scholarship on divided cities, describes how energy infrastructures are being discussed as conduits of urban politics and develops from this discussion an analytical framework to guide the research. The paper then sets the three cities' experience of division to energy infrastructures in their historical contexts. On this basis the strategic responses to infrastructural division are subsequently analysed for each city. The subsequent chapter conducts a cross-city comparison, interpreting the findings in terms of how energy infrastructure served purposes of separation, control and collaboration in the cities at different times. The final chapter summarises the findings and draws conclusions on their implications for urban planning and governance in contested contexts, indicating productive avenues for future research.

2. Research design and methods

This paper emanates from an international interdisciplinary research project, conducted between 2020 and 2023, studying the experiences of divided cities through the lens of their energy systems and, through comparative and contrasting analysis, deriving fresh insight into the relationship between conflict and cooperation in the field of urban energy. An inquiry into the interplay between energy infrastructure and contested urban spaces requires combinations of complementary strands of literature. The paper draws for inspiration and guidance on scholarship from history, energy studies, geography, urban studies, political science, international relations and economics. It brings into dialogue literatures on divided cities, energy politics and urban infrastructure (see inner triangle in Fig. 1). Thus, the paper offers a unique theoretical and methodological contribution by engaging these distinct literatures and disciplines beyond its empirical contribution to the study of individual divided cities. Fig. 1 outlines the paper's research design highlighting the interface of the three research strands and how they informed the research process.

Given contextual differences and the broad extent and complexity of factors and variables influencing divided cities, we employ a comparative analysis approach (Hancké, 2009) to examine similar concepts and urban processes across diverse spatial, historical, cultural and political contexts (Robinson, 2011; Rokem, 2016; Savitch & Kantor, 2002). Comparative urbanism offers a valuable access point to examine common yet differentiated experiences, processes, forces and narratives, contributing to competing notions of convergence and divergence (McFarlane & Robinson, 2012; Robinson, 2016; Marom, 2019). It offers several central variables that are particularly important for our study, notably power relations, agency and forces of change; connectivity vs. isolation; planning, services and infrastructure; sovereignty; and city-state relations (Nijman, 2007; Rokem & Boano, 2018; Charney et al., 2022). These variables facilitate a comparative longitudinal analysis of continuity and change to analyse energy infrastructure in three contested environments. Their comparison contributes to our understanding of spatial-political separation, collaboration and control, and a mix of these dynamics.

We analyse three past and present cases of long-standing politically divided – and partially reunited – cities: Berlin, Jerusalem and Nicosia. All three cities have experienced extreme forms of political division in their recent history. The impact of this division on their respective systems of electricity supply – and, in Berlin's case, also gas supply – was hugely disruptive in all three cases, given the duration of division, the prospect of an unknown future and the volatile political context. Apart from the severity, longevity and infrastructural impact of division in all three cases, each city has been chosen to reflect a particular trajectory of separation and cooperation as well as a particular type of conflict. Berlin's trajectory goes from unified to divided (in 1948/49) to reunified (in 1990) and represents an ideological-political divide embedded in Cold War politics. In Nicosia's case, it goes from unified to divided (in 1974) and represents an ethno-national rift. Jerusalem presents a more ambiguous case, changing from unified to divided (in 1948) and subsequently to contested reunification (in 1967), reflecting varying degrees of ethno-national-political and religious conflicts. The three cities have also been chosen to capture diverse energy demand profiles and energy infrastructures, reflecting their specific climatic conditions and socio-economic structures.

As presented in Table 1, these divided cities have been selected not only for their dynamic trajectories, but also for their differences concerning (a) the nature of the conflict and the reasons behind it, such as ethno-nationalism, ideology and geopolitics; (b) the political context, namely the conflict's embeddedness within domestic and international conflicts; (c) the territorial and political geography, such as territorial insularity, connectivity to a hinterland and the nature of political borders; (d) the extent of municipal control of energy services, from direct ownership to indirect influence; (e) the level of energy dependence,

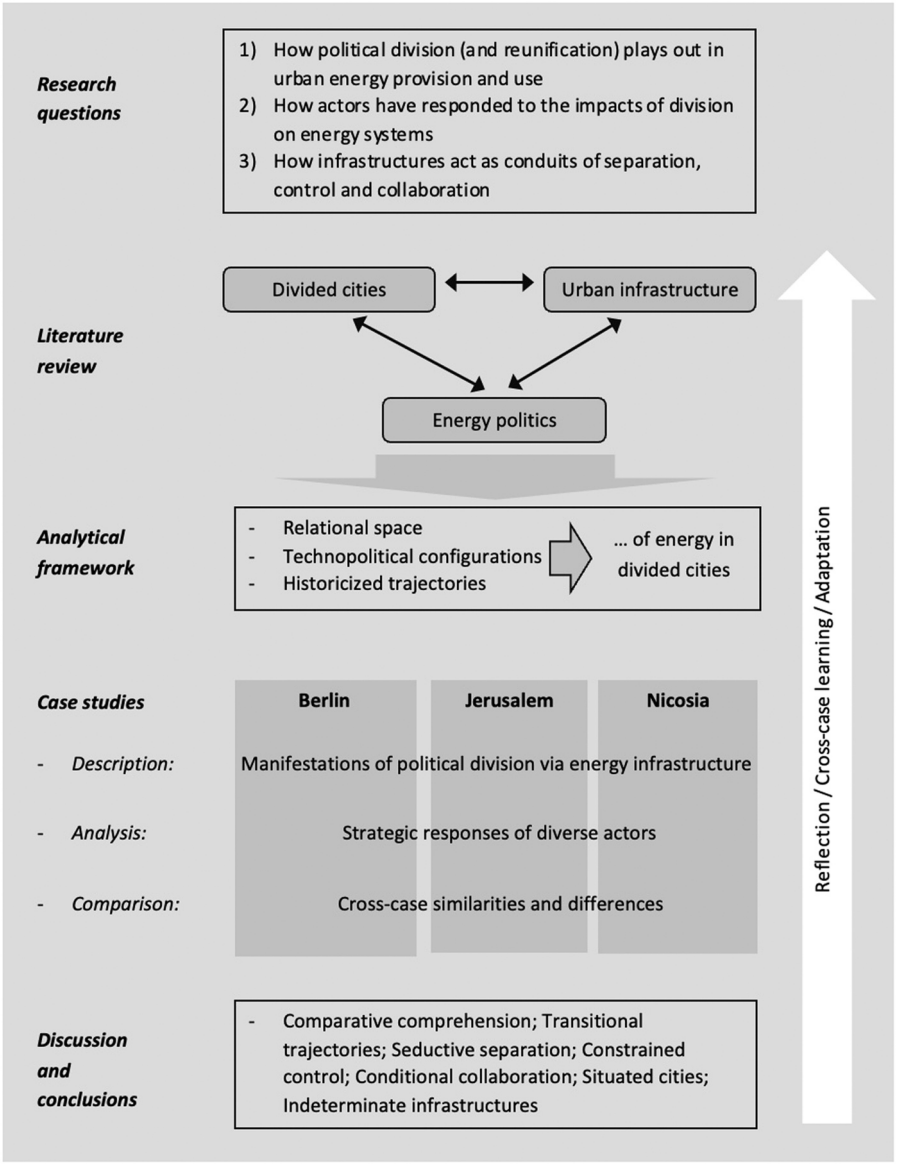

Fig. 1. Research design.
Source: Own compilation.

ranging from self-reliance to full dependence; (f) practices of sovereignty and unification and whether they are disputed or accepted.

To increase the generalisability of our research we complement the comparative approach with longitudinal analysis. Thus, rather than examining each case study as a snapshot in time, we trace processes over long periods – from initial political division to the present day – to detect continuity and change. The underlying purpose is to ascertain whether common experiences – in terms of impacts and responses – can be identified despite the differences in spatial and temporal contexts.

This long-term analysis, reaching from the late 1940s to the present day, has required historical as well as contemporary research methods. The paper draws on archival sources covering, for instance, correspondence, minutes of meetings, confidential reports, strategy documents and statistics. Archival datasets draw on national, city, energy utility and private archives as well as foreign archives (see Table 2). These historical sources were supplemented by municipal and parliamentary proceedings, newspaper articles, historical professional journals, published statistics, primary and secondary literature, on-site visits to key infrastructure locations (e.g., power stations) and semi-structured expert interviews with energy providers (utilities), regulators (government agencies), NGOs, users (households, businesses, public bodies) and other relevant parties (e.g., international actors). Interviews were conducted between 2020 and 2022.

In the Jerusalem case, the sample included 25 interviewees that balanced Israeli, Palestinian and international voices. The Israeli interviewees comprised five Jerusalem municipal officials involved in approving electricity infrastructure projects in the city, three senior directors from Jerusalem's water, electricity and economic development agencies and a government representative from Israel's Ministry of Foreign Affairs involved in promoting international collaboration over infrastructure projects in Jerusalem. On the Palestinian and international side, it included Palestinian project managers, end users and civil society activists involved in electricity projects in East Jerusalem, as well as four project managers in NGOs and intergovernmental organisations, including the United Nations Development Program, involved in infrastructure development in East Jerusalem.

In the case of Nicosia, the sample included 20 interviews with representatives of the Greek and Turkish Cypriot communities. These were complemented by a stakeholder workshop, held in May 2022, involving 14 participants from both sides of the divide and visits to power plants in

Table 1
Differences across the case studies.

City / *Characteristics*	Berlin	Jerusalem	Nicosia
Nature of the conflict	Geopolitical and political	Ethno-national	Ethno-national
Political context	Post-World War II global order and the Cold War	Post-World War II Arab-Israeli conflict	Turkey-Greece conflict; inter-communal tensions
Territorial and political geography	Before 1990: West Berlin as an energy and territorial island; East Berlin connected to East Germany After 1990: reunified city and energy systems	Before 1967: West and East Jerusalem deriving electricity from Israel and Jordan After 1967: territorial and political unification with blurred electricity boundaries	Territorial and political division of the island and the city reflected in increasingly divided electricity systems of an island without connection to international grids
Municipal control	Strong in West Berlin, weak in East Berlin	Weak	Weak
Energy dependence	Self-supply of electricity and gas in West Berlin; growing dependence of East Berlin on East Germany / USSR	Varying dependencies over time reflecting changing political leverage and electricity production capacities	Varying dependencies over time as a product of shifting capacities to meet growing energy demand
Sovereignty and unification	From separation under two sovereigns to amicable unification	From formal division to disputed sovereignty	Formal division and limited collaboration

Source: Own compilation.

Table 2
Archives used for each case study.

Berlin	Jerusalem	Nicosia
– City-state archive of Berlin (LAB) – Archive of the city electricity utility Bewag, German Museum of Technology (DTM), Berlin	– Israel State Archives – Jerusalem Municipality Archives – Israel Electric Company Archives – Ministry of Energy Archives – British National Archives	– Cyprus National Archive – British National Archives – Ahmet Cavit An's personal archive

Source: Own compilation.

the North and the South meeting senior engineers. Of the nine interviews conducted in the South, participants included four energy engineers and experts, two local politicians, one diplomat and two representatives from energy utilities. In the North, eight interviews were conducted with three former politicians (holding positions as president, prime minister, energy minister and mayor of Nicosia), two former general directors of the Electricity Authority (Kıb-Tek), a high-level bureaucrat and two academics (engineers) also involved in public bodies and civil society organisations as consultants. Additionally, two interviews were conducted with representatives of the EU Commission and one with a foreign expert based in Cyprus.

Since the Berlin case study is primarily historical, the analysis there relied strongly on archival sources and historical documentation and publications (see Table 2). Both East and West Berlin perspectives are well documented in the archives. The Jerusalem case study relied on good access to archival data for pre-1967 West Jerusalem and post-1967 unified Jerusalem. Nevertheless, limitations to pre-1967 East Jerusalem archival sources required greater reliance on international archives (British National Archives), interviews and primary and secondary literature. The Nicosia case study drew on archival data for the colonial and immediate post-colonial periods (Cyprus National Archive, British National Archives) yet confronted limited access or availability of archival sources of the power utilities and of North Cyprus. Owing to this, greater emphasis was placed here on interviews and focus-group work with key stakeholders from both sides of the divide and involving the entire international research team.

Special attention was also paid to difficulties in studying cities against the backdrop of ongoing conflict. Researching areas of conflict gives rise to various ethical and security, as well as epistemological and methodological, challenges in acquiring knowledge and interpreting it (Gordon, 2021). Our reliance on a wide variety of sources attempted to minimise ethical issues and our interactions with human subjects (interviews, focus groups) respected relevant ethical procedures, including full disclosure of the research aims and assurance of anonymity. The paper's comparative strategy and diversity within the research group were useful in addressing these challenges. The team included members from both South and North Cyprus. Inter-communal parity was not possible in the case of Jerusalem and not necessary in the case of Berlin. The resultant data asymmetries for Jerusalem could be partially addressed by conducting interviews with Palestinian and international stakeholders and using primary and secondary Arab literature, but this remains a limitation to our research. Furthermore, the diversity of the research team and continuous comparison across cases proved valuable in providing both insider and outsider views on each case-study city.

Thus, this paper also demonstrates the importance of methodological flexibility when an ideal methodology is impossible in a research environment marked by inter-communal tension and power asymmetries. Case-specific methodologies can reduce methodological gaps, particularly when comparatively examining case studies with variable availability of, and accessibility to, research materials. These tailored methodologies require alternative methods to increase data availability for each case and enhance case comparison. At the same time, these methodologies need to account for specific challenges by reducing potential research biases, promoting researchers' self-reflection and sensitivity to different narratives.

3. Seeing the divided city through a sociotechnical lens

3.1. Introduction

This chapter positions the study of divided cities in the broader debate on the co-evolution of cities and their infrastructures. It complements existing research that discusses divided cities in terms of ethnonational conflict, geopolitical intervention and socio-spatial segregation with insight drawn from recent scholarship on energy infrastructures as conduits of urban politics. The purpose of this literature review is to provide guidance for the later interpretation of the empirical findings but also to build a unique dialogue between research on urban planning, infrastructure studies and divided cities, teasing out synergies, challenging epistemic assumptions and revealing complementarities. In line with the thematic thrust of this journal, we focus attention on urban energy governance, policy and planning, covering issues of deliberation and design, control and coercion, and resilience and resistance, all within broader geopolitical contexts. The chapter turns first to the literature on divided cities, appraising the (limited) degree to which the built environment, and especially infrastructures, have been addressed there. Issues of separation, control and collaboration emerge as key dimensions to this literature. The chapter then surveys four strands of scholarship on energy infrastructures as conduits of urban politics,

covering the technopolitics, histories and geographies of energy infrastructures, as well as infrastructures as instruments of conflict. Based on these literature reviews, the chapter concludes by developing a conceptually grounded framework to guide our socio-material, relational and historical study of energy infrastructures in divided cities.

3.2. Placing infrastructures in divided cities research

3.2.1. Introduction

Divided cities have long captured academic interest (Musterd et al., 1999). These urban environments, often characterised as contested/divided, dual, polarised, partitioned or frontier cities (Kotek, 1999; Shlay & Rosen, 2010; Bollens, 2012), are formally and informally divided by intense power struggles between competing groups. Divisions, whether by nationality, ethnicity, socioeconomics, ideology or religion (Kliot & Mansfeld, 1999; Calame & Charlesworth, 2009; Bollens, 2012), lead to marginalisation, displacement and violence. In these struggles, some groups attempt to achieve supremacy and control, while others fight for survival, their right to live and their identity (Moss, 2009; Shlay & Rosen, 2015; Bollens, 2018). Despite differences in their histories, roots of conflict and governance systems, divided cities such as Belfast, Berlin, Jerusalem, Nicosia and Sarajevo share significant similarities: multi-layered divisions (whether ethnonational, ideological, socio-economic or religious) and intense sovereignty disputes underlined by the polarised positions of opposing groups (Kotek, 1999; Silver, 2010). Moreover, geopolitics frames urban conflict in divided cities, in contrast to urban disputes in pluralistic cities such as London, New York and Paris, where conflicts centre on class, status and equity (Gaffikin & Morrissey, 2011). The intense struggle to control territory in divided cities is of the utmost importance, as sovereignty is continuously disputed (Kliot & Mansfeld, 1999; Bollens, 2000).

Infrastructure plays a crucial role in shaping the character and functionality of cities (Graham & Marvin, 2001). Urban infrastructure planning, development and management continuously influence, but are also shaped by, political agendas and ideologies (McFarlane & Rutherford, 2008). Infrastructures, therefore, should be conceptualised as sociotechnical configurations characterised by multifaceted interrelationships between political power, citizenship, technology and critical urban services (Moss, 2014; Van Neste, 2020). Planning and controlling infrastructure such as roads, bridges, water and sewage systems, electricity and telecommunications can lead to unequal access to essential services and opportunities (Graham & Marvin, 2001).

In divided cities, infrastructure may reinforce and create social, economic and political divisions, thus further separating different groups of people physically and symbolically. For example, in some divided cities infrastructure such as roads, bridges or walls (e.g., Belfast's peace walls and the Berlin Wall) may physically separate different neighbourhoods or communities (Boal, 2002; Moss, 2009). Surprisingly, there has been limited exploration of infrastructure configurations in divided cities (exceptions include: Moss, 2014; Nolte & Yacobi, 2015; Luque-Ayala & Silver, 2016). Shlomo (2017a) discusses the privatisation of 'soft' urban infrastructures, such as education, health and transportation, as a political tool of governmentality and colonisation in East Jerusalem. Verdeil (2016) demonstrates how a damaged post-war energy system in Beirut created uneven class-based distribution and activated urban political protest. Other studies have examined the role of infrastructures, such as water and sewage, enabling cross-border political cooperation in Cyprus (Hocknell, 1998; Demetriades, 1998; Shtern et al. 2022b). Four interrelated themes emerge from the limited research on the role of infrastructure in exacerbating or relieving conflict in divided cities: segregation and inequality, parallelism and duplication, the built environment and its planning and infrastructure narratives. These are discussed in the remainder of this section.

3.2.2. Segregation, inequality and exclusion

Divided cities are abundant with various political, ethnic, economic and social fault lines resulting in segregation, exclusion and inequality. Segregation through infrastructure in divided cities refers to separating different ethnic and socio-economic groups through physical structures such as water and sewage systems, roads and highways (Brand & Fregonese, 2013). This separation can occur intentionally as well as unintentionally and often has significant consequences for the affected individuals and communities. Infrastructure segregation in divided cities is closely related to issues of equity and justice. In some cases, infrastructure can promote economic growth and development, support businesses and attract investment. However, the uneven distribution of urban infrastructure might reinforce and contribute to economic inequality and segregation (Shlay & Rosen, 2010).

One example of segregation through infrastructure in a divided city is the presence of "highways to nowhere": roads built through predominantly low-income neighbourhoods or neighbourhoods with a high concentration of people of colour or ethnic minorities. These highways often serve as physical barriers that divide communities and create barriers to access and mobility (de Lucas, 2020). Other examples include restriction of the water flow and water connections to specific neighbourhoods and communities to limit their growth (Amir, 2011; Avni et al., 2022) or limiting transportation infrastructure, such as public transit stations and stops, thereby creating barriers to employment and education (Nolte, 2016). In Belfast, for example, the separation of infrastructure using physical 'peace walls/lines/interfaces' resulted in "mental and physical health inequalities, inadequate facilities, poor delivery of public services, physical blight and neglect" (Mullan, 2017: 3).

The manipulation and misuse of urban infrastructure can increase segregation and accentuate dividing lines. Yet, even in divided cities, infrastructure development and expansion may occasionally assist marginalised groups by improving their mobility and access to services, highlighting ambiguities of benefit and harm. The Light Rail network in Jerusalem, for instance, has, on the one hand, linked Jewish and Palestinian neighbourhoods and improved access for all residents. On the other hand, it further symbolises Israeli domination and has been a target of Palestinian sabotage during conflict peaks (Nolte, 2016). Similarly, in the 1970s, the interconnection of Jerusalem's electricity grids to Jerusalem's Palestinian population was viewed by Palestinians as an act undermining their identity and sovereignty. On the other hand, it facilitated more affordable, reliable and available electricity to Palestinian communities (Herman & Fischhendler, 2021; Shtern et al., 2022b). Infrastructure segregation may have unintended consequences in the longer term. It can prompt segregated communities to increase their self-sufficiency that can, if successful, eventually foster cross-community collaboration on an equal footing (Bollens, 2012; Shtern et al., 2022a).

3.2.3. Parallelism and duplication

Another prominent feature of divided cities is the parallelism engendered by disputed sovereignty and legitimacy, as expressed in the duplication of infrastructure, services and institutions (Calame & Charlesworth, 2009; Gaffikin & Morrissey, 2011; Bollens, 2012; Gusic, 2020). Whereas public services, education, infrastructure and planning usually cover a whole city, in divided cities they are frequently split in two along ideological, ethnonational or religious divides (Bollens, 2012: 103).

Institutional parallelism can be formal or informal. For example in Nicosia, two competing states (the Republic of Cyprus and the Turkish Republic of Northern Cyprus) formally provide services to two parts of the city (Calame & Charlesworth, 2009; Shtern et al., 2022a). In Berlin during the Cold War, distinct systems of electricity, gas and water provision were developed for the socialist East and capitalist West of the city (Moss, 2009). In contrast, in the case of "united" Mostar, an informal arrangement empowers two public authorities, Bosnian and Croat, to offer the same services to different parts of the city (Calame & Charlesworth, 2009; Bollens, 2012). There, the two communities are served

by separate education systems (Gusic, 2020). Parallelism and duplication of infrastructure services and institutions lead to functional redundancies, inefficiencies and waste (Calame & Charlesworth, 2009; Moss, 2009) and represent competition and contestation over distinct infrastructure systems (Shtern et al., 2022b).

3.2.4. The built environment and its planning

Studies of divided cities have traditionally emphasised the impact of planning on residents' everyday lives. Development planning involves allocating basic infrastructure and services to different communities, making urban planning a critical analytical lens for understanding interventions in divided cities (Bollens, 2012). Critical appraisal of urban governance in divided cities has emphasised its role in reproducing colonial relations and minority suppression (Nolte & Yacobi, 2015; Shlomo, 2017b). Planning in divided cities often takes a reverse logic. Whereas the conventional planning logic of shared spaces and services emphasises integration and efficiency, in these hyper-segregated environments each community defends its ownership and control of infrastructures and utilities (Calame & Charlesworth, 2009).

Planners and architects can significantly shape the built environment in divided cities (Shlay & Rosen, 2015; Rokem & Allegra, 2016; Nitzan-Shiftan, 2017), manifesting political power in concrete and observable ways (Bollens, 2012). They can reinforce spatial marginalisation and urban conflict or promote the development of shared spaces that support positive interactions (Bollens, 2018; Gaffikin & Morissey, 2011; Shtern & Rokem, 2021). Planners can advance tolerance and trust by reducing investment and infrastructure gaps between neighbourhoods and groups (Rokem & Allegra, 2016).

Planners can adopt different strategies in divided cities (Caner & Bölen, 2016). First, they can be neutral by distancing themselves from problems caused by division, allocating infrastructure and services by technical criteria. A neutral strategy, though, often benefits the hegemonic group. Second, planners can use a partisan approach to enhance the dominant group's power. This strategy expresses itself in rejecting the deprived group's claims while expanding the dominant group's control of access and territory. Third, planners can embrace an equity strategy to reduce inter-group inequalities and conflicts by allocating services according to ethnic group identity. Finally, planners can act as problem-solvers by addressing sovereignty issues and the root causes of division.

Calame and Charlesworth (2009) argue that planners in divided cities adopt free market practices to avoid accusations of partisanship. Examining similar compliance, avoidance, engagement and advocacy strategies, they also highlight that planners lack the necessary skills, capacities and motivation to engage with post-conflict urban planning, leading to inadequate and inequitable responses to urban divisions. Nicosia's Master Plan and shared sewer treatment system are sometimes cited as an exception to the rule (Calame & Charlesworth, 2009; Bollens, 2012). But most studies of planners' interventions in Berlin, Beirut, Belfast and Jerusalem show that division is often deliberately overlooked. The desire for infrastructural self-sufficiency of each group can impede future reunification and perpetuate infrastructure duplication after reunification, as in the case of Berlin (Moss, 2020). Prescriptively, some studies have argued that planners should avoid neutrality and compliance strategies and accept that urban planning is inseparable from political framing, particularly in divided cities. From this standpoint, planners should adopt engagement and advocacy strategies that will address multiple and opposing groups competing for sovereignty in a divided city (Calame & Charlesworth, 2009; Gaffikin & Morrissey, 2011). Nevertheless, these calls for action to address the social and material aspects of infrastructure planning have limitations. The acknowledgment of such co-constitutive relations between the social and material implies that planners cannot "design out" social problems (Brand & Fregonese, 2013). Planning the built environment in divided cities, according to recent research, is just as social as it is technical. Indeed, "[t]he intimate links between social and material sides of polarisation deserve a more symbiotic consideration than is conventionally acknowledged" (Brand & Fregonese, 2013: 3). Nowhere is this more salient, we contend, than over urban infrastructure.

