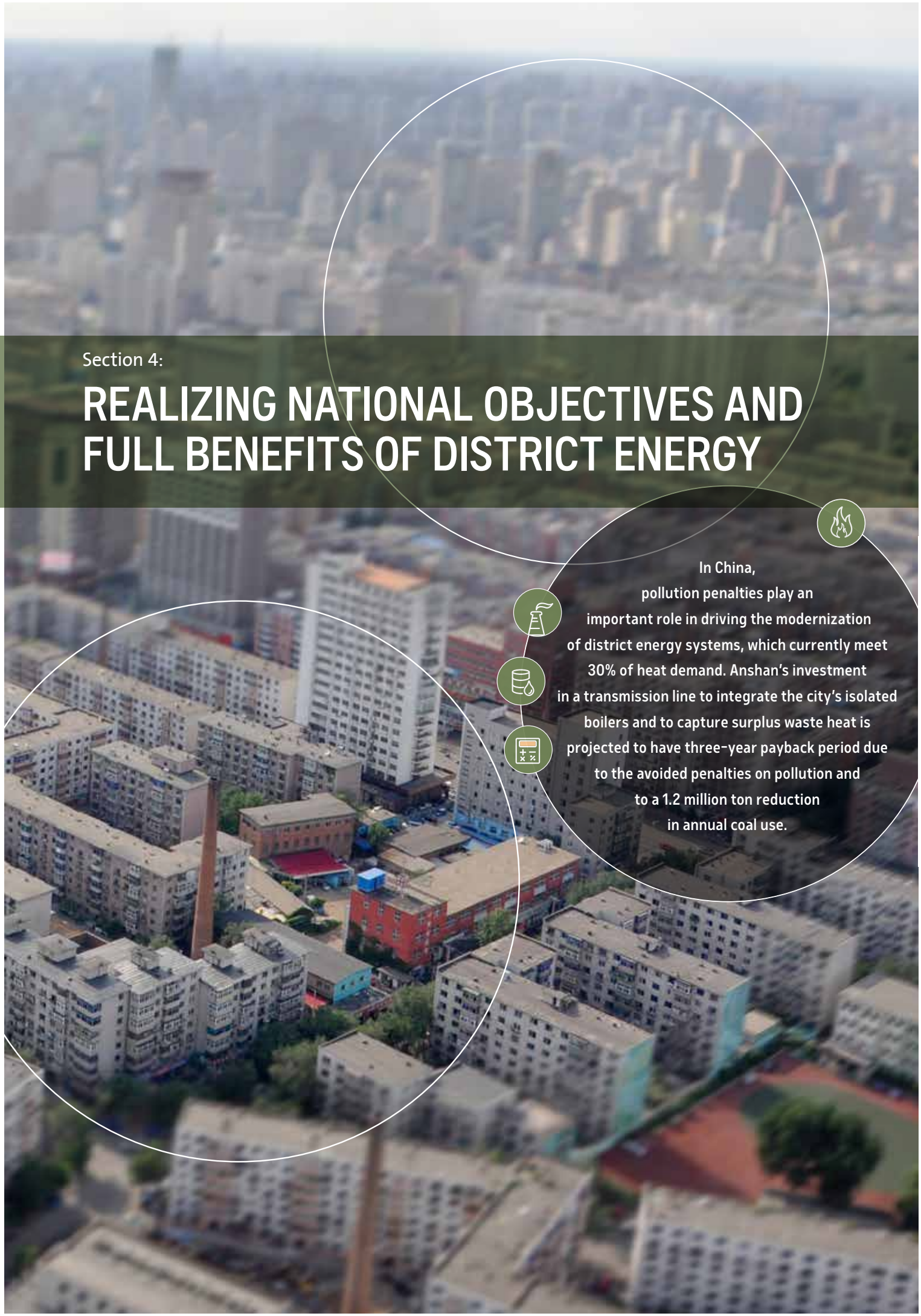
Section 4:

REALIZING NATIONAL OBJECTIVES AND FULL BENEFITS OF DISTRICT ENERGY



In China, pollution penalties play an important role in driving the modernization of district energy systems, which currently meet 30% of heat demand. Anshan's investment in a transmission line to integrate the city's isolated boilers and to capture surplus waste heat is projected to have three-year payback period due to the avoided penalties on pollution and to a 1.2 million ton reduction in annual coal use.