Recently, greater attention has been given to the role of civil society within the planning process, particularly in intergroup mediation, peace education and leadership development capacities. However, civil society's role is highly challenging as it must navigate a complex political reality while being scrutinised by both sides continuously (Nagle, 2013; Murtagh, 2016; Avni et al., 2022; Brenner et al., 2022). Nicosia's successful city-wide sewer system points to the possible positive influence of external actors, such as the EU, in providing finance and guarantees to support such ventures (Kliot & Mansfeld, 1999; Bollens, 2012).

3.2.5. Infrastructure narratives

A growing yet relatively limited literature has examined the role of infrastructure narratives in divided cities. An infrastructure narrative is a story or set of stories explaining the purpose, function and value of a particular infrastructure project or system. Infrastructure narratives can be used to communicate information about an infrastructure project to various stakeholders, including the general public, policymakers and investors. In addition, they can help build support for an infrastructure project by highlighting its benefits and addressing stakeholders' concerns. Infrastructure narratives can take many forms, including written descriptions, visualisations and interactive media, and may be presented through various channels, such as press releases, websites and public meetings.

Infrastructure narratives in divided cities can be more complex and nuanced, as they address inequality, segregation and historical tensions. Rival ethnonational groups use these narratives to cement their sovereignty over the city through the lenses of infrastructure. Nolte and Yacobi (2015) discuss how Jerusalem's Light Rail is represented in a hegemonic narrative by the local municipality and the state as a Zionist ideological enterprise. The narrative is then promoted by functional, neutral and progressive language about serving all Jewish and Palestinian communities. However, Palestinians resist such a narrative with violence since it legitimises occupation and infringes upon their sovereignty (Baumann, 2016; 2018). West Berlin's self-dependence in electricity generation after 1955 was heralded as a symbolic answer to political isolation by the city authorities and power utility alike (Moss, 2009). Yet, by the 1970s the powerful imagery of an "electricity island" (Herman & Parag, 2024) was being questioned by residents and environmental groups critical of the ecological degradation and build-and-supply logic on which it was predicated.

Maps are also representations of narratives. Investigating Berlin and Jerusalem's representations in maps, Leuenberger (2016) argues that "the geographies of physically divided cities – their spaces, infrastructures, locales, and streets – are places in which geopolitics dictate that which is made visible and that which is made invisible in maps" (Leuenberger, 2016: 86). Thus, maps are storytellers providing information the map creator decides. Maps support land claims and control resources or erase unwanted topography, particularly in divided cities.

3.2.6. Beyond the state of the art

This theoretical section has revealed how separation, control and collaboration permeate narratives and experiences of politically divided cities. It has demonstrated how infrastructure can act as a medium and manifestation of each of these three phenomena. Despite its critical role in the making and functioning of cities, infrastructure is relatively under-researched in the divided cities literature. Studies tend to: (1) focus on single-city case studies, (2) be limited and confined chiefly to a single infrastructure, usually transportation, and (3) lack longitudinal research. This finding resonates with the three advances in recent research on urban infrastructures identified in the introduction, relating to socio-materiality (politics and agency of infrastructures), relationality (co-shaping of cities and infrastructures), and history (changes and

continuities over time). Hence, the nexus between divided cities and infrastructure is also about (a) how the social and the material interact through infrastructure and what this reveals about the politics of divided cities, (b) unpacking place-specific configurations of infrastructures in co-evolution with the cities they serve and how infrastructure thereby mediate urban division and/or cooperation and (c) using long-term analysis to observe the temporal dynamics and combinations of change and continuity in divided cities.

3.3. Energy infrastructures as conduits of urban politics

3.3.1. Introduction

Since our literature review of infrastructures in divided cities is pointing to the importance of analytical perspectives that are socio-material, relational and historical, what conceptual inspiration and guidance can be sought from social and humanities studies on energy infrastructures in cities? The following section explores recent research into infrastructures as spatially and temporally contingent socio-technical configurations, drawing primarily on science and technology studies (STS), human geography and the history of technology and focusing on the field of energy. This disciplinary range enables us to combine STS's attention to the "interconnections, mutual shaping, co-constitution, or coproduction of the technical, social, and natural" (Hess & Sovacool, 2020: 2) with geography's concern for spatial contexts (Furlong, 2011) and history's sensitivity towards continuity and change over time (van der Vleuten et al., 2017).

Infrastructure studies is a rich vein of scholarship. The 'infrastructural turn' in the social sciences and humanities is proving both generative of fresh knowledge and transformative to ontological approaches (Harvey et al., 2016), translating into urban studies as "a new genre of thinking that narrates the social life of a city through its material infrastructure" (Amin, 2014: 137). While definitions of infrastructures vary wildly, their scholarly appeal can be attributed to five core characteristics: their essentiality for modern human life, the networked nature of their functions, their physical and institutional embeddedness, their political instrumentality and the powerful symbolism often attached to them (Star, 1999; Edwards, 2003; Engels & Schenk, 2014). As several scholars have pointed out, these properties and meanings of infrastructures are not intrinsic, but emerge through the interaction of objects and social processes (Bakker & Bridge, 2006: 12; Anand et al., 2018). The sociotechnical configurations that constitute infrastructures are, therefore, always shaped by – and formative of – specific spatial and temporal contexts.

This applies to the co-constitution of energy infrastructures and society. Energy is both society-shaping and society-shaped (Bridge, 2018). Energy infrastructures serve as conduits not merely for electricity, gas or oil, but also for policy objectives, power relations, bodily comforts, material metabolisms and much more. For the purposes of this paper, we select four thematic foci from the literature on energy-society relations that are particularly suited to unpack the temporal, spatial and political dimensions to energy supply and use in divided cities. These are: (1) histories of (energy) infrastructures, (2) geographies of (energy) infrastructures (including the urban), (3) technopolitics / energopower and (4) infrastructural violence.

3.3.2. Histories of (energy) infrastructures

Historians of technology pioneered social studies of infrastructure, generating sociotechnical perspectives on urban technology since the 1970s (Hughes, 1883). Focussing almost exclusively on the emergence and consolidation phases of modern energy, water and transportation networks, this early work has left three lasting legacies. It highlights, first, the co-evolution of cities and infrastructures, second, the hegemony of large technical systems and, third, the path dependence of infrastructures. The obduracy of large sociotechnical systems – locked in to early-generation technological solutions – has remained a powerful paradigm of infrastructure in research and policy circles. The "inertia of the installed base" (Star, 1999: 381–382) is regularly blamed for infrastructure's resistance to change. Transitions research has become popular precisely for exploring how transformative shifts to such entrenched sociotechnical systems have occurred in the past and what implications this has for present-day transitions (Geels & Schot, 2007; Geels, 2011).

More recent historical research is challenging path dependence as the prime explanation for infrastructure trajectories. Studies of adaptation, maintenance, repurposing, diversity and destruction are revealing more nuanced, varied and dynamic histories of infrastructure than hitherto assumed (Moss, 2020; Weber & Krebs, 2021). Far from being straightforward and uniform, the trajectories of large technical systems are shown here to feature non-linearity, hybridity, reversals, decay and afterlives (van Laak, 2001; Moss, 2014; Monstadt, 2022). Research is also highlighting the existence – alongside dominant large technical systems – of alternative, small-scale technologies and practices well before the present day (Edgerton, 2007; Lawhon et al., 2018; Hasenöhrl & Meyer, 2020). It is pointing to important processes of layering of small and large, as well as of old and new, technologies (Anand, 2011; Engels, 2020; Weber & Krebs, 2021). Above all, this body of scholarship is disputing assumptions of stability and revealing the malleability of infrastructure (Furlong, 2011) through historical experiences of de- and reassembling its sociotechnical components (Collier, 2011; Moss, 2020).

Much of this recent historical scholarship is targeted explicitly at energy. Many energy researchers are, indeed, assessing the value of historical analysis for energy transitions today in the light of more nuanced approaches to infrastructural change (Hasenöhrl & Meyer, 2020). Whilst some unpack the similarities and differences between earlier shifts from wood to coal to oil and low carbon transitions today (Pearson & Foxon, 2012), others question the inescapability of traditional chronologies of energy transitions, calling for greater appreciation of the multi-dimensionality of the transitional experience (Sovacool & Geels, 2016) and the long-term socio-historical forces at play (Gismondi, 2018). Being empirically grounded, rather than theory-driven, this historical research is showing how energy transitions have always been embedded in broader societal transitions, norms and imaginaries and have often been marked by hidden pathways, critical junctures, unanticipated consequences and bitter contestations (Hasenöhrl & Meyer, 2020; Jabary Salamanca, 2014). Historicising trajectories of infrastructure in this nuanced manner is incumbent upon scholars today.

For the study of energy infrastructures in divided cities, this body of scholarship encourages us to entertain an open-ended perspective on energy trajectories, not prioritising stability and permanence and accepting rupture and instability as non-exceptional (Haarstad & Wanvik, 2017). It, secondly, points us to the many ways in which energy infrastructures mediate historical processes, carrying over features from the past while reflecting socio-historical shifts over time (Anand et al., 2018; Monstadt, 2022). Exploring what changed – and what did not change – to these sociotechnical configurations following political division will be central to our analysis. Finally, it calls upon us to look beyond the familiar large technical systems to the often-hidden technologies and practices that providers and users have enrolled in the past to meet energy needs.

3.3.3. Geographies of (energy) infrastructures

Today, human geographers are at the forefront of infrastructure studies, rendering visible the sociotechnical underpinnings of the modern city (Amin, 2014: 139). Urban scholars are exploring how urban technologies get socially appropriated, why and in whose favour (Coutard & Guy, 2007; Rutherford, 2011). In doing so, they are revealing not only the connective and distributive capacity of networked urbanism, but also the power of infrastructure to disconnect and exclude, exacerbating socio-spatial fragmentation and polarisation (Graham & Marvin, 2001; Graham & Thrift, 2007; Luque-Ayala & Silver,

2016).

This is reflected in scholarship on the multiple geographies of energy (Bridge et al., 2013; Zimmerer, 2011; Calvert, 2015). The 'spatial turn' in energy studies today goes far beyond the traditional geographical argument that infrastructures have spatial outcomes (Bridge, 2018). It recognises, conversely, that space and place impact upon energy systems, creating very specific (infra)structures and practices and spatially uneven energy services. Urban electricity networks, for instance, can reflect prevailing distributions of economic and political power, nurture particular identities and be the target of social protest movements (Rutherford & Coutard, 2014; Luque-Ayala & Silver, 2016). Urban processes are thus both constituents and consequences of energy system change (Castán Broto, 2019). The networked nature of energy systems produces geographies of connection, but also of dependency and control (Bridge et al., 2013: 333). These are expressed, according to one much-cited article on energy geographies, across five dimensions: territorialisation (about the connections and separations of space through energy), spatial embeddedness (about the spatial fixes and lock-in around energy systems), scaling (about the multi-scalarity of energy and rescaling strategies), uneven geographies of energy (about the reproduction of spatial inequalities through energy) and the geopolitics of energy (about international and trans-boundary relations over energy) (Bridge et al., 2013). Space is very much a relational concept in today's energy studies.

All five dimensions advanced by Bridge and colleagues provide useful vantage points for unpacking issues of connection, dependence and control – but also resistance – in divided cities. For instance, uneven geographies are pertinent to Beirut, where energy systems reinforce the political and sectarian lines of division (Verdeil, 2016), just as they are in Israel/Palestine, where dependency relations have been embedded in infrastructure networks since the British mandate (Jabary Salamanca, 2014). The geopolitics of energy is equally prevalent in divided cities, as expressed in the contestation over cross-border electricity grids in Jerusalem (Fischhendler et al., 2016) or over the supply of electricity and gas to West Berlin during the Cold War (Moss, 2020). Attempts to create spatial fixes around energy to substantiate territorial claims are a further promising avenue for exploration in this paper.

3.3.4. *Technopolitics / energopower*

Infrastructures have long been viewed as important mediators of state power in the modern era (Scott, 1998, van Laak, 2001; van der Vleuten & Kaijser, 2006). By virtue of their deep materiality, durability and powerful symbolism, they are a precondition, product and source of power (Engels & Schenk, 2014: 25). The study of 'technopolitics' dismisses the popular notion of technology as a depoliticised object, exploring instead the political expressed in unfamiliar technical forms (Mitchell, 2013; von Schnitzler, 2016). From this perspective, advanced primarily by anthropologists and political ecologists, infrastructure is "integral to the conduct of politics" (Barry, 2013: 2). Technopolitics conceives of infrastructures as sites of negotiation, tension and struggle between different groups in particular places (McFarlane & Rutherford, 2008). This permits the study of infrastructures as instruments of connectivity, redistribution, selectivity and ordering. But it also acknowledges limits to the human power to govern, regulate and control infrastructure (Collier, 2011; Anand, 2012).

'Energopower' is a term coined by the anthropologist Dominic Boyer to express the same idea with respect to energy (Boyer, 2014). Research on the politics of energy views energy as constitutive of power relations (Bridge, 2018: 100). It entails thinking energy politics through the material and technical configurations of an infrastructure, such as an oil pipeline (Mitchell, 2013; Barry, 2013), but also through political ideologies and sociotechnical imaginaries (McFarlane & Rutherford, 2008; Hess & Sovacool, 2020). Here, too, the instrumentalisation of energy infrastructure to serve political objectives is one strand of research used, for instance, as a punitive or rewarding measure in situations of power asymmetry (Herman & Fischhendler, 2021). Other studies emphasise how energy infrastructures can resist enrolment in political projects, such as the district heating networks in post-Soviet states (Collier, 2011).

From the perspective of divided cities, this body of research uncovering the techno-political configurations of energy provision and use can help understand how political differences and divisions get scripted into the workings of infrastructures, for instance in electricity tariffs, service standards, control of the grid or access to generating fuel. It can also direct our gaze to the ways in which energy infrastructures confer power, store power, legitimise power, conceal power and even promise power (Engels & Schenk, 2014: 24).

3.3.5. *Infrastructural violence*

Of particular relevance to divided or contested cities is research into infrastructural violence – a sub-theme of technopolitics. This is understood, in the first instance, as *violence through infrastructure*. Here, infrastructure – or its absence – inflicts harm or injury on others, in particular political opponents. In this sense, violence can be practised through withdrawal of infrastructure (Rodgers & O'Neill, 2012) or as a 'stick' in asymmetric relations between states (Fischhendler et al., 2016). In a less tangible, but similarly harmful, way infrastructure can maintain urban inequalities (Pilo', 2021) or social differentiation between communities (Anand, 2011; 2012; Graham et al., 2013). A second meaning of infrastructural violence is *violence against infrastructure*. This can take the form of targeting electricity infrastructure during warfare (Graham, 2005; 2009), sabotaging energy infrastructure as a form of political activism (Malm, 2021) or manipulating electricity grids as a vehicle of protest (de Bercegol & Monstadt, 2018).

Infrastructural violence can be intentional in low-income communities that are excluded from economic growth (Mimmi & Ecer, 2010), in contexts of weak governance (Smith, 2004) or as a result of struggles between illicit and institutional suppliers (de Bercegol & Monstadt, 2018). It can also, though, be unintentional in unplanned areas (Criqui & Zérah, 2015). Infrastructural violence can be practised by individual actors (Giglioli & Swyngedouw, 2008), but also by collective action, as in the case of illicit access to the electricity network in favelas (Pilo', 2021). Violence can take the form of open physical damage (Malm, 2021) or be concealed through the discursive legitimation of violence (Kooy & Bakker, 2008).

Infrastructural violence is hugely significant in divided cities because it can shed light on how conflict can be manifested through infrastructure, whether intentionally or unintentionally. As energy infrastructure is ubiquitous and can be the means or the target of such violence, in divided cities where conflict is prevalent such cases of violence are widespread. The body of literature focusing on infrastructural violence is, thus, crucial to understanding infrastructural acts used to pursue political ambitions in harmful ways.

3.4. *Researching energy infrastructures in divided cities*

This chapter concludes by developing out of the issues and approaches raised in our literature reviews on divided cities and energy infrastructures an analytical framework for the paper. This analytical framework is designed to guide our discussion of the empirical findings in chapter 6 and to summarise the paper's original contribution to scholarship in chapter 7. We have chosen the format of a matrix that juxtaposes sets of categories emerging from our two bodies of literature: first, dimensions of infrastructural agency central to divided cities research – separation, control and collaboration – and, second, lenses on urban infrastructures characteristic of energy social sciences and humanities: techno-political configurations, relational space and historicised trajectories. Together, these two sets of categories capture, in condensed form, the essence of the literatures reviewed and the core issues of this paper. By presenting them in a matrix (see Table 3), we can direct attention to combinations of conceptual lenses (left-hand column) and modes of agency (top row) pertinent to energy infrastructures in

Table 3
Analytical framework.

Lenses on urban infrastructure	Examples of energy infrastructures as agents of …		
	Separation	Control	**Collaboration**
Techno-political configurations (incl. violence)	– Truncated networks and utilities – Violence through / against infrastructure	– Infrastructured power and exclusion – Resilience through self-sufficiency and parallelism	– Socio-material interdependencies – Planning and operational interactions
Relational space	– Socio-spatial segregation through energy – Geopolitical tensions	– Infrastructural territorialisation – Spatial circumvention – Cross-border subjection	– Interconnected energy spaces – Cross-boundary planning – Geopolitical incentives
Historicised trajectories	– Disruptive junctures – Narratives of entitlement and resistance	– Embedded dependencies – Narratives of sovereignty and self-reliance	– Windows of rapprochement – Continuities of contact – Narratives of reciprocity

Source: Own compilation.

divided cities. In the boxes at these intersections are illustrative phenomena of these combinations, used at this stage merely as indicative examples. It is important to point out that the categories of separation, control and collaboration are not mutually exclusive, nor do they represent a continuum passing from control to collaboration. Rather, we use them heuristically to tease out expressions of these categories – in isolation and in combination – in the strategies pursued by the involved parties. Similarly, we also acknowledge overlap between the three lenses on urban infrastructure in practice, where the politics, geographies and histories of energy in divided cities can – and often do – reinforce each other.

4. Berlin, Jerusalem, Nicosia: Manifestations of division in energy infrastructures

4.1. Introduction

The political division of cities has generally had a profound effect on their energy systems. Energy infrastructures have been reconfigured, energy sources altered and energy consumption practices adapted to accommodate the vulnerabilities associated with the political geographies of divided cities. At the same time, infrastructures, institutions and practices of energy provision and use have often been enrolled in strengthening the resilience of these cities, acting either intentionally or accidentally to reinforce separation or enable cooperation. Urban energy systems, in these contexts, can thus be both targets and tools of integration or isolation. This chapter introduces the divided cities under study – Berlin, Jerusalem and Nicosia – by explaining how political division (and subsequent unification) manifested itself in energy systems in the three cities. To enable cross-case comparison, these profiles of the impacts of division follow common analytical categories chosen to reflect the socio-material constitution of energy infrastructures. These are: energy plant and networks, energy sources for electricity (and gas) production, energy regulation, utility structures, supply of electricity (and gas), practices of energy use and geographies of energy services. The three cities' experiences of division and its impact on energy infrastructures are illustrated with timelines and compared at the end of the chapter with the help of a table.

4.2. Berlin

4.2.1. Blockade of West Berlin (1948-49)

On 24 June 1948, when the Soviet military authorities instructed the load dispatcher in its occupied zone of Germany to stop all electricity supplies to the western part of Berlin, they set in motion what became known as the Berlin Blockade.[1] This intervention, cutting off all land-based connections to West Berlin, marked the culmination point of an increasingly confrontational stand-off in the emergent Cold War between the Soviet Union and the three Western Allies occupying the city since the end of the Second World War (Wetzlaugk, 1988: 38–49; Engeli & Ribbe, 1987: 1052–66). The blockade of West Berlin, which remained in place until 12 May 1949, precipitated the division of the city into two political entities and accelerated the formation of two separate German states: the West German Federal Republic of Germany (FRG) and the East German Democratic Republic (GDR).

During the 11 months of the blockade the sectors of the city occupied by the Western military powers had no access to the national electricity grid, making them entirely reliant on power generated locally. West Berlin – as these sectors came to be known – was fortunate to possess several power stations, but the generation capacity of this plant had been severely diminished by Soviet acts of confiscation immediately after the war. Before the arrival of the western Allies in July 1945 the Soviet authorities removed around 60% of all electricity turbines in the three western sectors determined by the London protocol of September 1944, compared with just 4% in its own sector (Leithäuser, 1959: 220). More serious still, the coal needed to fuel the generation of electricity – as well as the production of town gas – was prevented from entering West Berlin via road, rail or waterways, which were all blocked. This dire situation prompted the radical solution of supplying West Berlin entirely by air. The Allied airlift that sustained West Berlin throughout the blockade was used primarily to transport coal that went largely to fire the city's power stations and gas works (Moss, 2009). Nevertheless, draconian measures were required to curb energy use there, with electricity rationed to just two hours a day for the civilian population. By contrast, residents of the eastern sector experienced no such restrictions. East Berlin continued to benefit from being connected to the national grid and possessing the city's largest power station, Klingenberg. The absence of electricity rationing was publicly celebrated as a symbol of the superiority of socialism over the capitalist West. Whilst street lighting was banned in West Berlin, the eastern sector of the city, it was reported at the time, "was bathed in the brightest of lights" (Magistrat von Groß-Berlin, 1950: 76). Behind the scenes, though, East Berlin was struggling to make up for the loss of town gas following the retaliatory cessation of supplies from West Berlin two days into the blockade (Bärthel, 1997: 109–110).

The political struggle for control of Berlin's municipal government

[1] For detailed accounts of how the electricity networks were divided in 1948, see the archive of the power utility Bewag in the Deutsches Technikmuseum Berlin, files DTM 1.2.130, Nos. 08870 and 08871 for a West Berlin perspective and DTM 1.2.130, No. 10435 for an East Berlin perspective.

during the blockade spilled over into a fight for the city's electricity utility, Bewag (Moss, 2009).[2] In June 1948 the Soviet Central Command had removed Bewag's technical director, Rudolf Wissell, for political reasons in a unilateral step that was immediately refuted by the three Western Allies. By November 1948 communist union leaders were attempting to depose the Bewag works council and replace it with members sympathetic to the Soviet line (Senat von Berlin, 1959). On 6 December, following the Soviet dismissal of a further Bewag director, a showdown meeting of the board of directors resulted in an agreement for Bewag to be operated separately in West and East Berlin. A similar arrangement was made for the city's gas utility, Gasag, on 26 March 1949. Henceforth until reunification in the 1990s, each utility had its separate headquarters, management board, workforce, infrastructure, customer relations and tariffs.

4.2.2. *The divided city (1949-1989)*

The end of the blockade, in May 1949, did not alter this organisational separation but it did reopen opportunities for trade in electricity. Grid connections, although not used for 11 months, remained intact and West Berlin was desperate to relieve the pressure on its extremely limited energy resources. On the very day the blockade was lifted, at 0:02 in the morning, Bewag (East) resumed the supply of electricity to the western sectors of the city, enabling West Berlin to end electricity rationing a week later.[3] This step, however, did not signal the end of contestation over energy, but rather a shift towards a more volatile relationship of repeatedly restored and disrupted supplies. For the next six years the East German and East Berlin authorities sought to exploit their structural advantage in electricity supply while West Berlin used its hard currency – the Deutschmark – to bargain for cheap electricity. This electricity trade ceased in 1955, once West Berlin had built sufficient generating capacity to supply itself, heralding a period of grid disconnection between the two sides that would last until after the fall of the Berlin Wall (see Fig. 2). It is worth noting that the erection of the Berlin Wall on 13 August 1961, an iconic event in Berlin's history of division, had relatively little impact on energy services since the city's energy utilities and infrastructures had already been divided during the blockade 13 years earlier. The separation of employees who lived in the other half of the city from their workplace was the only significant change produced by the Wall.

Fig. 2. West Berlin as an "electricity island".
Source: Stolpe, 1956: 280.

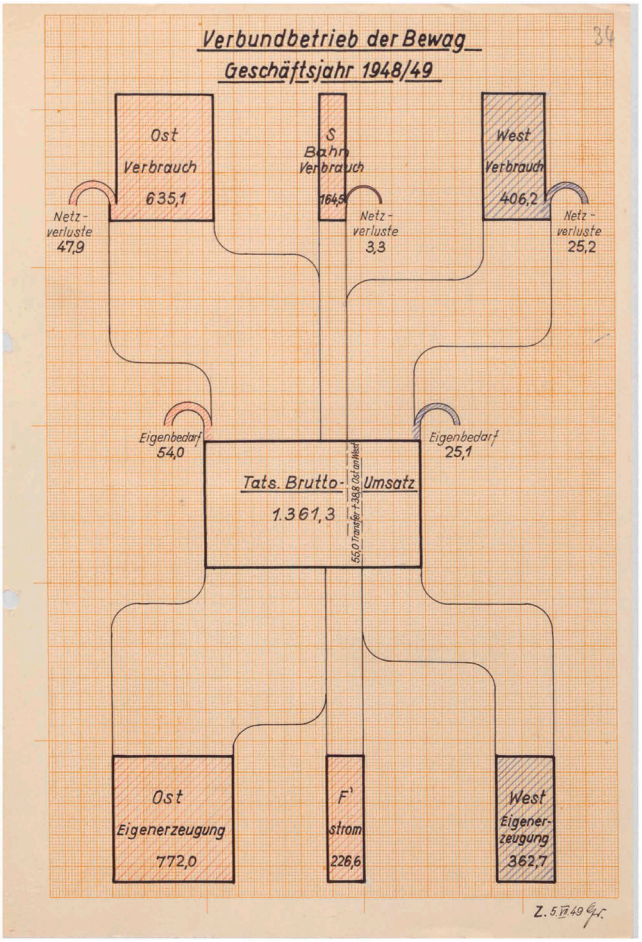

Fig. 3. Asymmetrical generation and supply of electricity in East (left) and West (right) Berlin.
Source: Landesarchiv Berlin (LAB), C Rep 752, No.104.

The physical and political geographies of East Berlin's energy supply networks were markedly different. Initially, it occupied a far more advantageous position, with ready access to the national electricity grid, as well as to coal or lignite for fuel (Tepasse, 2006: 206). Furthermore, its own installed capacity for electricity generation in 1948/49 – at 772 MW – far surpassed that of West Berlin – 362 MW – despite East Berlin having a much smaller population (see Fig. 3). Indeed, East Berlin found itself supplying the East German grid with electricity in the 1950s. This curious situation was indicative of a deep-lying problem that was soon to haunt Bewag (East): the chronic shortage of energy in East Germany coupled with unrealistic demands of the socialist planning regime on Bewag (East) to increase electricity generation. Its technical director Hans Witte, a stalwart of the Soviets during the blockade, protested to the city council in November 1950 that requirements to produce an additional 200 million kWh a year were "a sheer impossibility".[4] As Bewag (East) was called upon to supply more power to the country at large, it found itself having to impose restrictions on electricity and gas use in the city in the winter of 1952, and again in 1953 and 1954.[5]

Bringing East Berlin's utilities under the control of the state planning system was a further expression of the political divide. In the case of the

[2] On the division of Bewag, see the archive of the municipal government in the Landesarchiv Berlin, files LAB B Rep. 010, No. 1333 for a West Berlin perspective and LAB C Rep. 101, No. 296 for an East Berlin perspective.

[3] Letter of East Berlin Mayor Ebert of 27.05.1949 in LAB C Rep. 101, No.296.

[4] Minutes of a meeting between utility directors and the city council of 25 November 1950, LAB C Rep. 752, no. 20.

[5] Documented in DTM 1.2.130, No. 10352.

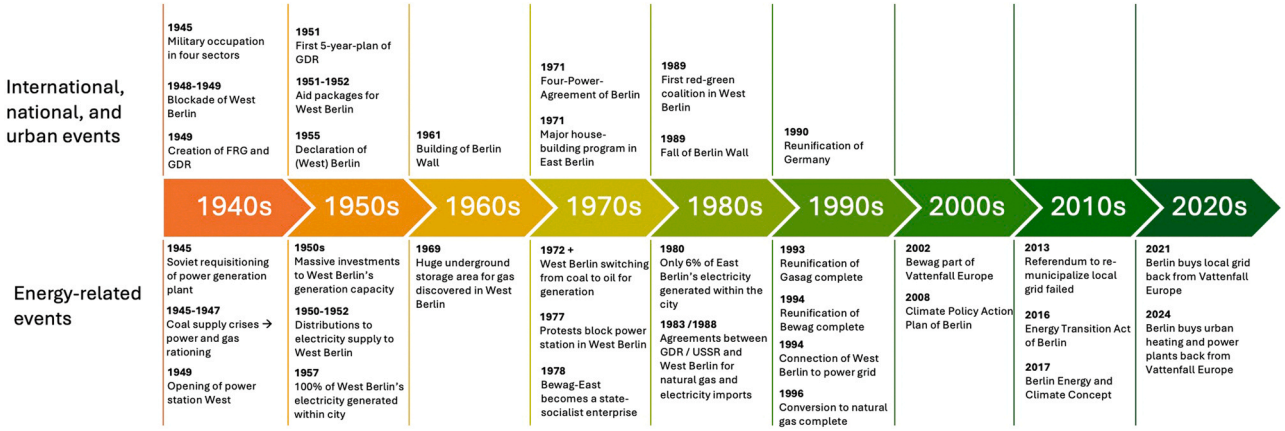

Fig. 4. Berlin timeline.
Source: Own compilation.

gas utility, Gasag, this was relatively straightforward as it was in municipal ownership. On 1 January 1956 Gasag (East) was removed from the auspices of the (East Berlin) city government and turned into a state-socialist enterprise, VEB Gasversorgung Berlin. This rendered the utility independent of the municipal authorities, but subject to planning by national agencies responsible for economic development. Attempts to socialise the electricity utility Bewag (East) in a similar manner ran up against massive legal complications, however, resulting in a curious anomaly of the Cold War. Bewag was not in full municipal ownership but belonged, following privatisation in 1931, to a consortium of public and private investors, many of whom were non-Germans. Here lay the crux of the problem, as the GDR was obliged by international law to respect the property of foreigners. For this reason, the East German authorities felt they could not touch ownership of Bewag, resulting in the continued operation of a share company in a state-socialist system.[6] This proved hugely disadvantageous for the utility, owing to its difficulties in accessing investment funding in the five-year planning regime, the need to pay dividends in hard currency to shareholders abroad and the requirement to operate two different budgeting systems. Only in 1978, once foreign ownership of Bewag had declined, did the GDR pluck up the courage to socialise Bewag (East) into VEB Energieversorgung.

The increasing division of Berlin's energy systems – from their infrastructure networks and management boards to their regulatory structures, ownership and supply practices – after 1948 created a situation of virtually complete system separation that remained until the 1990s. Although both sides continued to explore options for cross-border trade in electricity and gas throughout the intervening period and some very limited and occasional contacts across the divide were sustained (see chapter 5), West Berlin was effectively an "electricity island" that East Berlin and East German energy systems needed to circumvent.

4.2.3. *The reunited city (1990-present)*

The fall of the Berlin Wall in November 1989 and the subsequent reunification of Germany (and Berlin) in October 1990 opened the way for reconnecting the city's energy systems – physically, organisationally and politically. West Berlin was reconnected to the European electricity grid in 1994, with connections to East Berlin complete in 1996 (Tepasse, 2006). By then, the electricity and gas utilities of East Berlin had been amalgamated into their West Berlin counterparts. Following the transformation of the state-socialist enterprises into share companies under trusteeship, ownership was transferred to Bewag and Gasag in July 1994 and June 1993, respectively (Bärthel, 1997a: 156–175; Bärthel, 2006: 246). Service provision was unified across the city, with common standards of service and tariffs. To this end massive programmes of infrastructure renewal and expansion were rolled out to compensate for decades of underinvestment in East Berlin's networks. An overview of the pertinent events in Berlin is presented in a timeline (Fig. 4).

4.3. *Jerusalem*

4.3.1. *Origins of electricity provision (1914-1948)*

Over centuries of wars and shifting territorial control, Jerusalem evolved into a religious epicentre for Judaism, Christianity and Islam. The Ottomans, recognizing its significance, made it a regional centre and placed it under direct rule from Istanbul. In 1917, during World War I, Britain made Jerusalem the capital of Palestine. However, Jerusalem's central role led to a struggle over governance and infrastructure between Arabs and Jews, resulting in weak local governance and frail capacity and control over infrastructures and services (Cohen, 2013).

Jerusalem's electricity system had a unique origin. In 1914, Greek national Euripides Mavromatis obtained a concession to produce and supply electricity within a 20 km radius of the Holy Sepulchre Church in the Old City. This concession set the course for the ongoing battle over Jerusalem's electricity. Because of World War I and British reluctance to honour Mavromatis' concession, electricity did not reach Jerusalem until 1929. After a legal victory and a 44-year concession approval, Mavromatis sold his rights to the British company Balfour Beatty. They established the Jerusalem Electric & Public Service Corporation (JEPSC), with a diesel-based four-unit power station in southwest Jerusalem, and expanded the electricity grid (Shamir, 2013; Meiton, 2019).

Electricity became a focal point in the political struggle between Jews and Arabs, driven partly by a significant wage gap favouring Arabs (Government of Palestine., 1946: Vol 3, 1275–6). JEPSC favoured Arab employment, leading to accusations and competition for jobs, service areas and reliable supply, intensifying the conflict (Reuveni, 1929). Local national movements recognized electricity's role in advancing national sovereignty, particularly the Jewish Zionist movement and Pinhas Rutenberg, the founder of the Palestine Electric Corporation which later became the Israel Electric Corporation. Rutenberg secured an electricity concession for the rest of Palestine and opposed autonomous electricity production in Arab towns (Aran, 1982). Jerusalem,

[6] On the efforts, in 1953, by Bewag (East) to become a state-socialist enterprise and resistance, quoting legal reasons, by the East German Finance Ministry, see the files DTM 1.2.130, no. 10527 and LAB C Rep. 752, no. 157.

however, remained a historical relic of Ottoman colonialism.

By the end of 1947, Jerusalem's electricity production capacity had surged from 600 kW in 1929 to over 9000 kW, representing almost 11% of Palestine's total capacity (Authority for Economic Development., 1968). This electricity primarily powered water pumping and, to a lesser extent, industry, while nearly all city residents used it for lighting, cooking, heating and cooling (Avitzur, 1981). Fig. 5 illustrates the 1933 electricity system in Palestine, showing a proposed transmission line to Jerusalem.

4.3.2. *The 1948 war and its impacts on electricity services*

On 29 November 1947 the UN passed Resolution 181, creating the Partition Plan for Palestine, dividing the territory into Jewish and Arab states and declaring Jerusalem a *corpus separatum*, an internationally administered city. The 1948 War erupted the following day, splitting Jerusalem between Jordan (East Jerusalem and the Old City) and Israel

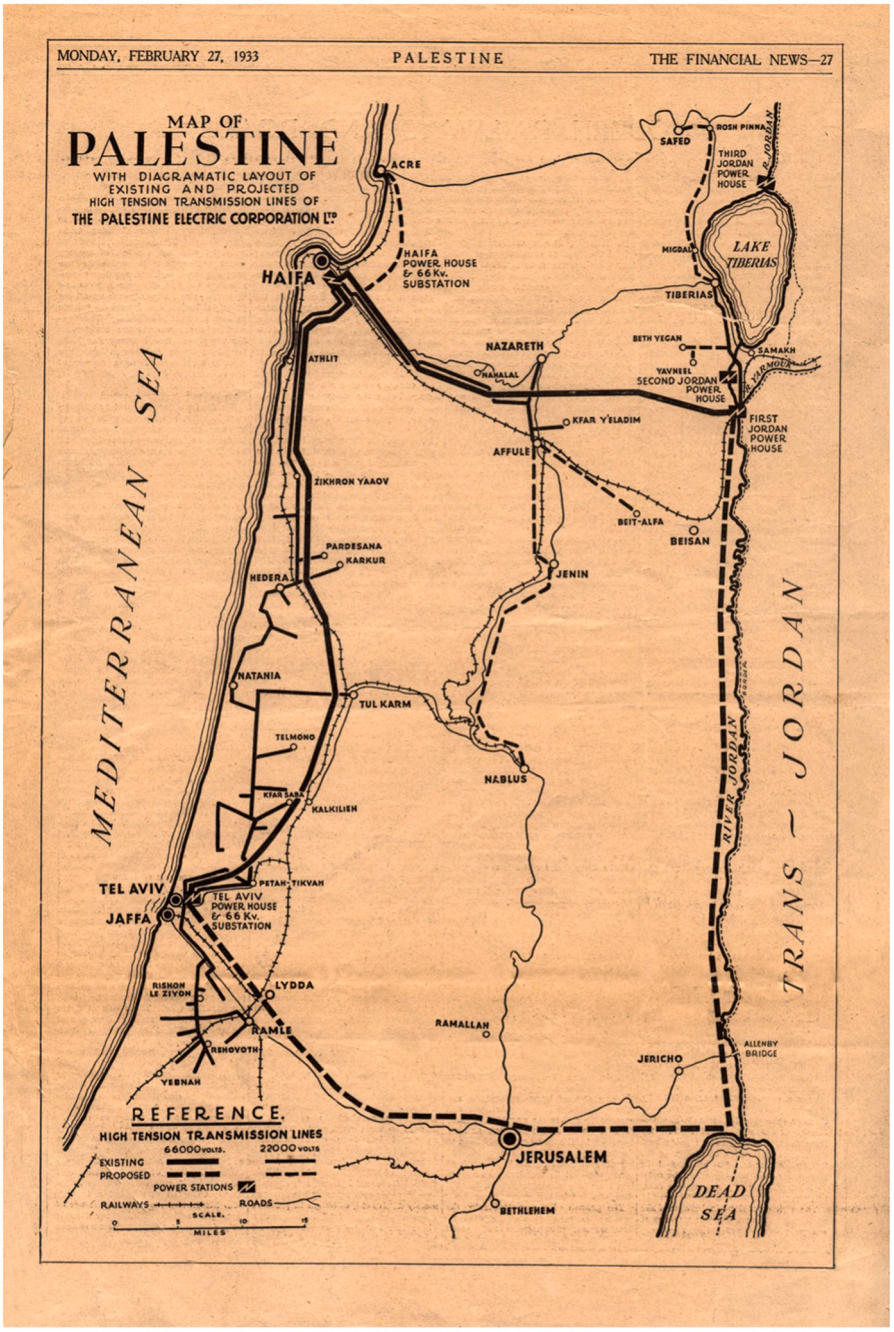

Fig. 5. Electricity map of Palestine, 1933.
Source: The Financial News, Palestine, 27 February 1933, p. 27.

(West Jerusalem), significantly impacting its infrastructure and socio-material fabric. This division left the JEPSC power station in Israeli-controlled West Jerusalem, disconnecting Arab consumers in the East and the Old City. Negotiations, mediated by the UN and the Committee of Consuls-General (Heimann, 2015), were conducted to enable the supply of electricity from West Jerusalem to the Old City in exchange for essential supplies like fuel, kerosene and water. Israel, citing insufficient electricity in West Jerusalem, declined to provide power to East Jerusalem. This led to the de facto division of JEPSC into two companies, with respective directors overseeing East and West Jerusalem operations (Levanon, 1949).

To manage critical resources during the 1948 War, Israel established an emergency authority overseeing the distribution of essentials, including diesel for electricity and heating, transport fuel and kerosene. These fuels were strictly rationed, with priority given to bakeries and electricity production. Transportation and household use, such as lighting, heating and cooking, faced severe restrictions. The shortage of electricity also exacerbated water scarcity issues, which had plagued pre-war Jerusalem due to rising demand. JEPSC had planned an interconnection with Rutenberg's electricity company to supply power from Tel Aviv to Jerusalem, but hostilities halted the project (Al Hamishmar, 1947). Israel's concerns over potential collaboration between JEPSC's British management and Arabs, possibly jeopardising the security of vital military and government installations reliant on electricity, led to the establishment of a covert parallel electricity network. This network supplied electricity to approximately 35 strategic locations, with payments made under fictitious consumer names (Levanon, 1949).

The disconnection of electricity left East Jerusalem and the Old City in darkness for two years until March 1950. Arab residents, accustomed to the conveniences of electricity, had to adapt to life without it. The absence of electricity had far-reaching negative effects on commerce, industry, poverty and public services like street lighting (Naamneh, 2019). East Jerusalem emerged from the 1948 War as a dark city.

During the 1950s, both JEPSC and its infrastructure were sold to Jordan and Israel. In Shuaafat, a village north of East Jerusalem, JEPSC established a small diesel-powered electricity plant, marking the return of electricity to East Jerusalem. The occasion was celebrated and "markets stayed awake until the late hours of the night and the city was decorated with a dress of bright lights" (Falastin 12/3/1950, cited in Naamneh, 2019). However, celebrations soon gave way to public disputes over JEPSC's high tariffs, electricity under-supply and failure to reimburse residents for pre-war payments. After several years of conflict, JESPC was dissolved. Its concession and infrastructure were sold to the municipalities of Jerusalem and surrounding towns (jointly owning 25.4%) and the public (comprising 74.6% and 1685 private shareholders). In 1957 this transformed into the Jordanian Jerusalem District Electricity Company (JJDEC), a regional-municipal utility with a strong local Jordanian-Palestinian identity (Naamneh, 2019; Shtern et al., 2022). JJDEC's Ottoman concession was extended in 1962 to serve three major West Bank towns: Jericho, Nablus and Hebron (Shtern et al., 2022).

In 1954, the Israeli Electric Company (IEC), a government-owned monopoly, acquired JESPC, including its power plant, grid and West Jerusalem infrastructure, connecting the city to the Israeli national grid (Herman & Fischhendler, 2021). Electricity became a symbol of nationalism and sovereignty. In the West, Jerusalem was integrated into the grid, supplied by large-scale power plants operating on coal and heavy oil for electricity production and subject to Israeli regulation. In the East, electricity assumed a role as a national Palestinian symbol amidst Jordanian difficulties in providing electricity and necessary infrastructure investment.

4.3.3. *The 1967 War and struggles over the electricity utility*

The 1967 War led to the reunification of Jerusalem as Israel gained control over East Jerusalem and the entire West Bank. Israel quickly annexed East Jerusalem along with surrounding areas, imposing Israeli laws and regulations on the city, while the remaining West Bank remained under military rule (Shlay & Rosen, 2010). Bringing JJDEC under Israeli regulation posed a challenge for Israel's political and symbolic annexation of East Jerusalem since the company was a significant national symbol and the largest Palestinian employer. JJDEC was compelled to transform into an Israeli entity, renamed Jerusalem District Electricity Company (JDECO). Ruhi El-Hatib, the former Jordanian mayor of Jerusalem and JDECO Chairman who refused to acknowledge Israel's rule, was exiled to Jordan. He was replaced by a local entrepreneur with a more pragmatic approach (Benziman, 1973; Benvenisti, 1973). The war significantly impacted JJDEC's customer base, reducing its clientele by 38%, from 31,000 in 1966 to 19,240 in 1967, due to the displacement of thousands of Palestinians (Abu Ghazala, 2003).

In the following two decades, JDECO's concession became a contentious issue between Israel and the company. The government aimed to either abolish the concession or nationalise the company, while the Israeli Electric Company (IEC) sought to extend its monopoly in electricity production and supply to East Jerusalem and the regions served by JDECO in the West Bank. JDECO's concession encompassed areas where new Jewish neighbourhoods, settlements and military bases were established. The company feared losing its concession if it refused to serve these customers. IEC exploited the tension between JDECO's commitment to safeguarding Palestinian national rights in Jerusalem and its desire to maintain its franchise. IEC attempted to connect new Jewish neighbourhoods within JDECO's concession area, leading to legal battles with JDECO and the government. Ultimately, JDECO retained its concession and agreed to serve these new customers.

During this dispute and its resolution, several changes occurred. First, JDECO was compelled to align its electricity tariffs with IEC's, resulting in a compromise involving the purchase of subsidised fuel from Israel to address the cost disparity (Lavi, 1969). Second, both companies were required to interconnect their grids for emergency purposes, driven by concerns that JDECO might cut off electricity during security and political escalations (Herman & Fischhendler, 2021). This interconnection paved the way for future electricity purchases from IEC, which commenced in 1973. Third, although JDECO had exclusively used Arabic and English and retained Palestinian locality names, it agreed to employ Hebrew-speaking staff and translate its bills into Hebrew (Bodenkin, 1970), although this agreement remained unfulfilled. Lastly, two representatives from Jerusalem's municipality (now entirely Jewish due to Arab voters' boycotts) were reinstated on JDECO's executive board (Shtern et al., 2022).

In the areas of West Jerusalem served by IEC, electricity remained consistently available and reliable. However, JDECO faced severe reliability issues, particularly during the early 1980s. The company's production plant was in poor physical condition, struggling to meet the surging demand for electricity resulting from the construction of thousands of new Jewish residential units in East Jerusalem and increased Palestinian demand. Despite increasing its electricity purchases from IEC in the late 1970s, JDECO experienced frequent power cuts and low-voltage incidents across its concession area, leading to customer protests and mounting debts to IEC.

In 1979, JDECO and the government negotiated a deal in which JDECO would receive 48 million ILS and a 20 million ILS debt forgiveness in exchange for transferring 15,000 Jewish customers and two industrial areas to IEC. While JDECO approved the agreement, its trade union launched a lengthy strike that ultimately resulted in the deal's termination (Shtern et al., 2022). The failure to reach an agreement prompted another Israeli government attempt to nationalise JDECO's Jerusalem operations, but this move was rejected by the Supreme Court following an appeal by JDECO. Despite its legal victory,

JDECO continued to face financial difficulties, an ever-increasing debt to IEC, over-staffing, an impending concession expiration in 1988 and uncertainty about its future.

Recognizing the leverage it held through JDECO's dire situation, Israel sought to achieve its long-standing goals. Jordan, concerned about its diminishing influence in the West Bank, the Palestinisation of JDECO and the growing control of its trade union and management by the Palestinian Liberation Organization (PLO), withdrew support for JDECO (Lukacs, 1999). The PLO, in response, provided financial support to preserve JDECO and its autonomous electricity production to counter Israel's attempts to gain political control through electrification (Sayigh, 1997; Jabary Salamanca, 2014).

In 1986, JDECO's precarious financial and technical condition led the company to accept a government plan that offered debt forgiveness and extended its concession until the year 2000. In exchange, JDECO transferred Jewish private and business consumers to IEC and closed its production unit. The agreement was executed in December 1987, sparking outrage among Palestinians who perceived it as undermining their rights in Jerusalem and strengthening Israel's rule in the Old City. This agreement played a pivotal role in triggering the First Intifada, a popular Palestinian protest against Israeli rule, which erupted the following day (Herman & Fischhendler, 2021).

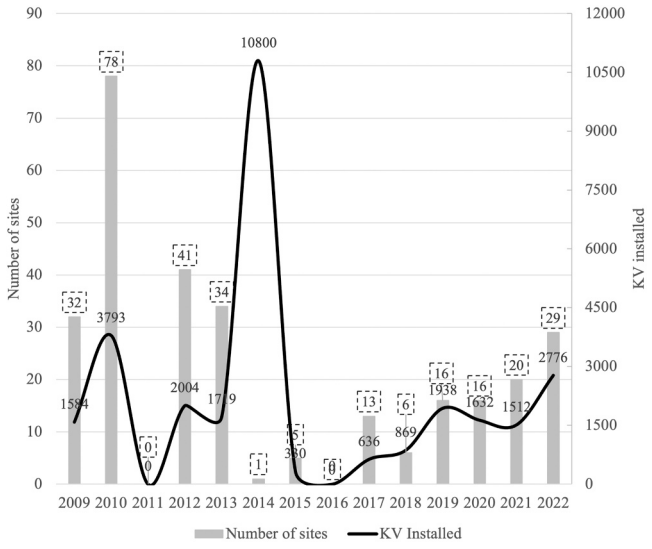

Fig. 6. Solar PV penetration in Jerusalem, 2009–2022.
Source: Israeli Electricity Authority, 2023.