04

THIS SECTION LOOKS AT

4.1 Introduction

4.2 De-risking investment

4.3 Economic competitiveness: a level playing field and multiple benefits

4.4 Vertical integration

KEY FINDINGS

- **NATIONAL POLICIES** are key to achieving optimal results for district energy. Policies at the national level allow for the appropriate devolution of authority, national support for local coordination and capacity to deliver projects, and the accounting for district energy in national standards. Such policies are key to realizing the national benefits that arise from development of district energy such as decreased imports of fossil fuels, reduced strain on national power infrastructure and the integration of renewable energy (see table 1.3 for more national benefits).

- **EFFICIENCY RATINGS, LABELS AND STANDARDS** are developed based on accounting methods often set out in national policies. Such methods were a key barrier to district energy deployment across the 45 champion cities, as they may prioritize building-level efficiencies over full energy-system efficiencies. To help address this challenge, cities can advocate for change in national policy. As a best practice, energy efficiency in buildings should be optimized to account for efficiency in energy supply and to target the reduction of fossil primary energy consumption.

- **DEVOLVING AUTHORITY** from the national level to local authorities allows district energy systems to benefit from local expertise and the influence and action of local authorities. Such devolution can include setting a regulatory framework that explicitly grants authority in areas such as mandatory connection policies, energy master planning and mapping, energy service provision and building codes. For example, national governments may encourage or mandate local authorities to create cost-effective energy or heat plans that require district energy to be considered in a city. This starts the process of a city developing an energy strategy, a key best practice in developing district energy and optimizing the heating/cooling sectors.

- **FINANCIAL AND CAPACITY SUPPORT** should be provided to local authorities to match any devolved responsibility. This can be financial and capacity support for energy mapping, project planning, related organizational development, appropriate commercial arrangements and technical quality control. Such support can be in the form of grants or providing access to funds for the early stages of projects.

- **LEVELLING THE PLAYING FIELD** for district energy must start with national governments acknowledging the multiple benefits of district energy and putting in place financial and regulatory measures to address pricing regimes that either do not account for the benefits of district energy systems or disadvantage them due to direct or indirect subsidies. This can be through national adjustments to tax regimes and direct subsidies for electricity, heat or cooling generation.

- **TARIFF REGULATION** , if it exists, often comes from the national level. Tariffs can be regulated so that district energy is priced at the alternative technology costs, or they can be effectively indirectly regulated by controlling the profits of district energy companies or the costs that they can pass on to consumers. Variations on these two tariff regimes are present in many cities, and the choice will depend largely on the existing energy market structure and on its level of regulation and liberalization.

- **A VERTICALLY INTEGRATED GOVERNANCE STRUCTURE** is key to optimize the planning, coordination and monitoring of district energy developments between different levels of government. One approach to simultaneously provide specific finance for local authorities and support multi-level governance is to incorporate local authority action into national mitigation strategies through Vertically Integrated Nationally Appropriate Mitigation Actions (V-NAMAs). V-NAMAs would support developing country governments in their efforts to mobilize local and provincial actors for achieving national mitigation targets through cost-effective incentive packages and measurable, reportable, and verifiable (MRV) actions and results.

4.1 INTRODUCTION

"Cities will play a critical role in achieving multiple energy policy targets for an efficient, sustainable future. Analysis under the IEA CHP and DHC Collaborative has shown that by aligning local initiatives and national policy frameworks, it is possible to improve market structures in support of flexible, integrated and sustainable energy systems."

John Dulac, IEA, 2014

CHP and wind development in Denmark from 1985 (top) to 2009 (bottom) as a result of strong national policies for renewables and district heating. The maps show centralized (red circles) and decentralized (orange circles) CHP plants, onshore and offshore wind power (green circles) and interconnectors (Lauersen, 2014).

As with other aspects of the energy transition, a key factor in the successful development and scale-up of modern district energy is establishing an appropriate policy framework. Although many of the decisions and measures associated with a given system can and must be made at a local level, national policies are key to achieving optimal results. Policies at the national level allow for the appropriate devolution of authority, national support for local coordination and capacity to deliver projects, and the accounting for district energy in national standards (see section 4.1).

Although the benefits associated with district energy are felt at the national as well as the local level (see tables 1.3 and 1.4), the national benefits are not easily captured or valued in the local business case for these systems. District energy is already cost-competitive (see figure 1.8), but national policy measures are necessary to bring it on to a level playing field with other technologies to reflect its national benefits (see section 4.2).

Multi-level governance can interrupt effective policy integration and implementation between the national and local levels. For example, strategic, policy and administrative arrangements can be misaligned with the provision of funding, capacity or information (Hammer et al., 2011). Cities are increasingly helping to design and develop "vertically integrated" state and national policies to help overcome these barriers. Section 4.3 explores how some cities are accessing new climate financing mechanisms for emerging economies and developing countries, such as Nationally Appropriate Mitigation Actions (NAMAs).

4.2 DE-RISKING INVESTMENT

Investing in district energy requires a long-term commitment. A national climate or energy vision that explicitly addresses the heating or cooling sector is a first step in building investor confidence in the long-term priorities of governments. Reducing policy uncertainty is best achieved when national energy visions for district energy contain medium- and long-term objectives with clear milestones and reviews (IEA, 2014b; Euroheat & Power, 2013).

However, local governments are key to implementation (for example, to help reduce load risk; see section 2). Clear planning guidance and regulations that provide local governments with a mandate to act are the most important national lever to unlock cost-effective deployment of district energy systems, by creating market demand and limiting associated capital investment risk. Any national vision should be set to create a coherent and enabling framework for local action, with related support (Chittum and Østergaard, 2014).

Renewable CHP plants, such as this wood-fired plant in St. Paul, USA, could provide the primary energy efficiency improvements and renewable heat that could count towards an improved efficiency label for a building.

4.2.1 COHERENT ACCOUNTING PRINCIPLES: ENERGY EFFICIENCY LABELS AND STANDARDS

Because district energy interacts with other areas of energy production, supply and consumption (i.e., end-use) that are regulated, it is particularly vulnerable to legislative inconsistencies among these areas, which can hamper the business case significantly.

Across the 45 champion cities, a key barrier to district energy deployment was the accounting methods used to develop efficiency ratings, labels and standards for buildings, such as the Leadership in Energy and Environmental Design (LEED) certificate system (see box 4.1). Methods that rely on energy consumption at delivery to the building do not account for the ways that electricity and heat are produced, or for the use of non-renewable energy, creating a disincentive to use district energy and contradicting energy targets for its deployment. In the Netherlands, installing an electric heat pump in an individual house results in an impressive improvement in the efficiency label, whereas connecting a house to district heating often has no effect on labelling.

Cities themselves cannot remedy this challenge, although they can advocate for changes in standards (as shown in section 2). A recent study by Euroheat & Power (2013) concludes that energy efficiency in buildings should not be considered in isolation, but rather should be optimized by taking into account efficiency in energy supply, and by targeting the reduction of fossil primary energy rather than final energy.

Best practice examples exist in Finland and Germany, where building codes set primary energy efficiency standards for new buildings and where different sources of heat have different coefficients. The higher the coefficient, the more difficult it is to achieve the standards, as the primary energy efficiency is lower. Both countries require that a certain share of the energy used come from renewable sources. District heating based on CHP/surplus heat and/or renewable energy is automatically considered to fulfill this criterion.

The energy-saving ordinance in Germany aims to reduce the primary energy demand of buildings to save resources and lower greenhouse gas emissions. Either using more insulation or more efficient systems engineering or primary energy sources can fulfill the obligations. The system therefore reflects the efficiency benefits of modern district energy (Euroheat & Power, 2013). The Pearl Rating System used in Abu Dhabi is another example of coherent energy efficiency accounting in design, planning and implementation.