JDECO transitioned into a pure distribution company, procuring electricity from IEC, alleviating its financial burden temporarily. However, it amassed a growing debt amounting to hundreds of millions of ILS owed to IEC (Herman & Fischhendler, 2021). Much of this debt stems from difficulties in collecting payments from customers, with roughly a third of East Jerusalem customers failing to pay their bills on time. Additionally, JDECO grapples with electricity theft, particularly in homes without legal permits, where residents resort to illegal connections.

The 1993 Oslo Accords led to the creation of the Palestinian Authority, affecting JDECO's operations in the Occupied Territories under varying governance regimes, depending on location. This has resulted in differing expectations among Palestinian consumers, with disparities in tariffs and regulations between Jerusalem and the surrounding areas. Enforcement efforts often provoke violence, entangled in the Israeli-Palestinian conflict and Israel's attempts to restrict Palestinian expansion in Jerusalem (Al Omri, 2014).

In 2016, an agreement was reached to settle Palestinian electricity debt to Israel, including JDECO's debt to IEC, which at the time amounted to approximately 2 billion ILS. The agreement included debt forgiveness and a gradual repayment plan, acknowledging the multifaceted aspects of electricity provision to Palestinians in Jerusalem and the Palestinian Authority, encompassing economic, security, political and humanitarian considerations (Michael, 2016). Although JDECO's debt was significantly reduced, it remains at several hundred million ILS. In recent years, IEC twice attempted to cut off electricity to JDECO to pressure debt collection and JDECO's consumers. Failed government attempts to nationalise the company, coupled with electricity market privatisation reforms, led to extensions of JDECO's concession, most recently in August 2010, when the Electricity Authority extended it until 2030 (Authority for Public Services - Electricity, 2010).

Israel is currently experiencing an energy transformation marked by the increasing adoption of renewable energy, particularly solar PV energy (Eitan et al., 2022). However, this shift has been relatively slow and uneven in Jerusalem. Solar PV installations are growing on national government and municipal buildings, but private sector and citizen installations remain limited. From 2009 to 2022, there was a continuous increase in renewable energy installations in Jerusalem, with 291 new solar PV sites added, boasting a total capacity of nearly 30 MW (see Fig. 6). The vast majority of these installations are concentrated in West Jerusalem, creating a division between the city's eastern and western parts. In West Jerusalem, solar PV panels adorn the rooftops of schools, the Parliament, three Hebrew University campuses and the city's football stadium. Conversely, East Jerusalem has seen only a handful of installations. Fig. 7 provides an overview of key events that have shaped

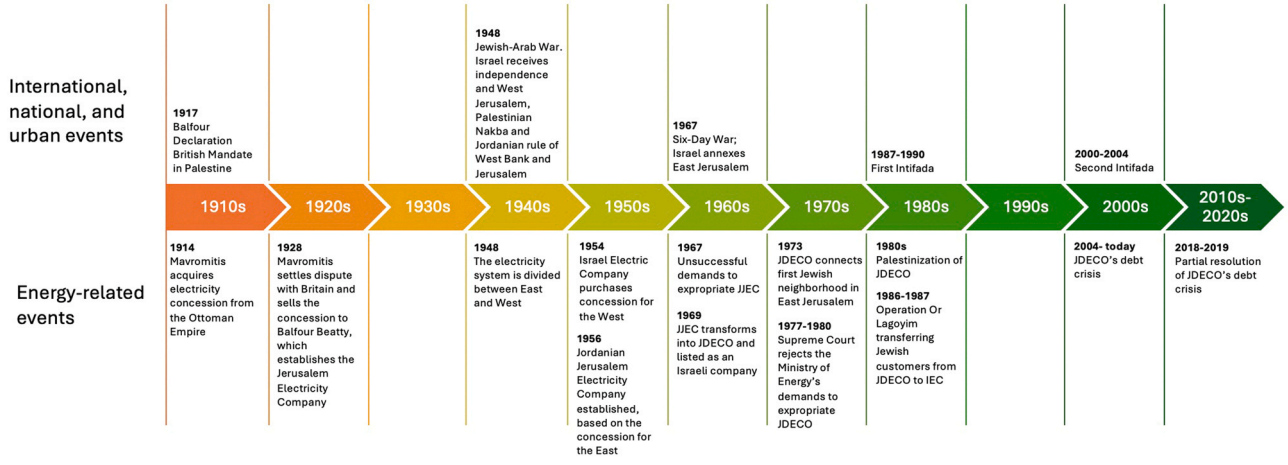

Fig. 7. Jerusalem timeline.
Source: Own compilation.

Jerusalem's electricity system.

4.4. Nicosia

4.4.1. The Nicosia Electricity Company (1921-1954)

The story of electricity in Nicosia is powerfully connected to the changing political regimes that the island of Cyprus has witnessed during the 20th century. The island was first electrified during British colonial rule, at the beginning of the 20th century. Nicosia, as the seat of the colonial government, became the first site of small-scale electricity generation with two power generators installed in the High Commission building and the General Hospital. An urban electricity grid in Nicosia was launched in 1912 with the establishment of the Nicosia Electricity Company (NEC) (Nicosia Electricity Company, 1938) as a private enterprise by the Greek-Cypriot tycoon George Pierides (2023).

The company received an exclusive concession for 25 years from the municipality to provide electricity for lighting in Nicosia. However, financial problems and the First World War delayed the operation of the company until 1921. Throughout the 1920s and the 1930s NEC signed several new agreements with the municipality that eventually extended its concession up to 1977 Nicosia Electricty Company, 1938). In 1928, NEC signed a separate agreement with the colonial government for the supply of electricity to governmental buildings in the city and its vicinity, allowing the government to shut down its small power plant. Operating from its power station within the city walls (see Fig. 7), NEC became the sole electricity utility in Nicosia, supplying electricity to civic, municipal and colonial customers (Nicosia Electricity Company, 1938).

During this period, electricity service in Cyprus was still highly disjointed between several local urban grids, operated by municipal or private corporations (Palmer, 1937). As in other cities, the NEC grid was based on small diesel generators, providing insufficient and unreliable supply mostly to non-residential units, such as governmental and municipal institutions, factories and small businesses (Gamben, 1936). NEC itself was infamous for its poor facilities, high prices and safety hazards (Palmer, 1938). Another characteristic of NEC was its domination by Greek Cypriots, who made up most of its shareholders as well as its founder (Telegram, 1952). (Fig. 8).

To meet growing demand, improve service reliability and enact the national scheme for electrification during the 1930s, the colonial government promoted the formalisation and consolidation of electricity production and distribution in Cyprus (Palmer, 1937). Based on the Electricity Law of Palestine (1934), the first Electricity Law of Cyprus was approved in 1940 and plans for a centralised national grid were set in motion. The legislation was seen by the colonial government as an opportunity to take over NEC, as well as other municipal utilities, to ensure a better, more reliable and cheaper service for customers (Palmer, 1938). The Second World War brought the electrification scheme to a halt until the end of the 1940s. Meanwhile, on 17 November 1947, the Nicosia power plant was destroyed in a fire and, in the absence of interconnections to other local grids in Cyprus, electricity supply in the city was interrupted for months (Governor of Cyprus, 1948). In 1952

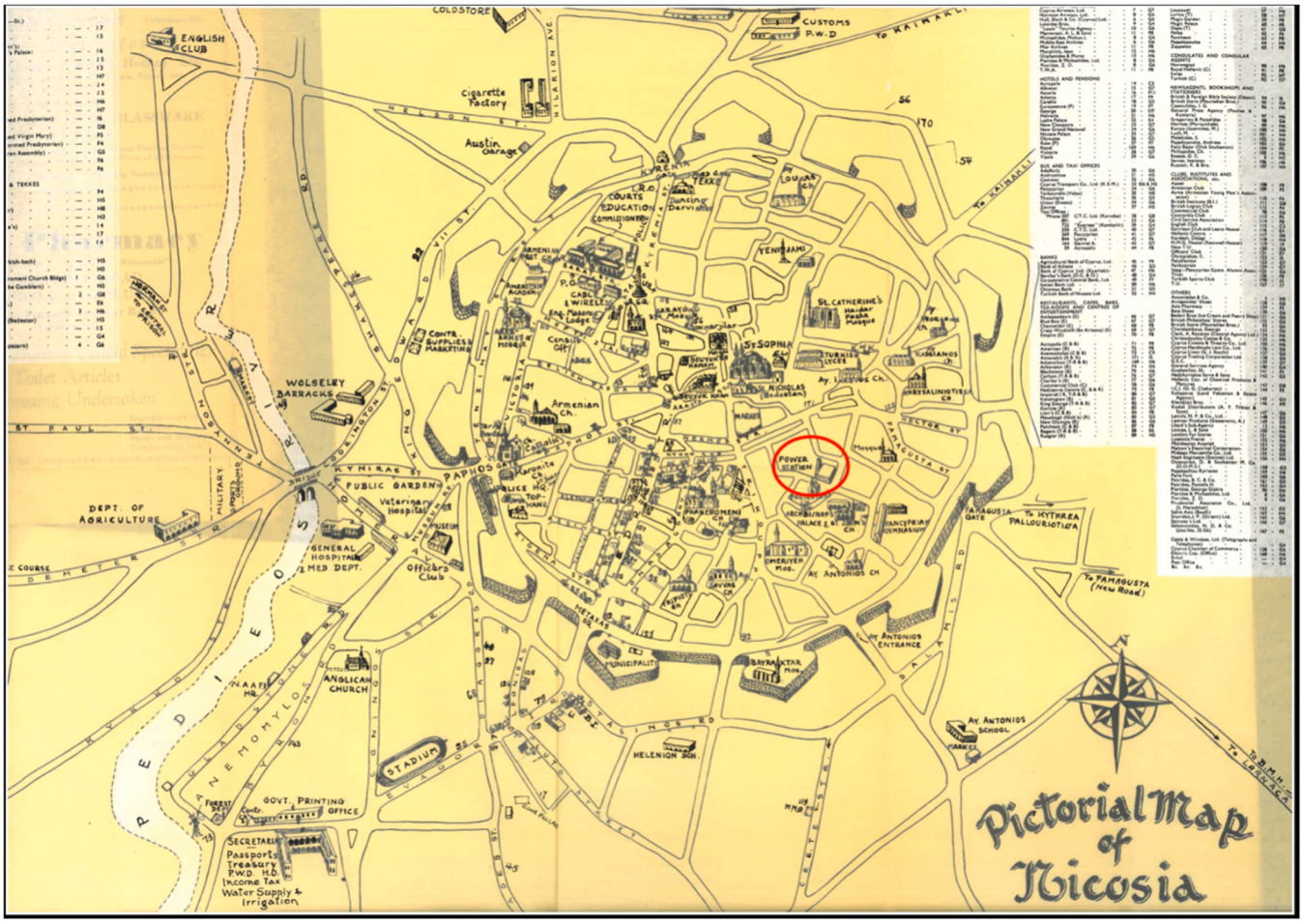

Fig. 8. Map of Nicosia, 1944 (with power station circled in red).
Source: "Romantic Cyprus. 3rd Edition: A Comprehensive Guide for Tourists and Travellers", K. Keshishian, 1945. Copyright: Kevork Keshishian, Nicosia, Cyprus.

the Electricity Authority of Cyprus (EAC) was finally established, merging smaller public and private electricity providers, including NEC. All existing corporations and municipalities were compensated for their infrastructures, properties and other amenities (Cyprus Electricity Development Law 1952). In 1952, NEC was acquired by EAC and was de-jure and de-facto liquidated (The Electricity Authority of Cyprus, 1959). This marked the effective end of municipally governed electricity provision in Nicosia and the subsequent subordination of the urban to an island-wide grid.

4.4.2. *The Electricity Authority of Cyprus (1952-1974)*

In 1953 the first Cypriot thermal power station became operational in Dhekelia (north of Larnaca), creating the first national grid of generation and distribution on the island. A transmission line was established between Dhekelia and Nicosia (2023). Nicosia became the largest service district of EAC and the site of a standby power station.

The EAC was a governmental authority, and – as customary in other British colonies – its board was headed by British officials serving as chair and vice-chair. The other three board members were local representatives (Fletcher-Cooke, 1952). Despite earlier considerations (Executive Council, 1952), no Turkish Cypriot members were recruited to the board, which consisted of Greek or Armenian members only. The rise in inter-communal strife during 1957–1958 gradually disrupted EAC functionality. Organisational and financial crises led, for example, to Turkish-Cypriot employees refusing to work in Greek-Cypriot areas (Morrison, 1958). Following an intervention by the British governor in 1959, a 2-million-pound British loan was secured to cover the company's debts and expand its grid. It was also agreed with both communities' leaders that the Dhekelia power station would remain under British sovereignty and that the EAC board would be reconstituted to include both Greek and Turkish Cypriots members (Government House Cyprus., 1959; Public Information, 1959).

With Cyprus' independence from colonial rule, and the subsequent 1960 declaration of the Republic of Cyprus, EAC transitioned from being a colonial authority to a national authority of the new republic. A new amendment to the Electricity Development Law (1960) was approved which included the expansion of the EAC board to seven members, of which two were now Turkish Cypriot (including the vice-chair). During the 1960s, despite the resurgence of inter communal violence in 1963–1964, EAC invested heavily in infrastructure and by the end of the 1960s the electricity grid covered every village and city in Cyprus (EAC, 2023). The state-wide national grid was now based on two oil-generated power stations located near two major commercial ports in the East and South of the island: Dhekelia and Moni. Oil was imported and distilled at national refineries outside the coastal city of Larnaca in the southeast. The Nicosia power station continued to function throughout this period, as a small standby unit, producing 29,400 kWh in 1969. Substations in greater Nicosia, such as Athalassa and Haraklis, functioned as the main nodes connecting northern parts of the island to the grid (Fig. 9).

In sum, despite minor tensions during the transition from colonial to republican periods, electricity in Cyprus, and in Nicosia in particular, prior to 1974 was addressed largely as a technical issue of service expansion to government, business and private customers. The development of electricity in Nicosia from a local municipal grid to part of the national EAC network was marked by Greek-Cypriot leadership, whether in private or national ownership. This was partially corrected in 1960, when new Turkish-Cypriot board members were added to EAC. However, most conflicts concerning energy supply to Nicosia or Cyprus at large were disputes over technical and financial issues, relating to service standards, prices and reliability, without a clear connection to inter-communal relations. Notwithstanding growing inter-communal tensions during the 1950s, electricity infrastructure was to a large

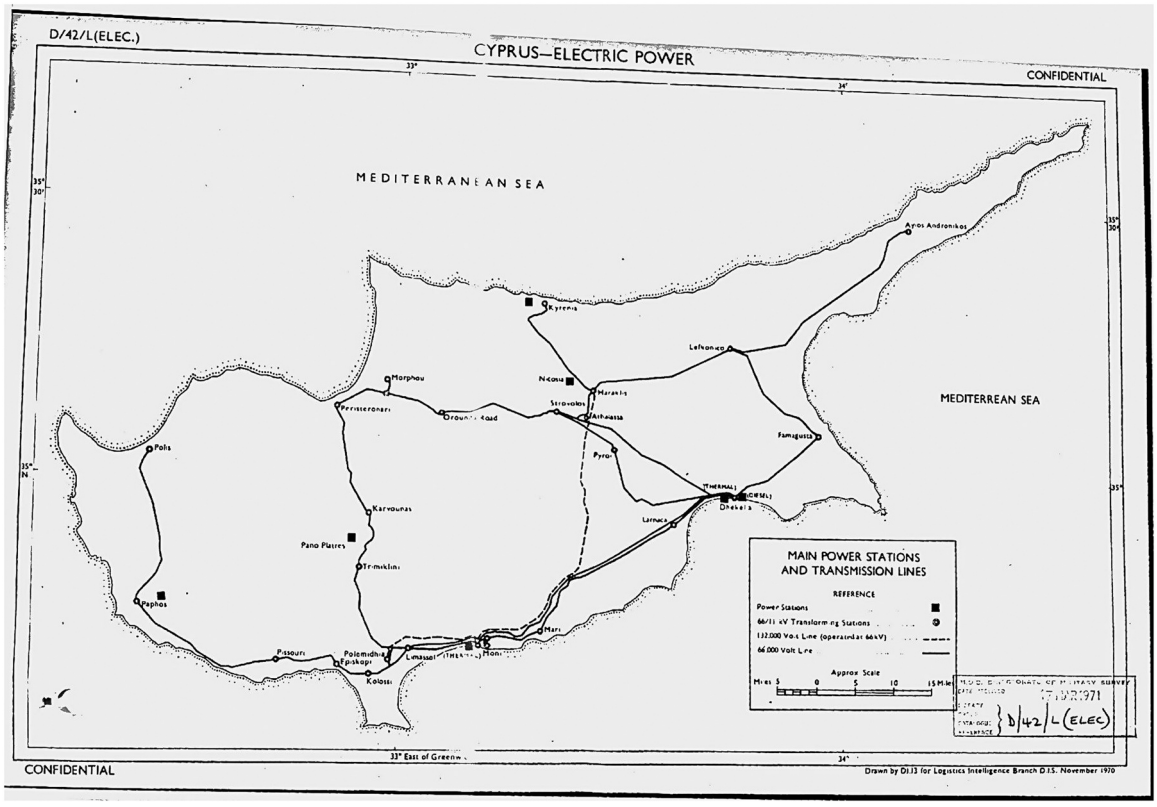

Fig. 9. Cyprus electricity grid, 1970.
Source: British National Archives: "Cyprus: electric power" (DEFE 64/67).

extent not politicised and did not play a significant role in the island's ethnic strife.

4.4.3. A divided grid (1974-2006)

On 15 July 1974, the Greek military junta staged a coup d'etat against the elected government of the Republic of Cyprus. In response to the coup, Turkey invaded the northern part of the island on 20 July and has since occupied around one third of its territory. Despite the complete physical division between the two communities following the invasion, basic amenities, such as water, sewage and electricity, remained partly connected and some modes of connectivity even expanded during the following years (Hocknell, 1998).

However, all existing facilities of electricity generation infrastructure were still in the southern part of the island (on the following, Moss et al. 2024). Surprisingly, the electricity grid remained connected and the Turkish-controlled North now relied on production in the South. Moreover, electricity was supplied to the North free of charge (Hocknell, 1998: 230). This irregular practice was embedded within the Greek-Cypriot narrative of a single united island and the policy of non-recognition of TRNC (self-declared in 1983), which did not allow official monetary transactions. Supplying electricity to the North was also presented as a humanitarian gesture to the residents of Northern Cyprus, even though after years of following this practice, by the late 1980s, the Greek Cypriots were not supportive of this costly practice. In the words of a senior EAC officer "It was a big problem that the TCs [Turkish Cypriots] were not paying. It cost us 100 million euros". The TRNC government justified this practice as being their historical right for taxes and labour as well as foreign aid that had been invested prior to division to construct the electricity grid and production units. In the words of one interviewee, a former Turkish Cypriot politician, "these were built for both communities but ended up in the South. Our authorities argued that the 1960 treaties remained in force and that our rights within the republic – including its infrastructure – persisted. The United Nations also gave support…". Another former politician pointed out that "Turkish Cypriots provided the South with water from Morphou in exchange for electricity".

However, this mode of asymmetric distribution increasingly ran up against the reality of lack of capacity to meet increasing demand in the developing South. The RoC's economy was growing after division, with a construction and tourism boom along the southern coastline and simultaneous intensification of the manufacturing sector. Standards of living were improving and with that came an ever-increasing demand for electricity (2023). EAC added power plants and turbines to its capacity in Dhekelia and Moni but could not keep up with demand. During peak periods when electricity would have to be temporarily cut-off, EAC would prioritise load-shedding on the Turkish Cypriot North (Hocknell, 1998). One of the Turkish Cypriot experts who participated in our stakeholder meeting said that he had "decided to become an electrical engineer to help my country overcome blackouts".

Despite the favourable trading arrangement since 1974, TRNC was engaged in attempts to become self-reliant in electricity generation. In 1975 it received generators from Turkey of very limited generation capacity, but these marked the first step towards future self-production. In 1981 the first power station was commissioned in Dikmen (Dikomo) and, in 1983, a second one in Teknecik (Trapeza) (Hocknell, 1998). Yet, both stations were "primitive, diesel-fired gas turbine power plants dating back to the 1970s" with very limited capacity, and only in 1996 did the Turkish Cypriots, with direct support from Turkey, complete the construction of a new power plant in Teknecik (Hocknell, 1998). Technically, the transition was coordinated between the Turkish Cypriot electricity utility Kıb-Tek and the Greek Cypriot EAC, involving initial tests conducted in consultation between the two sides. A former general director of Kıb-Tek captures this interaction graphically: "Upon completing the first unit and initiating testing in 1995, a direct

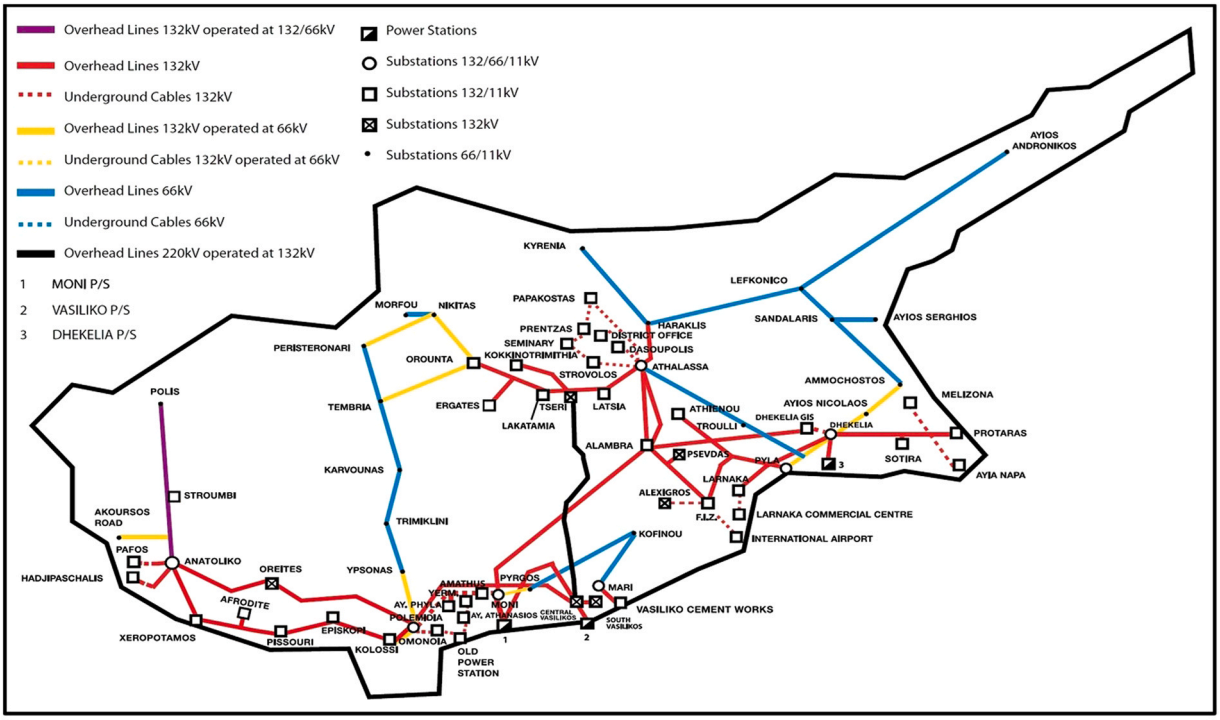

Figure 2.24: Map of the Transmission network of Cyprus at the end of 2013 (EAC, 2013: p. 19)

Fig. 10. Cyprus electricity grid, 2013.
Source: EAC, 2013.

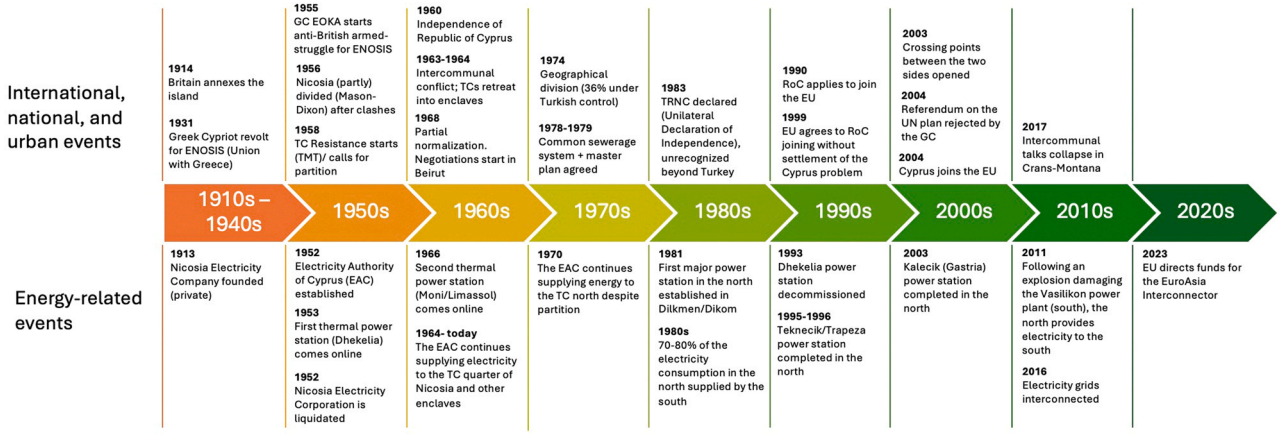

Fig. 11. Nicosia/Cyprus timeline.
Source: Own compilation.

connection between the control room in South Cyprus and ours was established for the first time, routed through the Turkish-Cypriot Presidential Office. It was a rudimentary line. The bell would ring, and they would pick up the phone and talk. Yet, even this basic connection was significant, as it didn't exist between 1974 and 1995". Eventually, when the Teknecik power plant came fully online, the Greek Cypriots refused to reconnect the grid – "our request to reestablish the connection was met with silence" (former general director of Kıb-Tek) – and the reluctant cooperation between the two sides came to an end in 1996.

4.4.4. *Reconnection (2006-today)*

Between 2002 and 2004 negotiations on reunification were held under the sponsorship of UN Secretary General Kofi Annan. The plan was eventually rejected by the Greek Cypriot side although it was accepted by Turkish Cypriots in a referendum held on 24 April 2004 (BBC, 2004). However, in the meantime the first crossing points were opened in 2003 along the buffer zone, allowing the first pedestrian and car travel between the two sides since 1974. Against this backdrop, a reconnection process of the two grids started in 2006 (Moss et al. 2024). The pretence for reconnection was the urgent need for maintenance work on the Teknecik power station which demanded a temporary shutdown of one of the turbines of the plant. "The Greek Cypriot side accepted our request, but only on condition that we would pay for it this time", the then Turkish Cypriot Prime Minister said. Following the maintenance work the connection was severed. Five years later, in July 2011, the electricity grids of the two sides were reconnected once again after an explosion at a nearby naval base (Evangelos Florakis Naval Base) destroyed the main Greek-Cypriot power plant, Vasilikos (Kıbrıs, 2011). For the first time it was TRNC that provided electricity to the South that had suffered considerable shortages after the plant's destruction.

Following a new round of peace negotiations that began in 2015, the two grids were interconnected on 11 August 2016 (Yenidüzen, 2019) and, from then on, the two sides have supplied electricity to each other on a regular basis (In Cyprus, 2019). To date, the interconnection continues without interruption, although the formal negotiation process reached a stalemate in July 2017. The electricity deal has left both sides better off. It not only allows each side to buy electricity from the other during times of crisis or temporary shortages. Interconnection provides stability for both sides' generation processes. The Turkish Cypriots have problems balancing solar energy production, while the Greek-Cypriot side is more reliant on wind turbines. Under these circumstances, a larger grid provides more flexibility for both sides and helps stabilise the island-wide grid (Yenidüzen, 2019).

The new phase of interconnectivity was based on interconnection along the buffer zone, thus diminishing the role of Nicosia as a connection hub. The grid in Cyprus had originally been designed as a "star system", in which sub stations in the Nicosia area functioned as focal points of the system. Following disconnection in 1996 and reconnection in 2006, the system was reshaped as a circular system, in which Nicosia serves as one of the interconnecting points but the system as a whole is operated from its power stations at the margins of the island: mainly Teknecik in the North and Dhekelia and Vasilikos in the South (Fig. 10). An overview of the events shaping electricity provision in Nicosia and Cyprus at large is provided in Fig. 11.

4.5. *Case Comparison*

Looking across the three cities' experiences of division to their energy systems, we can detect significant similarities, but also notable and instructive differences. Table 4 provides an overview of these manifestations of political division and unification to each of the cities' energy systems, drawing on the indicators set out at the start of this chapter: energy plant and networks, energy sources for electricity (and gas) production, energy regulation, utility structures, supply of electricity (and gas), practices of energy use and geographies of energy services. In all three cases, political division manifested itself in separate electricity utilities, service areas and infrastructure networks. However, processes of separation did not always occur suddenly or completely. So, while Berlin did experience the rapid division of its electricity and gas networks, technically as well as organisationally, Nicosia's experience was indicative of continued connectivity between the two communities over energy for years after political division. In Jerusalem, division in 1948 did bring a truncation to electricity networks but connections re-emerged following 1967 at a time when, however, each side consolidated its own electricity utility and service areas. Efforts by each side in all three cities to increase resilience through self-generation repeatedly ran up against realities of system interdependence. As a result,

Table 4
Manifestations of division in energy infrastructures: a comparative overview.

City	Berlin	Jerusalem	Nicosia
Energy system			
Physical plant and networks	Truncation of electricity and gas networks. Reconnection after reunification.	Truncation of electricity networks. WJ connected to the national Israeli grid in 1950s. Networks reconnected in 1970s.	National grid maintained after political division. Disconnected after North began electricity generation. Reconnected at limited points today.
Access to energy sources for generation	WB dependent on coal and oil transported through GDR; EB shifts to national lignite.	Both East and West depended on diesel from Jordan and Israel respectively.	Diesel imported to ports initially in South and later also North.
Cross-boundary trade in electricity (gas)	East supplied WB in the early 1950s. No trade in town gas. Supply of electricity and natural gas to WB only in 1990s.	No trade during years of division. After unification, East supplied to new Jewish neighbourhoods and West sold electricity to the East.	Trade from South to North maintained even after division. Trade stopped in 1990s, recommenced to meet supply crises and continues today in both directions.
Energy utility structures	Municipal electricity and gas utilities divided in 1948/49. EB utilities nationalized after division and amalgamated into WB in 1990s.	Privately-owned electricity utility divided in 1948, and subsequently sold to the national utility (West) and local private-public municipal utility (East).	Municipal utility incorporated into state electricity utility in 1950s. Post-division split between South and North utilities.
Energy service areas	Spatial reconfiguration around island of WB, national context for EB. Single service area after 1990.	Separate service areas in East and West, expanded to serve own communities and new settlements.	Single service area maintained into 1990s, then separate service areas of North and South.
Regulatory structures	Municipal-democratic controls in WB; state-socialist planning for EB. Dependence on occupying powers.	During division, separate national regulatory regimes. Following unification (1967), single regulatory regime.	Separate national regulatory authorities in South and North.
Practices of energy use	Rationing of energy during blockade of WB, later in EB. Appeals to save energy in EB not effective.	Following division, rationing of electricity in West, and in East substitution of electricity with other fuels. Illicit electricity tapping in East.	Long history of electricity black-outs and load-shedding to meet shortfalls in supply, especially in North.

Key: WB = West Berlin, EB = East Berlin, WJ = West Jerusalem, EJ = East Jerusalem
Source: Own compilation.

dependencies over generating capacity, service areas and system stability have discouraged complete separation and nurtured tentative forms of collaboration to be explored in detail in the following chapter.

5. Strategic responses to infrastructural division (and reunification)

5.1. Framing the analysis

How have providers, regulators and users of energy services in Berlin, Jerusalem and Nicosia responded to the division (and any subsequent unification) of energy infrastructures? How and why have these responses altered since initial division? What differences and similarities can be observed between strategic responses in the three cities and how can this raise our understanding about the use of infrastructure to mediate political contestation in cities? To frame this in-depth analysis, we first set out a common approach for describing the strategic responses in each of the cities, presented here and compared in the following chapter.

This common approach is designed to capture (1) the strategies of diverse actor groups, ranging from city authorities, national governments and international players to energy utilities, interest groups and urban consumers, (2) the dynamic interaction of changes and continuities to their strategies (and counterstrategies of the other actors) over time and (3) the outcomes of these strategies, in terms of actor relations, infrastructure development and service provision. Three categories are used to describe and assess the strategic responses, in line with our objectives: separation, control and collaboration. Here we refer back to the analytical framework developed in chapter 3 (see Table 3). By *separation* we refer to the process of dividing an asset, a territory or a service shared by different people or groups requiring them to explore more independent modes of operation. Relating to energy infrastructure this could entail the partition of a power utility and establishment of competing service providers as a means of limiting dependence on, or deliberately weakening, the other side. *Control* means exercising mastery or coercive power over another party, relating to how one group has more resources and privileges and, thus, more capacity to control others (Miller, 2003). This could find expression, in our case, in restricting access to fuels, withholding electricity supplies or undermining the viability of an energy utility. *Collaboration* means working across difference (Tsing, 2015). It entails a voluntary common effort by rival parties to resolve a shared problem. This is often done through joint pursuit of agreed goals in a manner corresponding to a shared understanding about contributions and payoffs (Gulati et al., 2012: 533–537; Castañer et al., 2020). In our case this shared problem could be a shortage of electricity or an unreliable power supply that prompts parties to work together to exchange electricity to the advantage of both sides.

It is important to point out that we use these three categories not in an essentialist or autonomous sense, but in a constructivist and relational way. Hence, we acknowledge that analysing strategic responses through these categories should be based on the understanding and interpretation of each party, and that potential combinations and overlaps between categories exist. This allows us to explore not only how specific strategies are deemed to be divisive, controlling or cooperative by different parties, but also how these strategies can entail combinations of separation, control and collaboration. Thus, collaboration over electricity supply can entail a level of control due to power asymmetries. Similarly, practices of infrastructure separation are frequently tempered by continuing interdependencies that demand some degree of collaboration or control over energy provision. Unpacking the co-existence and hybridisation of these three categories at any one time and place is a core objective of the paper.

For each city, the analysis is structured according to different phases of strategic responses across the respective period of study. To enhance commonality and facilitate comparison, each of these phases is presented to reflect three aspects. First, the predominant strategy (and counterstrategy) of actors from each side of the urban divide is described, in terms of its political intent, rationale and ambition. Special attention is paid to the enrolment of separation, control and

collaboration as arguments underpinning these strategies. Second, the degree to which these strategies were implemented in practice is analysed, documenting the achievements made, but also the failures, limitations and inconsistencies encountered – whether political, material, socio-economic, institutional or environmental. Third, the outcomes of the strategies are assessed in terms of how far actor relations, infrastructure development and service provision express elements (and combinations) of the three categories of separation, control and collaboration. In conclusion, each case-study analysis reflects upon the co-existence of diverse strategies, the limitations of human agency and the ambiguities of our three categories.

5.2. Berlin: Cold War retrenchments around electricity and gas

The strategic responses of West and East Berlin to the division of their energy systems – and the counterstrategies these engendered – were not a constant across the period between the Berlin Blockade of 1948/49 and the reunification of the city in 1990. Although there was virtually no cross-border trade in electricity or gas during this entire period, shifts in political, environmental and financial circumstances prompted changes in strategic orientation that can be loosely categorised into three phases, with a fourth addressing post-reunification legacies of division. In each of these phases, issues of separation, cooperation and control played out in different ways as West and East Berlin each tried to render its own position more resilient – with or without the other side. These shifting responses to divided networks are presented in terms of the positions taken by key stakeholder groups (covering city authorities, energy utilities, national governments, occupying powers and urban publics), the infrastructure strategies they pursued and the impacts and limitations of these strategies.

5.2.1. Navigating asymmetries of divided energy infrastructure (1948 to mid-1950s)

The first phase is characterised by emergency responses by West Berlin to the truncation of its electricity supplies from the East during and after the blockade of 1948/49 and the counterstrategy of East Berlin (and East Germany) to exploit its advantageous position of electricity provision. The blockade that began in May 1948 prompted West Berlin to take drastic measures to secure supply and reduce demand for energy. During the 11-month blockade, the airlift was the only means of bringing coal into West Berlin. Of the 1.8 million tonnes of goods flown into the city by this means, 62.8% came in the form of coal, most of which was directed to the city's power stations and gas works (Wetzlaugk, 1988: 46; Bärthel, 1997: 194). Electricity and gas rationing became standard, with West Berliners suffering worse energy poverty than during the war (Fig. 12).

The end of the blockade in May 1949 – and with it, the restoration of cross-border power supplies – eased the immediate crisis of energy supply to West Berlin but created new problems emerging from the asymmetric relationship in energy infrastructure between East and West. While West Berlin lacked electricity generation capacity and was therefore heavily dependent on imports from the East, East Berlin had far greater generation capacity of its own as well as open access to the national grid (Tepasse, 2006: 206; Witte, 1952). The East Berlin authorities, together with the East German government, sought to drive a tough bargain with West Berlin on electricity trade, repeatedly withholding deliveries of coal or electricity to hold West Berlin to ransom. An initial agreement of 18 July 1949 to supply West Berlin with 1 million kWh a day ended suddenly on 1 July 1950 when the Soviet authorities instructed the grid connection to be cut off. Several agreements to resume electricity trade from East to West were concluded in the autumn

Fig. 12. West Berlin family experiencing a winter power cut, 1949.
Source: LAB F Rep. 290, No.0001142.

of 1950 but proved short-lived.[7] A regular bone of contention was over payment, with East Berlin/Germany insisting on payment in hard currency and West Berlin trying to pay at least part of its debt in East German Marks (Senat von Berlin, 1962; Stolpe, 1953). The most promising arrangement involved a tripartite deal in kind whereby a West German power utility provided electricity to areas of East Germany near the border in return for East Berlin supplying West Berlin with an equal amount. This scheme, neatly sidelining the conflict over currency, became operative from 1951 to 1952 and again between 1953 and 1955. However, it too proved vulnerable to political intervention and on 8 April 1955 power supply to West Berlin was terminated once more, allegedly to conduct repair work, but this time for good.

West Berlin could only tolerate such a break in relations thanks to a rapid programme of investment in its own electricity generation capacity. The festive launching of a major new power station, West, in December 1949 – the largest coal-fired power station in Germany at the time – heralded the forthcoming phase of capacity-building to achieve self-sufficiency in electricity generation (Senat von Berlin, 1955: 154). West Berlin was already self-sufficient in the production of (town) gas, dependent here just on coal deliveries through the GDR that were also subject to unannounced interruptions. West Berlin's utility Gasag was even able to maintain gas supplies to peripheral areas of the Soviet-controlled zone in 1950 in return for gas from East Berlin along the inner-city border (Senat von Berlin, 1951: 134). Particularly in the case of gas, a historical legacy of municipal self-provision since the nineteenth century proved to be a lifesaver for West Berlin during the early 1950s.

Overall, this brief initial phase was characterised by massive asymmetries in dependency relations, favouring the East especially in electricity supply. This encouraged East Berlin to play for short-term financial and political gains through physical interruptions of supply and disruptive economic blackmail. Such tactics only strengthened the resolve of West Berlin and its political backers to reduce dependency on, and the need for cooperation with, the East by building up its own supply capacities. The seed for the pursuit of energy autarky was sown by the trauma of disconnection and disadvantageous dependency.

5.2.2. Pursuing divergent energy pathways (mid-1950s to 1970s)

During this second phase the energy systems of West and East Berlin were developed along very different trajectories, in terms of their spatial

[7] These agreements and their problematic implementation are documented in DTM 1.2.130, Nos. 03482 and 05732 for a West Berlin perspective and DTM 1.2.130, Nos. 10435 and 10540 for an East Berlin perspective.

reach, political orientation, institutional framing, technological innovation, access to funding and service quality. Physical interaction between their electricity and gas networks was minimal. Cross-border communication on energy issues was extremely limited. Securing energy independence from the other side was the motive of the era.

For West Berlin this was expressed in a strategy for urban autarky in electricity generation and gas production. The city would always remain dependent on the East permitting the passage of coal and, later, oil to fuel the city's power stations and gas works, but it could at least control its own electricity and gas production. The experience of extreme dependence on East German electricity in the early 1950s goaded West Berlin into launching a massive investment programme in energy generation, distribution and storage infrastructure with the help of substantial funding from the US and West German governments.[8] The expansion of several power stations within the city enabled West Berlin to reduce dependence on the East in an astonishingly short period of time (Senat von Berlin, 1955: 154; Tepasse, 2006: 204) (see Fig. 13). Electricity imports from the East declined sharply from 296 million kWh in 1950 to 81 million kWh in 1954 and, after 1955, effectively zero (Statistisches Landesamt Berlin, 1955: 283). West Berlin was henceforth an "electricity island", generating all the power consumed in the city (Stolpe, 1956). West Berlin had been self-sufficient in gas production since division, but the five-fold expansion of capacity at the city's largest gas works at Mariendorf during the 1950s enabled West Berlin to meet rising demand too (Bausch, 1956; Tepasse, 2006: 190). Heavy investment in power plants and gas works within the confines of West Berlin was maintained throughout the 1960s and 1970s to meet predictions of ever-rising demand by a relatively stable – and at times even declining – population. Without access to regional grids, West Berlin had to reconfigure its distribution networks for electricity and gas around its territory, store sufficient coal to supply the city for at least three months (following a decree of the Allies) and maintain a 17% reserve in electricity generation capacity to cover for any disruption to supply (Bahde et al., 1977: 131). It also pursued innovative ways of flexibilising supply, using a steam storage facility that powered turbines and, later, the world's largest electric battery to manage peak loads (Stolpe, 1956: 280; Fischer, 1992).

While West Berlin was securing the insularity of its urban energy systems, East Berlin's energy services were being nationalised and socialised. As part of the GDR's strategy to de-municipalise energy provision, East Berlin was rapidly incorporated into national networks. In the early 1950s East Berlin was actually exporting electricity to the GDR grid to cover for national power shortages that were to persist throughout the Cold War era (Shin and Trentmann, 2019: 248–249). From the mid-1950s, electricity and town gas were increasingly provided from large power stations and gas works located at lignite mines in the South of the country, with natural gas piped from the USSR via Czechoslovakia after 1973. As a result, the proportion of electricity provided by East Berlin's own power stations fell from 100% in 1955 to 80% in 1965, 24% in 1975 and just 6% in 1980 (VEB Energiekombinat, 1989: 18). By 1978 East Berlin's two remaining gas works were producing only 15% of the city's gas consumption (Bärthel, 1997: 116). Chronic underfunding of energy infrastructure in the GDR resulted in repeated power shortages up until the 1970s, even for the privileged capital, East Berlin, resulting in frequent restrictions on energy use (Shin and Trentmann, 2019: 252–254).[9]

The rhetoric and reality of fully divided energy systems was perforated, at times, by minor cross-border exchanges. On a very modest scale, electricity was provided to the other side by each wing of the divided power utility Bewag even after cessation of cross-border electricity transfers in 1955. Bewag (East) continued to supply a small number of communities on the border to West Berlin where supply from Bewag (West) was not readily feasible. Bewag (West), meanwhile, supplied electricity to the East German Reichsbahn, operating suburban rail travel in West Berlin, as well as to the Soviet war memorial and transmission studio at broadcasting house. There were similar reciprocal supplies of gas to small border communities (Senat von Berlin, 1951: 134). Costs for these small amounts of electricity and gas were billed meticulously and gradually declined as each side sought to minimise dependence on the other.[10] In order to manage these exchanges – and the larger cross-border transfers up to 1955 – some technical contacts across the political divide were sustained during the 1950s. These included telephone exchanges between load dispatchers and power stations in East and West, written correspondence between the accounts departments of both utilities, an exchange of planning documents in 1957 and very occasional meetings of the utility directors.[11] These contacts subsided after the building of the Berlin Wall on 13 August 1961 that prevented the passage of people. When representatives of Bewag (West) and the east Berlin VEB Energiekombinat met in 1988 it was heralded as the first official contact for decades.[12]

By the mid-1970s the separation of the energy systems for West and East Berlin had, therefore, been virtually complete for 20 years, driven by a persistent desire to minimise dependence on the other side. There were inconsistencies to this strategy of separation, such as minor exchanges, but more serious were the increasingly obvious environmental limitations to energy autarky in West Berlin and chronic problems of underfunding in East Berlin. These were to herald a rethinking of cross-border energy relations.

5.2.3. *Acknowledging interdependencies (1970s-1989)*

The third phase is marked by West Berlin's strategy to explore options for importing electricity and gas from third parties via East Germany and East Berlin's counterstrategy of deriving financial, technological and political gain from West Berlin's predicament. A growing willingness of both sides to contemplate cooperation over energy was driven in part by geopolitical rapprochement from the 1970s onwards, but primarily by the increasingly apparent limits to West Berlin's strategy of energy autarky and East Germany's need for hard currency.

For West Berlin, providing its own electricity and town gas against the backdrop of ever-increasing demand was proving a race against time. All the self-congratulatory talk about being an "electricity island" and self-dependent in gas production could not conceal the harsh reality that West Berlin was running out of space to build enough power stations and gas works to meet demand growth predictions and to store huge reserves of coal and oil capable of pre-empting a repeat of the blockade (Elkins and Hofmeister, 1988: 134–135).[13] More significantly still, Bewag (West) and the Senate of West Berlin were being confronted by an increasingly critical public unwilling to shoulder the growing environmental damage of urban power and gas production, in terms of local air pollution but also the loss of green space to accommodate new infrastructure.[14] As the Senator for Economics, Karl König (SPD), bemoaned at a parliamentary committee meeting in October 1974, "everybody wants electricity but nobody wants a power station".[15] What

[8] These investment programmes are documented in DTM 1.2.130, No.05005.

[9] These supply problems and restrictions on use are documented in LAB, C Rep 101, nos. 793 and 794 and DTM 1.2.130, nos. 10598 and 10601.

[10] These minor supplies and their invoices are documented in DTM 1.2.130, nos. 05731 and 08878.

[11] For details of these contacts, see DTM 1.2.130, Nos. 03482, 08874 and 08889.

[12] Bewag press statement of 4.11.1988 in DTM 1.2.130, No.10108.

[13] Bewag (West) and the West Berlin Senate were all too aware of the multiple technical, environmental and political drawbacks of energy autarky, see DTM 1.2.130, no.05721 and LAB, B Rep 016, no.461.

[14] See, for details, DTM 1.2.130, No. 05721 and LAB B Rep. 011, No. 40.

[15] Minutes of a joint meeting of the parliamentary committees for federal affairs and for urban development of 7 October 1974, LAB B Rep. 016, No. 461.

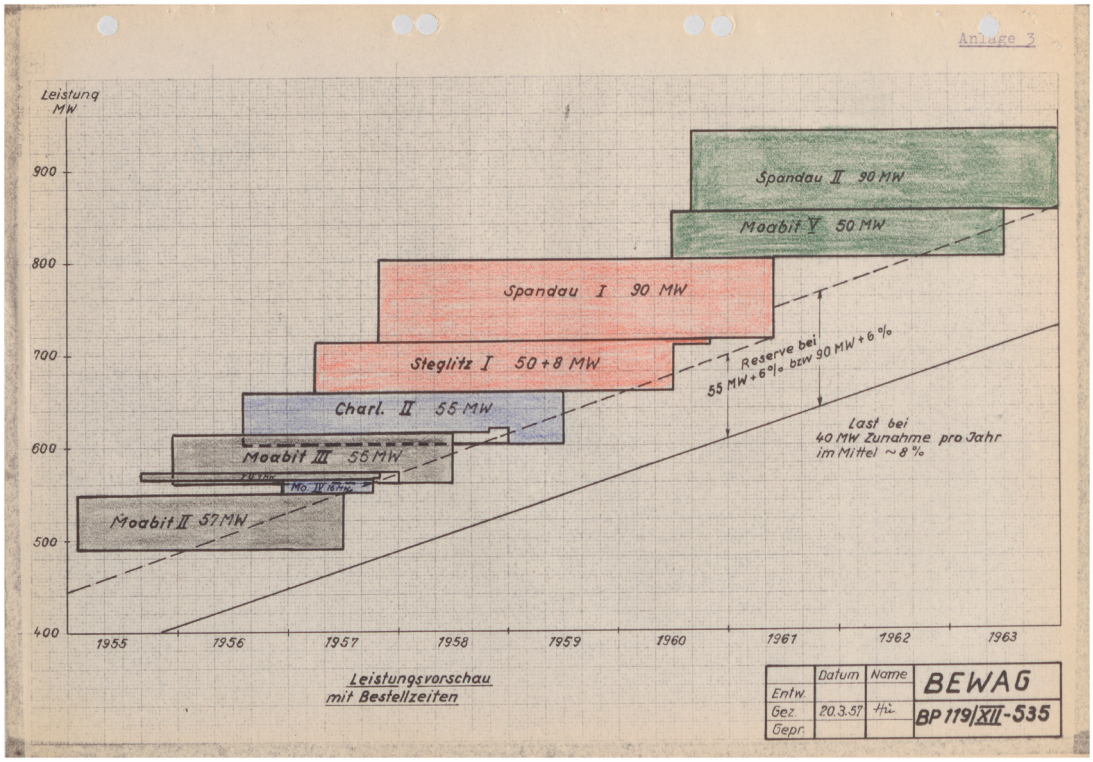

Fig. 13. Planned expansion of West Berlin's generating capacity, 1955–1963. Source: LAB B Rep. 011, No.40.

had been widely tolerated in the 1950s as essential to West Berlin's survival was by the mid-1970s no longer accepted as inevitable. Local opposition by residents grew into city-wide campaigns against the construction of new power stations that questioned not only the siting of plant but also the scenarios of growing energy demand underpinning the capacity expansion strategy (Moss, 2020: 252–257).

Already in 1964 Bewag (West) had been contemplating importing electricity as a way of avoiding the construction of new power stations. This culminated in the 1970s in a series of exchanges with representatives from East Germany, the USSR, Poland and West Germany to discuss where electricity could be imported from, along which route and under whose control.[16] Various options were on the table, involving power delivered from West Germany, Poland or even Kaliningrad (in the USSR) from a nuclear power plant to be built with West German technology. The crux of the issue was always whether East Germany would be able to control electricity bound for West Berlin that, inevitably, had to cross its territory. West Berlin wanted to ensure a direct cable connection with Poland and West Germany that would discourage interruptions by East Germany (see Fig. 14). The GDR's offer of supplying electricity to West Berlin from its own power stations was rejected out of hand for this reason (Tegethoff, 1984: 418). Senator König was adamant that "we want no switch in the GDR".[17]

Similar talks were held to arrange for pipelines of natural gas to be supplied to West Berlin from the Soviet Union from the 1970s onwards (Moss, 2020: 241–242).[18] Here too the sticking point was whether East Germany would have the capacity to cut off gas supplies at will. As the Senator for Transport and Enterprises, Herbert Hausmann, justified his rejection of one such long-distance gas pipeline, "Berlin must reckon with the possibility of the Russian and Soviet-German authorities causing us major transportation difficulties".[19] Consequently, both sets of negotiations – for electricity and gas – proved long and laborious. Agreement was only reached over electricity imports to West Berlin from West Germany in 1988, just one year before the fall of the Wall (Betriebsrat der Berliner Kraft- und Licht (Bewag)-Aktiengesellschaft, 1998: 143). It was only three years earlier, in 1985, that West Berlin received its first delivery of natural gas from the Soviet Union, ending its energy isolationism.

The willingness of the authorities in West Berlin to contemplate cross-border trade in electricity and gas laid bare the increasingly dire situation of energy provision and environmental pollution in the insular city. Nevertheless, it took decades of negotiation to produce agreements that acknowledged West Berlin's dependence on external energy provision, revealing the depth of distrust that still prevailed. The East German government, although desperate for hard currency and technological expertise from West Germany to address its own energy supply problems, insisted on controlling electricity and gas connections to West Berlin. Unwilling to relinquish this key advantage, it derived neither economic nor political benefit from rapprochement over energy.

5.2.4. Uniting the city in the Western mould (1990-present)

The fall of the Berlin Wall in November 1989 and the subsequent reunification of Germany (and Berlin) in October 1990 accelerated this process of rapprochement. The reunification of Berlin's energy systems, described in chapter 4, was cause for much celebration, evoking powerful symbolism of reconnection. Reconnecting the networks and organisations running them was an act of political union. However, there remained strong legacies of division that have posed serious challenges ever since, particularly in the 1990s. The long-standing existence of two parallel systems for electricity and gas created, after

[16] See, for details, DTM 1.2.130, Nos. 05721, 05722 and 05723.

[17] Manuscript for a speech by the Senator for Economics in January 1975, LAB B Rep. 010, no. 2349.

[18] See, for details, LAB B Rep. 016, Nos. 460 and 461 and LAB B Rep. 155, Nos. 143 and 144.

[19] Letter of Senator Hausmann to the Reichswerke AG of May 27, 1952, LAB B Rep. 011, no. 19.

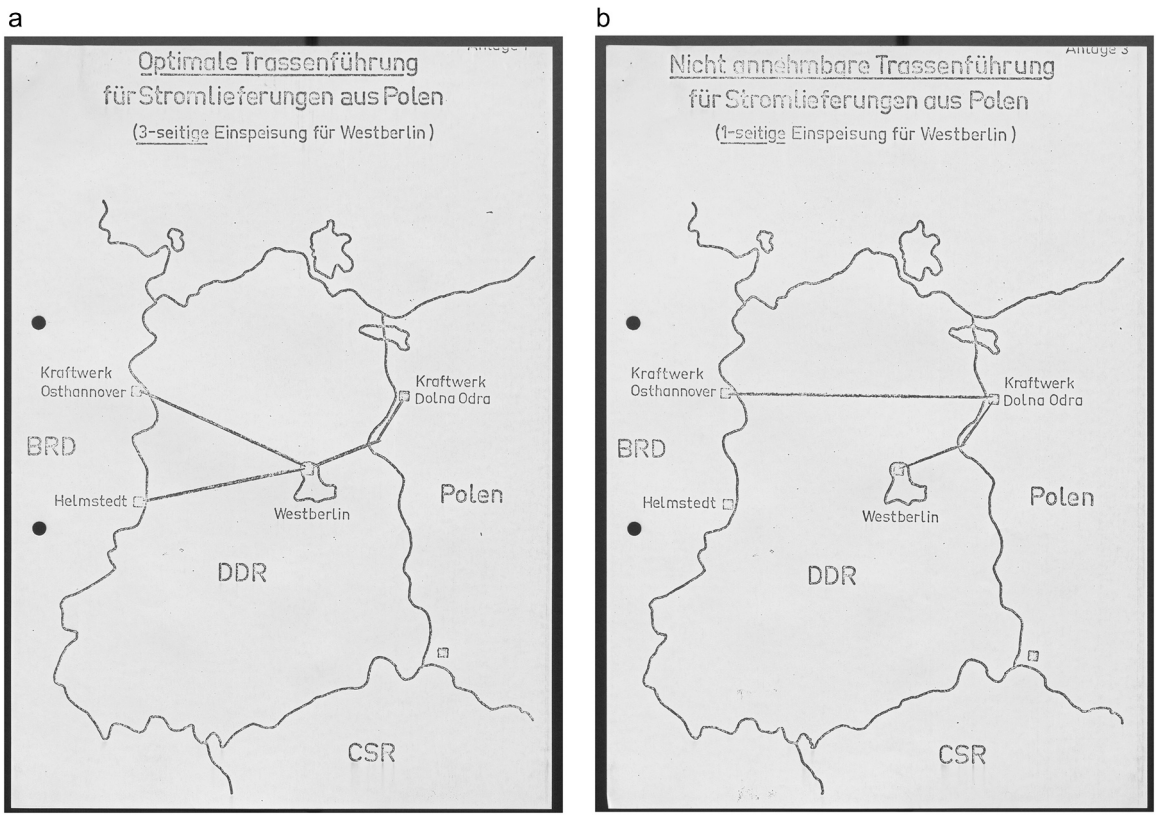

Fig. 14. Desirable (left) and undesirable (right) power cable connections for West Berlin, 1974.
Source: Deutsches Technik-Museum (DTM) 1.2.130 FA, No. 05723.

reunification, massive redundancies in generation and storage capacity, spatially diverse network structures, an overly large workforce, diverse cultures of infrastructure planning, funding and management and a huge financial burden to rectify past underfunding in East Berlin (Moss, 2020: 261–289). Both sides had to wean themselves off a culture of protectionism and the inefficiencies it engendered: in West Berlin's case from heavy subsidies from Bonn, in East Berlin's case from a market-averse planning system. Both sides also were heavily reliant on coal or lignite for electricity generation, creating a problematic legacy for mitigating climate change.

The reunited city struggled to address these challenges, especially in the context of an increasingly liberalised energy market in Europe that put an end to the territorial monopolies Berlin's energy utilities had always enjoyed (Monstadt, 2004: 410–414). The huge investments made by the city's utilities significantly improved service standards and environmental protection, especially in East Berlin. However, many power plants were decommissioned during the 1990s, while others were retained primarily as sources of district heating. All the city's remaining gas works were closed. The massive public debt incurred by Berlin after reunification – not least because of ill-fated commercial ventures by its utilities – prompted disastrous decisions to privatise its electricity and gas utilities in 1997 and 1998, respectively (Monstadt, 2004: 328–332). Having regained city-wide control of Bewag and Gasag in the early 1990s, Berlin lost it within a few years and has been trying to claw back influence over urban energy provision ever since. The initiative to remunicipalise Berlin's electricity utility and power grid after 2010 came, intriguingly, not from the city government but from civil society – principally an alliance of environmental and social justice NGOs – in an echo of the environmental protests against state energy infrastructures in 1970s West Berlin. Under growing popular pressure, the city government has, since 2013, been reasserting municipal influence on energy policy, creating the Berliner Stadtwerke as a municipal utility dedicated to promoting renewable energy and overcoming the city's legacy of heavy dependence on fossil fuels (Blanchet, 2015; Becker et al., 2017).

5.2.5. *Concluding remarks*

Looking back across Berlin's recent history, this analysis has demonstrated how Berlin's energy systems have mirrored political division, but also been hugely formative in how it played out. During the 40 years of the Cold War the strategic responses of city authorities and utilities – powerfully framed by national governments and geopolitical sensitivities and increasingly influenced by popular protests – shifted significantly to accommodate changing circumstances, whether geopolitical, technical, material or economic. Disruption to cross-border supplies of electricity and gas in 1948 prompted initial emergency measures to sustain basic energy services and stimulated the pursuit of disconnection and self-dependence to minimise control of supply by the other side. The energy networks of West and East Berlin subsequently developed along very different trajectories. This status continued throughout the Cold War period, but increasingly revealed limitations, as expressed by the material dependency on fuel sources, the technical requirements of insular energy networks, the financial shortfalls of a socialist economy and environmental degradation on both sides of the divide. These drawbacks encouraged West and East Berlin to negotiate over reopening cross-border energy trade, but this was achieved only shortly before reunification. The legacies of this experience of system separation and tortured cooperation are still tangible in urban energy policy and practice today.

5.3. *Jerusalem: Division, unification and control*

Over the years, the strategic responses of West and East Jerusalem to the city's energy system division and unification have evolved significantly, corresponding with changing rival identities. What initially began as a community struggle for influence within a privately owned

British electricity company (1928–1948) transformed into national division between two states (1948–1967), followed by an asymmetrical conflict between a dominant state and a minority population (1967–1994). It eventually evolved into a conflict between a state and a state entity (1994-present). Each phase left its imprint on the spatial, institutional and technical aspects of the city's electricity grid and supply. The Jerusalem case illustrates how, in an ethnic-national conflict, electricity can be perceived not only as a public utility but also as a tool of sovereignty, often prioritising political objectives over service quality or technical efficiency, to the detriment of both sides' living standards and national aspirations.

5.3.1. *Wrestling for power under British rule (pre-1948)*

The establishment of JEPSC in 1928 transformed the pre-1948 Jerusalem electricity infrastructure struggle into a competition between two ethnic communities vying to expand their representation within a privately-owned company. This rivalry aimed to secure jobs, professional training opportunities and influence over the company's future infrastructure projects in the city. Both communities sought to sway the company's priorities, advocating investments in their neighbourhoods at the other's expense, envisioning improved quality of life and a strategic edge in future city control (Shamir, 2016). Although employing similar strategies, each side faced limitations in blocking the other group's employees as a counterstrategy.

The internal struggle within JEPSC did result in a gradual expansion of the city's electricity grid, but this expansion was primarily determined by physical factors rather than political considerations. The company's expansion aligned with local urban growth patterns rather than ideological pressures from either community (Meiton, 2019). In essence, JEPSC prioritised neighbourhoods where it anticipated rapid electricity demand growth due to population increases or more available space for expansion. To ease tensions among employees, the company assigned Jewish workers to Jewish neighbourhoods and Arab workers to Arab neighbourhoods.

However, by 1942, rapid city expansion strained the company's budget, causing it to fall short of meeting the city's electricity demands. Consequently, JEPSC sought assistance from the Palestinian Electric Company (PEC) to supply electricity to the city (Shtern et al., 2022). This move would have allowed the Jewish community to provide electricity to its West Jerusalem neighbourhoods and connect them directly to the grids of other Jewish-majority cities. Arab employees opposed this, however, and the interconnection remained dormant until after the 1948 war.

5.3.2. *National division between Israel and Jordan (1948-1967)*

The second phase of Jerusalem's electricity infrastructure development unfolded during the 1948 Arab-Israeli war when the city was divided between Israel (West Jerusalem) and Jordan (East Jerusalem and the Old City), a division that persisted until 1967. During this time both Israel and Jordan aimed to establish a clear physical divide between the two parts of the city. However, their strategies diverged significantly, with Israel seeking to connect West Jerusalem to its national grid and Jordan attempting to create a decentralised and autonomous system in East Jerusalem (Rosen & Shlay, 2014).

Jordan faced constraints as it struggled to generate sufficient electricity for its population, and incorporating the Palestinian population of Jerusalem and the West Bank into its grid would exacerbate its energy shortage (Meiton, 2019). Additionally, the preferences of the Arab population in Jerusalem often clashed with Jordan's rule, which many perceived as an occupation. Conversely, the Jewish population welcomed Israeli control as liberation. Consequently, while Jordan initially sought to maintain a local grid connection with West Jerusalem to address supply shortages and delay infrastructure development, Israel rapidly disconnected East Jerusalem from local power stations and integrated these into the national grid operated by the IEC. This move was essential for Israel to ensure energy security for West Jerusalem, particularly during the post-1948 war siege.

In response, Jordan purchased JESPC and established JJDEC, leveraging the existing grid and constructing a small power station in the Palestinian village of Shuaafat. This move allowed Jordan to keep Palestinians on a separate grid while associating the West Bank, its residents and Jerusalem as political, religious and infrastructural centres under Jordan's rule. By 1962, Jordan had expanded JJDEC's concession in the West Bank to include Nablus, Jericho and Hebron, even though electricity was not supplied from Jordan to the West Bank.

During this period (1948–1967), two separate electricity systems emerged, with each side expanding or connecting its part of the system based on the physical or political constraints it faced. Jerusalem was a crucial junction, marking the "end of the road" for the hinterlands (Rosen & Shlay, 2014). The energy systems of East and West Jerusalem followed divergent trajectories concerning spatial reach, political orientation and institutional framing.

Israel's strategy, driven by security concerns, was to quickly disconnect West Jerusalem from East Jerusalem and integrate it with the IEC. Fears of Jordan using electricity supply as a wartime weapon spurred this action, ensuring West Jerusalem could generate its own power while also being supplied externally. In contrast, Jordan faced geographical and financial challenges, making full integration with its struggling grid too costly. Hence, a decentralised solution was adopted there.

These constraints led to divided grids, each reflecting the divergent political realities of the sides. West Jerusalem integrated into the Israeli national grid and, by extension, Israel itself. In contrast, East Jerusalem became a local electricity hub for Jordanian Jerusalem's hinterland, preserving its somewhat autonomous political status under Jordanian rule without full integration. Despite these circumstances, both sides experienced an incremental improvement in electricity quality and security during this period, a reality that was to undergo significant change in 1967.

5.3.3. *Battling over infrastructure sovereignty (1967-1994)*

The third phase of Jerusalem's electricity struggle began with Israel's annexation of East Jerusalem after the 1967 War and ended with the establishment of the Palestinian Authority as a distinct entity in 1994. During this phase, Israel pursued a vigorous strategy to merge East Jerusalem's infrastructure with the West, aiming to unify the city under its control. Simultaneously, this period witnessed the emergence of Palestinian resistance, leading to the "Palestinisation" of East Jerusalem's electricity grid and the entrenchment of two separate and nationalised electricity companies in the city: IEC versus JDECO.

The dominant focus for both Palestinians and Israelis during this competition for infrastructure sovereignty in East Jerusalem was not on providing the best electricity service but rather on asserting dominance over the production and supply of this critical service in a nationally and ethnically disputed area (Shtern et al., 2022). Consequently, territorial control, exclusive authority and political division took precedence over technical and economic considerations, resulting in significant disparities in service quality between the city's two sides.

Following the 1967 War, Israel swiftly expanded into East Jerusalem to assert its official sovereignty over the entire city through infrastructure integration or "unification". This involved the establishment of Jewish neighbourhoods in East Jerusalem and the integration of roads, water pipelines and the electricity grid along the former "seamline" that divided the city. The strategy aimed to eliminate traces of previous Jordanian and Palestinian presence, preventing potential future divisions along these lines (Pullan et al., 2007).

However, this process of urban integration primarily addressed the city's physical aspects rather than its inhabitants. Palestinians in East Jerusalem were granted permanent residency status rather than Israeli citizenship, indicating Israel's perception of them as entities outside the state's direct responsibility (Rosen & Shlay, 2014; Shtern, 2019). While modern Jewish neighbourhoods expanded in the East, with connections

to roads and Israeli utility providers, Palestinian-dominated areas remained underdeveloped, with poor municipal services. Consequently, the East-West divide in the city gradually evolved from a geographical division into a demographic and political one.

A significant challenge to Israel's strategy was posed by JDECO (formerly JJDEC), which fought to maintain its autonomy and concession in East Jerusalem and the West Bank amidst the new geopolitical landscape. Following the 1967 War, the Israeli Electric Corporation (IEC) sought to extend its monopoly over the West Bank territories, including East Jerusalem, making it the exclusive provider for future Israeli settlers there. However, JDECO contested this move, leveraging diplomatic and legal international pressure, which eventually compelled Israel to withdraw its demands and reaffirm JDECO's exclusive franchise over East Jerusalem and its West Bank extensions (Nitzan-Shiftan, 2017). JDECO wanted to preserve its franchise not only as an economic pillar for the Palestinian people but also to safeguard Palestinian national aspirations for political autonomy (Shtern et al., 2022).

Although JDECO successfully retained control, it grappled with meeting the escalating electricity demands of East Jerusalem. Its capabilities relied solely on the Shuaafat generation unit, comprising two ageing diesel generators and a substandard distribution grid (Cheshin et al., 1999: 138). Compounding the issue, JDECO was met by rapid population growth within its concession area. By 1979, 14,530 residential units had been constructed in Jewish neighbourhoods of East Jerusalem, accompanied by a 45% increase in the Palestinian population due to migration from Jerusalem's hinterland (Kimhi & Hyman, 1980: table 5.8).

Instead of allowing JDECO to expand its production capacity or procure electricity from Jordan, Israel's approach essentially reduced JDECO to a sub-unit of the IEC. This was achieved by compelling JDECO to purchase all its electricity from the IEC and distribute it to both Jewish and Palestinian residents of East Jerusalem. By 1975, JDECO was acquiring one-third of its distribution volume from the IEC but still struggled to meet the surging demand. This electricity shortage led to frequent power cuts and low-voltage incidents in East Jerusalem, particularly during winters.

Responding to the recurrent power disruptions, Jewish customers of JDECO in East Jerusalem initiated a national protest campaign in Israel. They called upon the municipality and the government to transfer electricity provision from JDECO to IEC (Kollek, 1994: 150). The protest shed light on the unreliable electricity services and emphasised the Arab character of the company. Demonstrators pointed out that JDECO issued invoices in Arabic, occasionally featuring the old JJDEC logo, appealing to Israeli sentiments of national pride and the desire for Jewish sovereignty over East Jerusalem (Shtern et al., 2022).

In the wake of a right-wing shift in the 1977 Israeli elections, Israel initiated an ambitious effort to nationalise East Jerusalem's entire grid. However, this endeavour encountered significant setbacks. Although the Israeli government aimed to annex East Jerusalem's concession from JDECO, the Israeli court intervened, thwarting this move following extensive litigation, street protests and international pressure. In 1981, the court deemed the nationalisation of JDECO's operations solely in Jerusalem as impractical and unlawful, as noted by Shtern et al. (2022). Ironically, this legal battle marked the complete Palestinisation of JDECO, its infrastructure and its sociotechnical dimensions. The struggle over JDECO shifted from a local matter between a regulator and a struggling electricity provider to a geopolitical issue, illustrating a growing reliance on geopolitical developments at the expense of JDECO's long-term economic viability. Jabary Salamanca (2014) offers a Palestinian perspective on the political nature of this transformation.

Despite successfully elevating the company to an international Palestinian symbol, JDECO grappled with ongoing financial challenges and mounting debt, directly affecting the quality of electricity services for its customers. To resolve the impasse with JDECO and exploit its financial vulnerabilities without triggering another protracted legal and international conflict, Israel executed the covert "Light unto the Nations" operation. The operation's objective was to swiftly and physically switch the grids in East Jerusalem, providing reliable electricity from the Israeli Electric Corporation to Jewish neighbourhoods while retaining Palestinian neighbourhoods under JDECO's franchise (Herman & Fischhendler, 2021; Rabihia & Baron, 1987). This operation alleviated JDECO's provisioning crisis by removing many users from its grid but exacerbated its economic woes by eliminating a significant portion of its paying customer base.

In the end, the third phase of the Jerusalem electricity struggle left both sides falling short of their objectives. JDECO's franchise rights gained international legal protection, but it became reliant on IEC for power generation, losing control over significant portions of East Jerusalem and its pursuit of infrastructure sovereignty in that area. Consequently, the company relinquished exclusive spatial control and technical capabilities, although it retained its executive, financial structure and symbolic Palestinian identity. Israel succeeded in providing reliable electricity to most Jewish East Jerusalem residents but failed to assert infrastructure sovereignty over the entire city.

5.3.4. Expansion vs. status quo (1994-present)

The fourth phase of the Jerusalem electricity struggle commenced with the establishment of the Palestinian Authority (PA) in 1994 and has since followed a convoluted and inconsistent trajectory. This path reflects Israel's uncertain stance regarding the future of East Jerusalem and the broader West Bank, wavering between annexation and separation strategies within the confines of domestic and international politics. Israel's dual approach aimed to integrate East Jerusalem seamlessly into the rest of the city while simultaneously neglecting and disengaging from its Palestinian population. This neglect was driven by the hope that it would incentivise Palestinians to relocate elsewhere, particularly due to challenges posed by family reunifications under the Oslo Accords (Stein, 1997; Shlay & Rosen, 2010).

To implement this paradoxical strategy, IEC employed JDECO as a scapegoat for maintenance failures, placing it in an operational model that hindered revenue generation and service consistency. This resulted in recurrent blackouts for JDECO customers, causing mutual accusations and legal disputes between IEC and JDECO. While technical issues, such as illegal connections to Palestinian homes, often triggered these blackouts, Palestinians frequently perceived them as politically motivated punishments by Israel rather than JDECO's fault.

Israel's approach evolved over time, influenced by broader political trends at national and municipal levels. Subsequent municipal administrations shifted from indifference or contentment regarding the neglected Palestinian neighbourhoods to recognizing their development as essential for maintaining Israeli control over East Jerusalem (Ramon, 2021). This revised strategy emerged due to the repeated failures of Israeli-Palestinian peace negotiations since the early 2000s and the ensuing city violence, reinforcing the understanding among Israeli municipal authorities that they would govern the Palestinian residents indefinitely.

Israeli national and municipal authorities both increasingly viewed the neglect of Palestinian neighbourhoods not only as a sovereignty issue but also as a public safety concern. Deputy Mayor of Jerusalem, Arie King, expressed this sentiment in strong terms: "It is our responsibility to develop infrastructure in East Jerusalem because infrastructure building is sovereignty. Collecting sewage and garbage is sovereignty. If we do not do it, we provide legitimacy for others to do it".

This shift culminated in May 2018 when the Israeli government approved a 5-year budget of 2.1 billion NIS titled "Reducing Socio-Economic Disparities and Economic Development in East Jerusalem". The budget allocated funds for infrastructure improvements, transportation, services and other investments in Palestinian neighbourhoods, recognising that improving Palestinian residents' lives could alleviate grievances, reduce civil unrest and violence and foster acceptance of Israeli rule (Prime Ministers, 2018). The Minister for Jerusalem and Heritage in the Israeli government, Ze'ev Elkin, explained the new

budget as a matter of sovereignty: "We need some kind of a Marshall Plan for East Jerusalem. The State of Israel needs to say, 'What is happening in our capital city, 10 min from the Knesset, 2 min from the Western Wall, we can no longer accept the situation that it is as if it were a country in itself'. Not from the level of the infrastructure, not from the level of law and order, not what happens in the education system" (Elkin, 2018).

The integration policy in East Jerusalem sparked conflicting responses among Palestinian residents. Some sought opportunities in the Israeli education and job markets to improve their quality of life, even if they did not accept the political reality (Saar, 2022). Conversely, many Palestinians viewed these prospects as a prelude to annexation, jeopardising their aspiration for an independent state with Jerusalem as its capital (Nolte and Yacobi, 2015). A senior municipal official in Jerusalem argued that: "It's very hard to build infrastructure in East Jerusalem. Public land is grabbed by private people, and I wish you good luck in telling a Palestinian in East Jerusalem that you're going to take part of his land to build a public park – it will quickly turn into a political clash about the Zionist occupier trying to steal land". Essential electricity expansion and maintenance projects in Palestinian neighbourhoods were often met with resistance, protests and sabotage (Barghouti, 2009). Entering Palestinian neighbourhoods became increasingly perilous for municipal workers and contractors, hindering the enforcement of IEC electricity standards in East Jerusalem (Rettig & Herman, 2024). Frequent clashes between municipal authorities and Palestinian residents gave rise to "no-go zones" characterised by informal governance and escalating tensions.

The PA adopted contradictory strategies regarding Jerusalem. While aspiring to gain independence from Israel in electricity supply through autonomy or connection to the Jordanian grid, the PA implemented policies that hindered JDECO and other Palestinian electricity distributors from being profitable. These policies included providing free electricity for Palestinian refugee camps and increased politicisation of JDECO, leading to accusations of internal corruption. The PA's electricity distribution policies fuelled frustration among Palestinians in Jerusalem, questioning the PA's commitment to Palestinian national aspirations. As a result, an increasing number of Palestinians in East Jerusalem sought to connect to the IEC grid instead of relying on JDECO (Levi, 2020). Many recognised the improbability of changing the city's "unified" status and sought better job opportunities and services by cooperating with Israeli authorities, blurring the lines between East and West Jerusalem.

Multiple Palestinian and external actors have attempted to pressure changes in the city's evolving political "status quo", reflected in its electricity infrastructure. Over the past decade, foreign state and non-state actors have promoted initiatives to design, develop and fund infrastructure projects in East Jerusalem, aiming to enhance Palestinian residents' lives while preserving the possibility of future city division in a two-state peace solution (Shlomo, 2017a). Initiatives such as the European Union and UNDP-funded rooftop PV panels in East Jerusalem aimed to provide electricity autonomy to Palestinian neighbourhoods, enabling future disconnection from the Israeli national grid (Rettig & Herman, 2024). The European Commission's "2018 Annual Action Program in Favour of Palestine" outlined these objectives: "Special attention is given to East Jerusalem with the purpose of strengthening the resilience of Palestinian residents and preserving the Palestinian character of the city… to prevent the population in East Jerusalem from being further coerced into leaving the city, thus jeopardizing the chances to safeguard the Palestinian identity of Jerusalem in future status talks and consideration of Jerusalem as the future capital of two states" (European Commission, 2018: 3].

Offers from the UAE and Qatar to finance new West Bank power plants, potentially supplying East Jerusalem, have not yet materialised but could resurface with technological advancements in autonomous electricity generation. Israeli authorities often approve such projects, viewing them either as benign or as a convenient solution for a problem they cannot resolve. The former advisor to the Mayor of Jerusalem on 'Arab affairs' expressed this sentiment: "If you can't fund or execute something yourself, someone else will do it. If it's legal, if it solves a problem for you, if there's no real point in fighting it other than the principle of the matter, then why bother to block a foreign donor from doing it?".

5.3.5. *Concluding remarks*

Reviewing Jerusalem's recent history of electricity infrastructure struggles illustrates how energy systems mirrored and exacerbated political divisions. The strategies and counterstrategies pursued prioritised politics over technical capacities and led to utility malfunctions and disorder for both Jewish and Palestinian residents of East Jerusalem. Solutions like the "Light unto the Nations" operation deepened divisions and disparities between the city's two sides rather than overrode them. This analysis emphasises the limited and occasionally counterproductive potential of using electricity infrastructure to alter, appease or eliminate existing ethnic divisions.

5.4. *Nicosia: From the heart of the grid to its divided fringes*

The strategic responses of the two main communities in Cyprus, Greek Cypriots and Turkish Cypriots, to the division of Nicosia's and, subsequently, the island's energy systems – and the counterstrategies these engendered – have changed throughout the years (see Moss et al. 2024). Since the inter-communal clashes at the end of the British colonial period, energy strategies of each side of the political divide have adapted to the island's independence in 1960, geographical and political division in 1974 and the political rapprochement during the 2000s. Across this long history, there were periods of stable connection (from 1963 to the early 1990s), disconnection (1996) and cautious/temporary reconnections (2006 and 2011–12, 2016-to date). Shifts in geopolitical, economic and regulatory conditions in Cyprus stimulated changes in strategic orientation in the South and the North that can be classified into three phases. In each of these phases, separation, collaboration and control issues played out in different ways as both communities tried to stabilise their electricity network between sometimes opposing geopolitical, political and technical interests.

Against this backdrop of geopolitical transitions in Cyprus, the role of Nicosia within the island's grid gradually diminished in a process that we define as de-municipalisation of electricity generation. Structural forces such as modernisation, inter-communal conflict and territorial dispute have created two electricity networks that are centrally operated on both internal and inter-communal levels from their power stations at the margins. Nevertheless, Nicosia remains a central connecting point, keeping together a larger bi-communal divided grid subject to forces for dissipation. The following section presents three phases of these shifting responses to the division of the grid in Cyprus as reflected in the positions of the opposing governments and public utilities, the strategies they chose regarding their infrastructure politics and how these affected the functions and development of the island's electricity system.

5.4.1. *A shared grid amidst an escalating conflict (late 1950s–1974)*

With the nationalisation and de-municipalisation of electricity generation in Cyprus, Nicosia lost its position at the heart of a star-shaped grid. Its power station was downgraded to a standby position and control of electricity supply shifted from local businesspeople to the national utility. Still today, in the words of a senior officer at EAC, "electricity is not something municipalities have control over". Following construction of the first government-funded power station in Dhekelia, a 66 kV transmission line was built between the power station and the major cities in Cyprus, including Nicosia, thereby establishing the national grid (2023). A transformation station of 11,000 volts was built in Nicosia to supply other towns in the region, and existing low-voltage distribution lines in the city were reconstructed and reinforced (EAC, 1954) (see Fig. 9 above).

The newly established public electricity utility, EAC, soon faced dramatic geopolitical shifts that gradually reconfigured the island's electricity system (Moss et al. 2024). As in the case of the Nicosia Electric Company previously, Turkish Cypriots were absent from the EAC executive board, yet now this was a public utility rather than a private one. Escalating inter-communal violence between 1956 and 1958 brought financial losses and delayed the growth of the electricity network (Morrison, 1958). In the summer of 1957, during inter-communal violence, Turkish-Cypriot employees of EAC, fearing for their physical safety, refused to work in the main office in the Greek-Cypriot parts of the old city, prompting the corporation to open for them a new sub-office in Kyrenia Road, in the Turkish-Cypriot quarter of Nicosia. This transition happened in several Cypriot towns, with Turkish-Cypriot leaders also demanding the separation of customer services (Morrison, 1958). Here were the first signs of system division and duplication, a process that became the dominant political logic of the city's infrastructures.

The foundation of the Republic of Cyprus (RoC) in 1960, with its fragile power-sharing mechanisms, brought changes to the organisational structure of EAC. The new political arrangements led to the nationalisation and diversification of the formerly British-Greek-Cypriot-dominated executive board. Turkish-Cypriot representatives were included, albeit in a secondary position (Government House Cyprus, 1959). Thus, as long as the new republic's political system functioned in an orderly manner, the EAC was led, at least formally, by both communities. British governmental patronage continued to stabilise the system and foster its advancement and development. Despite decolonisation, the British financed grid extensions and kept the area of Dhekelia, where the central power station was located, under its sovereignty (Public Information, 1959). It seems that the existence of Britain as a silent partner in the control room of the electricity system of Cyprus helped to depoliticise the situation.

A second wave of inter-communal violence erupted in 1963, leading to further segregation of the two communities and the emergence of the Green Line, which divided Nicosia into two parts. Since 1958, in North Nicosia a new Turkish municipality had been established that served the Turkish community (Kliot & Mansfeld, 1997). The future division of the five largest towns, including Nicosia, into ethnic municipalities was also envisaged by the 1960 constitution (Patrick et al., 1976: 34). On 21 December 1963, the killing of two Turkish Cypriots led to widespread rioting in the mixed suburbs of Nicosia. Following the riots, a buffer zone was set up between the two communities. It comprised a double-layered partition line drawn in green with a substantial no-man's-land in between. Yet, the arrival of UN peacekeeping forces in March 1964 saw the fortification of the Green Line with barbed wire, fences, roadblocks and other means to minimise contact between the rival communities (Gumpert & Drucker, 1998). Some 25,000 Turkish Cypriots were displaced island-wide during this time, while 700 Greek and Armenian Cypriots were displaced mainly in Nicosia (Gürel 2012: 9). The last decade of united Cyprus (and Nicosia) was marked by limited social contact due to the physical partition.

With the de-escalation of violence in August 1964, the Greek-Cypriot government imposed a fully-fledged economic blockade on, among others, the Turkish-Cypriot enclave of Nicosia (Patrick et al., 1976: 106–7), which was subsequently softened into economic sanctions. Yet, these were only partially extended to public utilities (ibid.: 111). As Patrick, Bater & Preston (ibid: 111) explained, "electricity and water supplies were not stopped, primarily because there was no way of disrupting these services to the Turkish Cypriot quarters or villages without simultaneously cutting them off for a substantial portion of Greek Cypriots as well". In this period, the Turkish-Cypriot authorities continued collecting electricity payments (at least in northern Nicosia) but did not pass these on to the EAC, keeping them in a "frozen account" pending a political settlement (ibid.: 112).

5.4.2. *Dividing the island – sharing the grid (1974 – 1996)*

The forceful geographic division of the island along the Green Line after the war in 1974 and the ensuing informal demographic (ex)change marked the beginning of a new geopolitical era in Cyprus, in which the land was split physically, politically and economically. However, for the following two decades, the electricity system remained shared, albeit in a strict asymmetric structure.

The two power stations, Dhekelia and Moni, were under the control of the Greek Cypriot authorities as they were in the southern part of the island. This did not, however, lead to disruption in the supply of electricity to the now Turkish-controlled northern part of the island even though both sides did not politically recognize each other. Northern Nicosia, as well as the rest of the northern part of the island, continued to rely on EAC supply through two points, Athalasa-Haspolat (Mia Milia) and Orounda-Guneskoy (Nikitas), both located in Nicosia. The city's role within the island's electricity system changed once again, to a connecting hub between the two communities.

Despite the ongoing conflict, electricity continued to be provided free of charge after 1974 (on the following, Moss et al. 2024). The Greek Cypriot side portrayed this as a "humanitarian gesture", which was consistent with their claim to be the sole legitimate government on the island. The unbilled electricity cost was transferred to the bills of Greek-Cypriot consumers whose support for the practice diminished as time passed and as the costs grew. In the words of an energy researcher from Nicosia: "You hear various estimations for the cost of the energy we gave the Turkish Cypriots for free, some more realistic than others. But the point is, it was expensive, and we never got that money back". In contrast, the Turkish-Cypriot side saw electricity supply as an "entitlement", claiming that, as one of the equal partners of the RoC, the island's infrastructure (which was at least partly financed by foreign aid) belonged to them as well (Hocknell, 1998: 232–3). Furthermore, the Turkish-Cypriot side claimed that they were providing the South with water in return, creating a quid pro quo relationship (Kliot & Mansfeld, 1997).

The division of the city had seriously damaged Nicosia's infrastructure. The reconstruction of the sociotechnical configurations of the city as two separate systems was a costly and complicated task for the struggling economies of South and North Nicosia. It led the two mayors during the 1970s and 1980s, Lellos Demetriades in the South and Mustafa Akinci in the North, to launch a local and depoliticised collaboration process in an attempt to stabilise the physical metabolism of the city as a whole (Shtern et al., 2022). This collaboration has been fruitful in two main arenas – sewage and urban planning. The city's partition had halted the construction of a new sewage system. With the financial support of the UN and the World Bank, the two mayors started collaboration in 1978 to complete the system and connect both of its parts to the sewage treatment plant in Mia Millia in northern Nicosia (Brouma & Ezel, 2011). Another field of cooperation was the production of the Nicosia Master Plan, which oversaw the preservation of the walled city and created in 1980 a series of written documents and maps that set the framework for developing Nicosia under various scenarios, including continued division and reunification (Demetriades, 1998). However, despite the fruitful collaboration between the two municipalities, these efforts did not include the city's electricity infrastructure. While some systems enjoyed the possibility of development through urban depoliticisation (Shtern et al., 2022), electricity, which demanded significant investment on an island-wide scale, did not.

5.4.3. *Disconnection and cautious reconnection (1996 – today)*

After 22 years of almost complete Turkish-Cypriot reliance on Greek-Cypriot electricity production and supply, growing electricity demand in both communities became a source of geopolitical destabilisation (Moss et al. 2024). In the face of growing electricity shortages and blackouts, the Turkish-Cypriot side started building a new power station in Trapeza (Teknecik) in 1990 with funding provided by Turkey. This power station became fully operational only in 1996, at which point the self-declared

Turkish Republic of Northern Cyprus (TRNC) had become self-sufficient in electricity generation. The island's electricity system changed from an asymmetrical, single grid structure based on southern production to duplication, with two generating hubs in the North and the South. This was made possible through the tacit cooperation between engineers from Kıb-Tek and EAC that had had a good working rapport in the past. Kıb-Tek engineers approached a senior EAC engineer with the specifications of the equipment Turkey would send for the construction of the power plant. The EAC engineer recognised that the Turkish standards and the RoC standards were incompatible and they would not be able to work in synchronisation. "So, without the electricity authority knowing, I passed them all our specifications and told them to use the specifications to develop the system in the North". The Kıb-Tek engineers followed the instructions, thus retaining the option of interconnection in the future. For the next decade, though, the island was divided into two totally separate electricity grids. Nicosia once again found itself at the margins of two networks. Disconnection, however, did not last for long.

The first temporary reconnection came in 2006, when the Turkish-Cypriot side asked for help from the South to conduct maintenance work at the Teknecik power station and the Greek-Cypriot side agreed to supply electricity conditional on Turkish-Cypriot payment. The Turkish Cypriot engineer who was involved in the process described the meeting between the two sides as "very tense because there had been no contact between the two sides for a long period of time". The non-recognition issue was circumvented by making the director of the Turkish-Cypriot electricity authority (Kıb-Tek) a subscriber of the EAC who would settle the bill in cash. As a result, from January to May 2006, the EAC supplied 40,6 MWh of electricity to the North (EAC, 2007), after which the connection ended.

Following the accession of the RoC to the EU in 2004, the European Commission started the "Aid Programme for the Turkish Cypriot community (TCC)" in 2006, aimed at facilitating the reunification of the island. One of the objectives of this programme was "developing and restructuring infrastructure" in the North. As one component of the programme, the two electricity cables between the two sides were reconnected and electricity meters were installed in anticipation of an emergency interconnection and possible future permanent interconnection. In total, the EU spent €11.6 million on the Turkish-Cypriot energy sector, including the construction of a 1.27 MW solar power plant on the outskirts of the Nicosia district Serhatkoy (Fyllia) (European Commission, 2014).

In July 2011, an explosion in a naval base near the southern Vasilikos power station led to its shutdown. Following the explosion, for the first time, the Turkish-Cypriot side supplied electricity to the RoC through a deal brokered by the two chambers of commerce (Yenidüzen, 2019). Two existing interconnection points (both located in the district of Nicosia) that had been recently renovated with EU funds became operational. According to one of the engineers involved, "at that time there was incredible technical cooperation between the two sides; there was constant emailing every day; every day the production planning of the coming day". However, the grid was again disconnected after the power station's restoration in early 2012.

In 2015, during a short period of political rapprochement, the leaders of both sides agreed to connect their electricity grids officially. As a result, in 2016, the two grids were effectively interconnected. This became permanent in 2019 following an UN-brokered deal between the two sides (Yenidüzen, 2019). Since then, the two sides have continued to exchange electricity regularly to balance each other's loads and stabilise their capacity, despite the political negotiation process collapsing in 2017.

Another significant development enhanced electricity interdependence between the two communities: the introduction of renewable energy as a vital part of Cyprus' electricity mix. Since the 2000s, TRNC has invested in solar energy production, while RoC has also invested in wind turbines (Yenidüzen, 2019). Expanding the production of renewable energy on the island has required a base network strong enough to accommodate intermittent solar and wind energy input. Neither of the two parts of the grid on the island could perform this effectively alone (Poullikkas, 2007). In other words, interconnection helps both sides to increase their PV capacity while helping the Greek-Cypriot side to ramp up its wind capacity (Fahrioğlu & Abbasoğlu, 2023). Hence, interconnection has become an indispensable factor for technical reasons of system stability, benefiting both sides. Sustainable energy policies in Cyprus are also likely to have an impact on Nicosia. At the time of writing, a feasibility project is being conducted to build a PV farm in the buffer zone near the site of the old Nicosia airport after the two sides, under the auspices of the EU and the UN, reached an agreement in February 2023. The planned 30/50 MW photovoltaic park, which will also have storage capacity, "will serve and be managed by both sides" (Kades, 2023).

5.4.4. *Concluding remarks*

In conclusion, the development of electricity supply in Nicosia since the early 20th century has been marked by a process of sociotechnical de-municipalisation. It developed from a local municipal grid to a central node in a new national grid. The division of the island in 1974 intensified this process of de-municipalisation, as energy became a critical security issue with geopolitical connotations, demanding centralised state control and electricity generated at coastal power plants. Nicosia's role has diminished to a site in a torn and divided system at the margins of two electricity networks that have recently been tenuously reconnected.

6. Discussion: Between separation, control and collaboration

6.1. *Introduction*

In this chapter, we look across the experiences of providing energy services in the divided cities of Berlin, Jerusalem and Nicosia over the past seven decades, making generic observations from the cross-case comparison. The first section draws on the empirical analysis in chapter 4 to capture why these three cities have proven so interesting to compare, in terms of manifestations of division in their energy geographies, politics and histories, and what we can learn from this comparison for wider debates on contested cities. The subsequent sections compare the three cities' responses to division (and unification), as described in chapter 5, in terms of the analytical framework developed in chapter 3. This represents our core contribution to research on divided cities (e.g., Kliot & Mansfeld, 1999; Bollens, 2001; 2012). The section 'transitional trajectories' provides a comparative overview from an historical perspective. The following three sections discuss our core categories under the headings 'seductive separation', 'constrained control' and 'conditional collaboration'. The final two sections highlight findings specific to our urban and infrastructural foci: 'situated cities' and 'indeterminate infrastructures'. The section headings are deliberately formulated to capture the ambiguities, uncertainties and contradictions revealed through our analysis.

6.2. *Comparative comprehension*

This article has compared how electricity (and gas) services have mirrored and mediated political division in three iconic divided cities: Berlin, Jerusalem and Nicosia. The constants to this comparison have been energy infrastructures and political division; the dependent variables have been the cities' diverse geographical, political and historical contexts and their shifting responses to divided energy systems over time. So, the three cities were selected for comparison by virtue of their common experience of political division but also because each presents a distinct combination of contextual features that affected how energy infrastructures were provided and used.

Berlin represents a city where division was ideological and geopolitical, characterised by an asymmetrical geography whereby West

Berlin was isolated from West Germany while East Berlin remained integrated with its East German surroundings. This contrast played out in the divided city's energy infrastructure, which between the blockade in 1948/49 and reunification in 1990 was urban and isolated for West Berlin but connected to national electricity and gas grids in the case of East Berlin. The historical tradition of municipal service provision in the city enabled West Berlin to build up its own supply infrastructures, producing all its electricity and town gas, and pursue a strategy of urban energy autarky, albeit increasingly constrained by the physical limitations of transporting and storing fuels and public opposition to the environmental costs of urban infrastructure expansion. In East Berlin, by contrast, municipal influence was subverted to a state socialist regime, resulting in the city's energy systems becoming increasingly dependent on national production and its capacity limitations. The emergent structural weaknesses of both sides were instrumental behind attempts to seek deals over energy transfers since the 1970s that, however, always fell foul of deep-seated distrust and only came to fruition after 1990. Reunification marked a complete reintegration of West Berlin into the surrounding electricity and gas grids and of East Berlin into the West Berlin model of energy governance.

Jerusalem represents, by contrast, a continuous and dynamic case of urban division driven by ethno-national conflict between Israelis and Palestinians. Dividing lines between sovereign entities have shifted dramatically, especially in 1967 when Israel took over control of East Jerusalem but also with the subsequent expansion of Israeli settlements, resulting in territorial sovereignty being heavily disputed. A situation where, between 1948 and 1967, West Jerusalem was dependent for its electricity on a trunk line to the rest of Israel and East Jerusalem possessed its own generating capacity has transformed into one where East Jerusalem depends entirely on the Israeli power utility for all its electricity. Yet asymmetries in electricity generation have not translated into the complete subversion of East Jerusalem as an energy actor. The political symbolism attached to the East Jerusalem power utility JDECO has ensured its survival even under conditions of dependency, while fear of the repercussions of changing the electricity status quo in East Jerusalem has encouraged the Israeli authorities to tolerate huge debts incurred by JDECO amassing from non-payment by its electricity consumers. As international agencies strive to promote peace through energy initiatives – such as for solar panels in East Jerusalem – electricity continues to act as a bellwether of political relations in and beyond the divided city.

Nicosia also represents a city divided by ethno-national conflict but, in this case, the territorial divide between North and South has, since 1974, been clearly bounded by a UN buffer zone. In contrast to Berlin, both halves of the city have access to their respective national hinterlands of the Turkish Republic of Northern Cyprus (TRNC) and Republic of Cyprus (RoC), respectively. Nicosia is a city of low municipal influence over energy infrastructures, with no local electricity generation since national electrification by the EAC, the Greek-Cypriot power utility. The city is, however, the site of all the transmission cables connecting the TRNC with the RoC. These cross-border interconnectors have proven instrumental to electricity governance over the past 60 years of conflict. At different times and in response to shifting technopolitical circumstances, they have been used to sustain power supplies to the TRNC from the RoC, to block electricity transfers, to enable emergency assistance to the other side and to balance supply and demand in both directions. Nicosia retains its significance as an electricity exchange hub so long as the island of Cyprus remains entirely dependent on locally generated electricity. Plans for transnational interconnectors, linking the island to electricity grids in Greece or Turkey, run the risk of destabilising the carefully curated cooperation over electricity that has recently emerged under the radar of political divergence.

Interpreting these experiences with the help of the literature on comparative urbanism discussed in chapter 2 (Nijman, 2007; Rokem & Boano, 2018; Charney et al., 2022), we can, firstly, confirm the huge significance of power relations and political agency in shaping urban energy services in all three cities. This is perhaps an unsurprising observation, given the political contentions characteristic of divided cities, but our analysis calls for a more nuanced appreciation of power relations. These relations are not a given (as electricity exchanges in Cyprus reveal), can change quite radically over time (as in the case of East and West Berlin), can be deceptive (concealing the power of the structurally weak, such as the Palestinian utility JDECO), and are socio-material (with, for instance, air pollution concerns limiting urban autarky ambitions in West Berlin).

Drawing on a further theme of comparative urbanism, the relationship between connectivity and isolation is a second useful analytic for the three divided cities. Energy infrastructures are debated today as instruments of both integration and segregation (Graham & Marvin, 2001; Luque-Ayala & Silver, 2016) and this applies to divided cities to a high degree. As might be expected, electricity infrastructures have been used in all three cities to divide, segregate and deprive. In Berlin, this was experienced as regime division with two unconnected systems; for Nicosia, the power utility EAC prioritised Greek-Cypriot over Turkish-Cypriot communities; in Jerusalem, inequalities and disparities of service between West and East Jerusalem are the most pronounced. Yet, despite political differences, connectivities over electricity have in all three cases persisted or, at least, been seriously considered throughout the period of division – a point discussed further below.

Thirdly, the issue of sovereignty is an intriguing comparative lens (Shtern et al., 2022) on the three divided cities and their energy infrastructures. In the case of Berlin during the Cold War, we see the emergence of two de facto sovereign entities, West and East Berlin, even if their legal status was contested until the 1970s and compromised by the authority of the four occupying powers until 1990. This clear division of sovereignty, with neither side being able to intervene in the operative provision of energy services of the other, enabled the emergence of wholly distinct structures of electricity and gas supply characterised by an insular urban solution for West Berlin and an integrated national one for East Berlin. In Nicosia, we also have a case of two distinct sovereigns – RoC and TRNC – but with a dividing line between them that runs through the city as well as through the two national entities. This, together with the comparative weakness of the municipalities over energy issues, makes for two state-oriented energy systems, though with the connections mentioned above. Jerusalem is distinctive for being controlled by one sovereign – Israel – since the 1967 War, which has created a context of disputed sovereignty in East Jerusalem. This finds expression in electricity supplies there not only to Palestinian communities – that rely on electricity generated by the Israeli utility IEC and distributed by the Palestinian JDECO – but also in new Jewish neighbourhoods and settlements in East Jerusalem and the West Bank that insist on being supplied by IEC.

Related to this is a fourth dimension central to the comparative urbanism literature: city-state relations. In a divided city, there is a constant blur between city and state level, where the state intervenes in municipal decisions to promote national goals that are sometimes unrelated or even in contradiction to urban daily needs. This can create tensions between the two levels when it comes to electricity provision owing to different priorities: the municipal level tends to prioritise supply reliability and affordable prices, whereas the national level prioritises territorial sovereignty and political control. In the case of East Jerusalem the state of Israel wants to assert sovereignty but is unwilling to provide the municipality of Jerusalem with the money or capacity to provide better electricity services that would exercise authority there. In East Berlin, traditional municipal ownership of energy services was undermined by amalgamation into national agencies and subjection to a state-socialist planning regime. For Nicosia, demunicipalisation of electricity services preceded inter-communal division, with consumer irritation over long-standing price subsidies by Greek Cypriots to the Turkish-Cypriot North being overridden by state interests of the RoC in maintaining the fiction of sovereignty across the whole island. There are, though, cases of synergy and complementarity between national

Table 5
Place- and time-sensitive examples of strategic responses to division/unification.

	Strategy	**Separation**	**Control**	**Collaboration**
City				
Berlin	1948 to mid−1950s	Division of city's networks and utilities	East interrupts coal supplies to WB	Intermittent trade in electricity after blockade
	Mid−1950s to 1970s	WB strives for energy autarky	EB energy nationalised and socialised	Minor cross-border exchanges
	1970s to 1989	Deep distrust blocks trade deals	EB demands control of trunk links	Negotiations over electricity and gas trade
	1990 to present	System duplications persist	WB governance model prescribed for EB	Reunification of city's networks and utilities
Jerusalem	Pre−1948	Jewish neighbourhoods serviced by Jewish employees	Attempts to influence JEPSC expansion plans	JEPSC requests electricity purchases from PEC
	1948 to 1967	Division of city's networks and utilities	WJ integrated into Israeli grid	Minor coordination between IEC and JJDEC
	1967 to 1994	Competition between IEC/JDECO over service areas	Forceful merging of EJ infrastructure to WJ	JDECO purchases electricity from IEC
	1994 to present	Service neglect of EJ Palestinian neighbourhoods	Attempts to increase Israeli sovereignty over EJ	Increased coordination between IEC and JDECO
Nicosia	1950s to 1974	EAC workforce serves own communities	EAC fully supplies the north	Asymmetrical dependency around electricity from south
	1974 to 1996	Grid division in 1990s	EAC continues to supply north	Temporary support for maintenance in north
	1996 to present	Political stand-offs limit progress	Both sides manoeuvring for self-control	Electricity trade in kind negotiated by UN

Key: WB = West Berlin, EB = East Berlin, WJ = West Jerusalem, EJ = East Jerusalem
Source: Own compilation.

and municipal needs in divided cities. National subsidies for electricity prices in East Berlin and externally funded investments in West Berlin's energy infrastructure meant that prices were never an issue on either side of the divide. Reliability of electricity supply has been a major factor behind the reconnection of the electricity grids between the North and South of Cyprus at points located within the Nicosia municipality but controlled by state-owned utilities on either side. In the case of Jerusalem, the sudden connection in 1986 of Jewish neighbourhoods, settlements and army bases to the EIC distribution network improved service reliability for these areas as desired by the municipality but also in the interest of state sovereignty – albeit at the expense of poorer service reliability for Palestinian communities.

6.3. *Transitional trajectories*

Taking the long view (Charney et al., 2022) on divided energy systems, covering over 75 years, has enabled us to detect significant shifts over time that defy conventional notions of path dependent trajectories. The strategic responses to division (and unification) by both sides of the divide in each of the three cities varied hugely, ranging from separated electricity networks or enforced energy dependency to tentative collaborative ventures. The energy trajectories of each city were consequently non-linear, characterised by critical ruptures, policy reversals and system adaptations. The triggers or drivers behind these changes could be geopolitical, financial or ideological but also technical, material or environmental.

Table 5 illustrates these shifting strategies with indicative examples from each city. This table serves three purposes. First, it captures how the strategic responses to division changed over time, as reflected in the phases identified for each case. These phases have allowed us to pinpoint what changed – and what did not change – in the sociotechnical configuration of energy systems as circumstances altered. We can see, for instance, how emergency responses to the division of Berlin's networks in 1948 were followed by separative strivings that have repercussions in system duplication to this day. Similarly, our historical perspective reveals significant shifts in how electricity was provided in West and East Jerusalem between division and unification. Attending to the ways in which sudden ruptures interact with longer-term transformations is, we argue, a helpful way of understanding sociotechnical trajectories under duress.

Second, the table – if read from left to right – highlights the co-existence of elements of all three strategies – separation, control and collaboration – at any one time in any one city. To take one example, during the 1970s and 1980s in Berlin intensive negotiations were being conducted over cross-border electricity and gas trade whilst both sides of the divide were advocating policies to increase their self-dependence in energy supplies. This is a key overarching finding of our research: strategies of separation, control and collaboration (each discussed in detail below) were rarely pursued in isolation, but more often in unexpected combinations. This was often because of the limitations of each strategy in practice, as illustrated best by the failure of all attempts to achieve urban energy autarky. Separation, control and collaboration are, it follows, not mutually exclusive categories. Studying their in-betweenness can, we assert, be hugely insightful.

Third, reading the table from top to bottom reveals some of the distinctive features of the three cities and how these distinctions played out in strategic responses to division. It shows how electricity supplies to a divided Nicosia were powerfully shaped by national energy governance, in sharp contrast to the strong urban orientation of energy provision in West Berlin. It reflects the fluid and contested nature of unification in Jerusalem after 1967, resulting in a higher degree of cross-border interactions compared with Berlin or Nicosia, where distinct boundaries and disconnected networks have characterised periods of division.

The term 'transitional trajectories' captures the conjunctions of continuity and change characteristic of all three cities. Their stories have revealed embedded dependencies and sustained contacts across political divides, but also disruptive junctures and windows of rapprochement. They highlight the need to develop a sounder, nuanced understanding of energy infrastructure trajectories when seeking to enrol them in

ameliorating inter-communal tensions in divided cities.

6.4. Seductive separation

In all three cities, both sides of the divide have been driven by the deep desire to become less dependent on the other side, minimising vulnerability to a hostile neighbour. The lure of separate energy systems has stimulated plans to enhance self-sufficiency with independent energy generation, transmission, distribution and fuel storage capacity. Expressions of this 'seductive separation' are the "electricity island" policy of West Berlin and the pursuit of divergent energy geographies in East and West Jerusalem between 1948 and 1967. The Turkish-Cypriot community has striven since the 1980s to become less dependent for electricity on the Greek-Cypriot South – with mixed success. Both sides of the Cypriot divide are currently succumbing to the attraction of transboundary electricity connectors to their respective allies abroad that might jeopardise cooperation over energy on the island. Several factors enable separation of this kind, such as available electricity generation plant or access to hinterland electricity grids, as in the case of East Berlin and West Jerusalem.

However, this ideal has often proven illusory. Self-sufficiency in electricity and gas provision has confronted many limitations in practice. One key obstacle is the lack of access to a larger national grid, for instance of East Jerusalem to Jordan, West Berlin to West Germany or the TRNC to Turkey. Other factors that undermine the ability to be self-sufficient in energy, our cases reveal, are difficulties and costs in transporting fuel, limits to fuel storage, geopolitical sensitivities, legal objections and environmental pollution. For instance, legal disputes between JDECO and the IEC placed severe limitations on JDECO's independence. West Berlin's pursuit of electricity and gas autarky was increasingly compromised by protests against the air pollution emitting from its power stations and gas works. Finally, persistent interdependencies often frustrate efforts for greater system separation, as is apparent today in Cyprus, where both sides are relying on each other to meet rising demand for electricity and deal with the volatility of renewables.

6.5. Constrained control

Energy infrastructure has been used in all three cities as an instrument of territorial and political control. Particularly in instances of power asymmetries over energy provision, the dominant party has been tempted to use energy infrastructure as a welcome weapon in the divided city arsenal. The blockade of West Berlin was a deliberate attempt by the Soviet authorities to starve the half-city into submission. The continued supply of electricity from the Greek-Cypriot South to the Turkish-Cypriot North between the 1960s and 1980s was designed to negate political separation by the North. Israel's IEC supplies all JDECO's electricity to keep the Palestinian utility subjugated. Such experiences have encouraged the belief that control through energy can come without significant repercussions.

In fact, this mode of sociotechnical control often faces constraints, debunking the notion of energy as a low-cost political instrument. First, power relations around energy are not fixed. West Berlin was, by the mid-1950s, generating more electricity than East Berlin, reversing the initial power asymmetry around energy services. The Greek-Cypriot RoC lost its generating advantage when its main power station, Vassilikos, exploded in 2011, making it partially dependent on electricity from the North. Second, the perceived weak party can exert a surprising degree of influence, for instance through claims to electricity as an entitlement to free electricity (by Turkish Cypriots) or through illegal connections to the local grid (by Palestinians). Third, control through energy can have unintended negative consequences. By making JDECO dependent on its electricity, IEC has made itself the victim of JDECO's inability to pay for this service. If IEC insists on the repayment of the debts owed by JDECO it would be made responsible for exacerbating an already poor service in East Jerusalem. Fourth, geopolitical contexts can constrain the extent of urban or national agency over energy. Relations between the USSR and the West during the Cold War limited or enabled exchanges between West and East Berlin. The Israeli-Arab conflict is always looming over electricity arrangements for East Jerusalem. Nicosia's ability to shape electricity services is framed not only by national entities but also by the interventions of Turkey and Greece, in particular. International norms put limits on the ability of a state or city to renege on contracts and investments, as observed in all three cities.

6.6. Conditional collaboration

Collaboration with the other side over energy infrastructure and provision was sometimes unavoidable, owing to embedded interdependencies, but was often actively pursued as part of cities' resilience strategies. Any collaboration across the divide was always conditional, though, on minimising vulnerability through dependence. This dilemma is most powerfully illustrated by the case of Berlin, where negotiations over electricity and gas connections to West Berlin dragged on for decades, reflecting the mutual distrust between the two sides and their unwillingness to sacrifice geostrategic advantages. Nevertheless, our analysis has documented multiple instances of operative collaboration across the divide, often kept out of the public eye for fear of arousing opposition. Electricity trade between the Greek-Cypriot South and the Turkish-Cypriot North was made possible after the 1990s through clandestine payments and technical interactions, despite a hostile political climate. In Jerusalem, in the decades after 1967 and amidst the ongoing conflict, JDECO maintained electricity supplies to some Jewish settlements. East and West Berlin initially continued to supply small, peripheral communities outside their territories with electricity. In these cases, techno-managerial considerations of service supply overrode political sensitivities.

Collaboration can also be induced or supported by third parties. Energy is perceived by international agencies as an effective conduit for getting conflicting parties to work together around an essential service. Examples from our case studies include the active role of the United Nations in negotiating an electricity trade agreement in Cyprus, the European Union brokering a solar park planned for the buffer zone in Nicosia, multiple international agencies such as the EU and the United Nations Development Program (UNDP) funding the installation of solar panels in East Jerusalem, and the involvement of the USSR, Poland and West German energy utilities to break the deadlock over supplies to West Berlin. That all these interventions have been contingent on shifting geopolitical contexts is self-evident. Third-party induced collaboration varied across the three cities. In Cyprus, all parties were significantly involved. In Jerusalem, cooperation was more limited. Israeli authorities approved permits despite these conflicting with their stated goals.

Finally, reunification of a divided city can find powerful expression in the symbolic reconnection of energy networks. Collaboration in these instances, however, was not always on equal terms. In Berlin, reunifying the electricity and gas systems was publicly celebrated but brought with it resentment in the East at being amalgamated into a distinctly West Berlin management model. On a more dramatic scale, the reunification of electricity networks in Jerusalem led in the short term to much resistance by Palestinians and reluctance by the IEC to engage with Palestinian customers or invest in their neighbourhoods. However, in the long term, JDECO and IEC have developed fruitful and voluntary cooperation, extending beyond selling and purchasing electricity. Such asymmetrical attempts to enforce collaboration generate a sense of injustice that ultimately limits the effectiveness of cooperation.

6.7. Situated cities

Scholarship on divided cities generally assumes the importance of the city as an actor. Each side of the urban divide is imbued with a kind

of collective agency. What our research indicates, however, is the need to consider the positionality of a divided city in multilayered relations between internal and external actors and factors. Seeing within and beyond the city is essential for comprehending the contested geographies around energy in divided cities.

The role of cities in energy provision varied greatly between our three cases. Municipal ownership and control of electricity in Nicosia was eroded by nationalisation of electricity provision as early as the 1950s, leaving the city as a hub for grid exchanges with little generating capacity. By contrast, a strong tradition of municipal governance over energy services made it possible for West Berlin to become self-sufficient in electricity and gas provision for most of the Cold War era. This was, however, eroded by the privatisation of both utilities in the 1990s as Berlin became embroiled in global trends of the liberalisation and commercialisation of public services. As energy governance gets rescaled around national and international paradigms our cities have, to a greater or lesser degree, transformed from an energy production hub to a node in the electricity supply chain. This has increased the dependency of both sides of the divide on international, national and/or private actors. Examples include the national IEC network framing urban electricity provision in Jerusalem and the stipulation of the Western Allies for West Berlin to store sufficient coal reserves to generate enough electricity for three months. International donor agencies are supporting new electricity infrastructure around renewables as peace-building initiatives, such as for a solar farm on the buffer zone in Nicosia, or to promote self-provision for the underprivileged, as with roof-top solar panels in East Jerusalem.

As well as looking beyond the city, scholars of divided cities need to explore the forces at play within the city. These apply not merely to divisions between the two respective communities but also to the interplay of phenomena within each side. Our analysis has revealed, for instance, emergent tensions within West Berlin between the energy utilities and environmental groups in the 1970s that challenged the expansionist logic underpinning the "electricity island" strategy. Municipal authorities and civil society groups in Jerusalem are divided over how best to provide electricity to East Jerusalem and Jewish settlements in the West Bank. Trade unions and left-wing groups in the Turkish-Cypriot TRNC are resisting efforts by their government to strengthen Turkey's influence over the national electricity grid. A relational understanding of (divided) cities, exploring the city as a realm of sociotechnical enactments around energy on multiple scales, is ideally suited to unpacking the dynamics of contested urban infrastructures.

6.8. *Indeterminate infrastructure*

The energy infrastructures studied here were not bulwarks of stability in the face of volatile urban environments. They have mirrored shifts in geopolitical, socio-economic and environmental conditions. The ways they were planned, operated and used reflected political division, as expressed in the redesign of urban electricity grids, the truncation of transmission cables and violence against infrastructure installations. Equally, infrastructures have at times been enrolled in policies and practices to enable inter-communal collaboration, whether to import electricity from the other side, offer support during a supply crisis or maintain lines of communication between engineers.

At the same time, components of energy infrastructures have themselves shaped strategic responses to political division at times. Examples include the explosion of a power station that reordered energy relations between the Greek- and Turkish-Cypriot communities, the limits to urban energy autarky posed by air pollution from power stations in West Berlin and the policy adaptations demanded by the introduction of renewable energies in both Nicosia and Jerusalem. This reveals a degree of uncertainty, responsiveness and agency to energy infrastructures not popularly associated with them. In all three cities they proved 'indeterminate infrastructures' in the sense of being continuously unsettled. Our sociotechnical lens on urban energy systems, embracing the interdependence of politics, materiality, practices and technologies, has helped reveal such important phenomena that transcend simplistic notions of energy infrastructures as being pliable by politicians or impermeable to change.

7. Conclusions

Energy infrastructures have rarely featured in research on politically divided cities (exceptions include Moss, 2009; Verdeil, 2016; Shlomo, 2017a). Embedded in the urban fabric and often hidden from public view, they have been largely overlooked as a critical component of urban contestation. Attention has been attracted to more visible and dramatic dimensions of conflict or cooperation. Largely for this reason, transportation systems – such as roads, bridges and light rail – are the only infrastructures that have been subjected to in-depth analysis in the literature on divided cities (e.g., Brand & Fregonese, 2013; Nolte & Yacobi, 2015; Rokem & Vaughan, 2018). This paper has set out to rectify this research gap by analysing how energy infrastructures have acted as a medium of contestation and cooperation in the divided cities of Berlin, Jerusalem and Nicosia. Conceptually, it drew on debates in the fields of urban infrastructure and energy politics to enrich the research agenda on divided cities. Empirically, the paper explored the experience of providing and using electricity (in Berlin, also gas) in the shifting contexts of urban division and unification covering a period of 75 years.

The experiences of these iconic divided cities were analysed through the lens of comparative urbanism. This confirmed, first, how power relations and political agency have been instrumental in shaping urban energy services in all three cities. What the empirical cases revealed, however, is that these relations are not a given, can change radically over time, can be deceptive, concealing the influence of structurally weak parties, and are as much material as they are social. Second, in terms of the relationship between connectivity and isolation, electricity infrastructures have been used in all three cities to divide, segregate and deprive: spatially, socially and symbolically. Nevertheless, connectivity – or the desire for connectivity – has persisted to some degree in all three cities despite entrenched political differences, thereby refuting simplistic assumptions about electricity infrastructure being vehicles for either confrontation or peacebuilding. The third comparative lens – on sovereignty – enabled us to distinguish the impact of situations involving, on the one hand, two emergent sovereign entities (as in Berlin and Nicosia) that fostered the emergence of separate energy systems and, on the other, a single sovereign with disputed sovereignty (Jerusalem), where service obligations in territories occupied or inhabited by the opposing community have been economically hard to fulfil, yet also politically difficult to deny. Fourth, the comparative urbanism literature directed our attention towards city-state relations. Here, we observed tensions between municipal and national state levels, with the municipal level prioritising supply reliability and affordable prices and the national level territorial sovereignty and political control. These tensions were least pronounced in Nicosia, where electricity services had been nationalised before inter-communal division, were highly relevant in East Berlin, where state socialist planning undermined traditional municipal energy provision, and in Jerusalem have tended to favour (Israeli) state sovereignty concerns over municipal interests in service reliability and affordability.

Viewing the history of divided cities through the lens of their energy infrastructures has revealed novel insights on the sociotechnical entanglements of urban contestation (cf. McFarlane and Rutherford, 2008; Luque-Ayala & Silver, 2016). Energy systems, despite their public invisibility, have become sites of sometimes bitter dispute and damaging disruption. However, they have also been enrolled as instruments of inter-communal cooperation and geopolitical peace-making thanks to their low political profile. The physical properties of energy supply systems – such as the inability to store electricity, the dependence on high-volume fuels from external sources and reliance on distribution networks reaching across political boundaries – posed massive

limitations on self-dependence. Consequently, electricity grids became linchpins of cross-border (non-)connectivity. The materiality of energy infrastructures was always, however, intricately entangled in broader social and political forces that endowed them with powerful technopolitical leverage. All three cities demonstrated emphatically that technology could never be divorced from politics: technical solutions would not work if the political conditions did not allow them to. This was particularly apparent in the dealings of energy utilities torn between longing for a service independent from the other side and acknowledging the interdependencies – political, socio-economic and material – that made this unrealistic. Future research could build on these findings by exploring how the identified interdependencies between political, socio-economic and material aspects are relevant to other 'invisible' and technically oriented infrastructures and services, such as water supply and waste management. Understanding such interdependencies better could create openings for developing these infrastructures in a more inclusive and integrated manner.

The historical perspective of the paper, tracing confrontation and cooperation over energy from the early years of the conflicts to the present day, has revealed urban relations over energy to be far from constant. Inter-communal disputes, national confrontations and geopolitical tensions have played out in the cities' energy provision and use just as disruptions to fuel supplies, limits to local power generation and non-payment for services have had political repercussions. The trajectories of each city's energy infrastructures have, consequently, been non-linear, subjected to frequent ruptures and reversals. This has disturbed some traditional connections between the two sides of the divide, but also created new opportunities or necessities for cross-border cooperation. Future research could benefit from historicising the experiences of divided cities in ways that do not pre-empt the present but rather consider the past as an experiential resource of revealing – and sometimes surprising – insights.

This brings us to the core question of how far energy infrastructures have been used to advance agendas of separation, control and collaboration in divided cities. What we have observed is that energy infrastructures were indeed enrolled to serve strategic responses to political division by nation states, energy utilities, international governments and consumers. However, these strategies were highly diverse, changed significantly over time and often floundered against infrastructures that resisted enrolment, revealing limits to human agency. Our findings challenge simplistic distinctions between separation, control and collaboration. They point, rather, to the co-existence and even hybridisation (Fregonese, 2012) of these three strategies at any one time and place. Our term 'seductive separation' captures the lure of self-sufficient systems of electricity generation, transmission and distribution in divided cities that proved illusory in the face of political, material and economic limitations. 'Constrained control' refers to attempts to use energy infrastructure as an instrument of territorial and political domination that often failed to meet expectations in complex and shifting geopolitical environments. 'Conditional collaboration' with the other side over energy infrastructure and provision reflects instances where modest cooperation was pursued out of a sense of necessity but also as part of cities' resilience strategies. All these phenomena point to the need to transcend the binaries of division/cooperation, domination/victimhood and control/chaos that has characterised much of the literature on divided cities. Research on divided cities could further explore the continuum between division and cooperation, between domination and victimhood and between control and chaos, as well as our findings on hybrid strategies. This line of research could benefit from examining how these strategies vary and what conditions lead to which outcomes.

Finally, the paper has demonstrated how a focus on energy infrastructures can help unpack sociotechnical relations within and beyond a city. Even in a city like Berlin that prided itself on a high level of self-generation, dependence for electricity and gas supply on external factors was high, whether for accessing fuel, balancing the grid or appeasing the occupying powers. Nicosia had no significant generating capacity after the 1950s and was consequently dependent on relations between the Greek- and Turkish-Cypriot communities. Jerusalem's electricity system remains divided between Israeli and Palestinian service areas that reflect power asymmetries in the city but also the limitations of the dominant Israeli side. External parties have been actively involved in all three cities, whether to destabilise or mediate, giving geopolitical heft to energy provision in volatile urban environments. This points to the need for future research to understand and conceptualise better the tension between municipal and state goals, the impact of geopolitical forces, as well as the ability of municipal authorities to shape infrastructures in divided cities.

Energy infrastructures, we conclude, are neither politically benign nor pliable tools. Only by appreciating them as sociotechnically constituted, spatially situated and historically contingent can we hope to enrol them effectively in the planning and governance of urban energy in contested contexts. From this technopolitical vantage point, the stories of energy infrastructures in Berlin, Jerusalem and Nicosia are salutary yet inspirational.

CRediT authorship contribution statement

Elai Rettig: Writing – original draft, Investigation. **Ourania Papasozomenou:** Writing – original draft, Investigation. **Shirley Lukin:** Writing – review & editing, Writing – original draft. **Lior Herman:** Writing – original draft, Methodology, Investigation, Conceptualization. **Itay Fischhendler:** Writing – review & editing, Supervision, Conceptualization. **Timothy Moss:** Writing – review & editing, Writing – original draft, Supervision, Investigation, Conceptualization. **Sertac Sonan:** Writing – original draft, Investigation. **Marik Shtern:** Writing – original draft, Investigation. **Gillad Rosen:** Writing – original draft, Investigation, Conceptualization.

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The authors declare no conflicts of interest associated with this article.

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