4.2.2 DEVOLVED RESPONSIBILITY

As the policy and business models reviewed in sections 2 and 3 demonstrate, any vision for district energy will require strong involvement of local authorities that can wield relevant planning (and mapping) authority, including over new development. Local authorities also act as the brokers of relationships with the owners of social housing, public buildings and other anchor loads that are likely to form the core of the schemes. This requires that national governments set a regulatory framework that explicitly devolves the relevant authority to local governments, for example in the areas of mandatory connection policies, energy master planning and mapping, energy service provision, and building codes (see section 2). Such devolution has occurred successfully in Norway (see case study 4.2). Mapping in particular requires a resolution that can be achieved only through localized modelling of energy use in a city, and cities are the ideal leaders in developing local mapping and planning.

Experience indicates that local governments are best placed to alleviate the risks associated with district energy schemes. The devolution of authority at the national level within a coherent and enabling framework can enable local governments to use their authorities to manage risks – and locate finance – for district energy projects that have long development periods (10–20 years), multiple phases and potential multiple owners/developers (particularly in the private sector).

As part of the devolution of authority over district energy, national governments commonly encourage or mandate local authorities to create cost-effective energy or heat plans. The Danish national government mandates this and provides a high degree of autonomy and flexibility to cities in this planning. Sometimes, the national vision can become a driver for local governments to act on district energy (as in London). In cases where cities have not given much consideration to the heating or cooling sector, or traditionally have not been involved in energy provision, national governments that develop district energy strategies can accelerate local implementation by requiring local energy visions and maps (see box 4.2 on the EU).

4.2.3 SUPPORTING CITY-LEVEL CAPACITY AND COORDINATION

Devolved responsibility to the local level, as discussed in section 4.1.2, has to be matched with the relevant financial and capacity support for energy mapping, project planning, related organizational development, appropriate commercial arrangements and technical quality control. Even in the case of not having multiple owners, such as in a public-utility model, time is required to develop the balance sheet of the utility to be able to expand a district energy network to this long-term vision. Early-stage finance often comes in the form of a grant directed at specific stages of development, such as the creation of a team in a city or public utility, individual project finance, project demonstration or the creation of a revolving fund.

The European Investment Bank's (EIB's) European Local Energy Assistance (ELENA) initiative provides a technical assistance facility to kick-start large energy efficiency and renewable energy programmes (see case study 4.1). This

BOX 4.1 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED) CERTIFICATION

Rating policies and certificate systems such as Leadership in Energy and Environmental Design (LEED), while sometimes offering small credit value for implementing district energy systems, often do not acknowledge the full benefits or contributions of district energy and/or tend to give preference to on-site solutions (by virtue of a focus on green buildings), regardless of overall cost and benefit. An important issue is the calculation of energy efficiency for new buildings and the energy labels for existing buildings.

Sometimes the business model for district energy dictates a slow build-out that requires a temporary strategy and/or use of transitional technologies. Under LEED, buildings that connect to new systems relying on natural gas as a transitional strategy (to larger, more cost-effective reductions once overall development achieves a critical threshold) are currently penalized and receive no credit for future upgrades (which often provide more-significant energy and greenhouse gas reductions). So developers must invest not only in connecting but also in installing other near-term (and potentially redundant or less cost-effective) systems and measures to achieve necessary credits for certification.

The U.S. Green Building Council has released an updated guideline on district energy that enables buildings connecting to district energy to now earn credits for efficiency improvements, renewable energy supplies and refrigerants (in the case of district cooling) as a result of district energy, as well as to possibly earn an innovation point related to "green heat" supply to buildings.

includes sharing costs on the technical support that is necessary to prepare, implement and finance the investment programme (e.g., feasibility and market studies, programme structuring, business and financial plans, energy audits, tendering procedures) ready for EIB funding (EIB, 2012).

The development cost at the individual project level can be up to 10 per cent of CAPEX for projects over £20 million (US$32 million) and 15 per cent for projects over £5 million (US$8 million). Developing projects is time consuming for companies and/or cities, representing a significant investment before any construction begins. For small projects in cities with relatively little district energy, this process can take three years until procurement and construction contracts are developed, and up to seven years for area-wide networks. In addition, capturing city-wide benefits in business models is a time-consuming aspect of the development process and has to be done on a city-wide basis, unless these benefits are already captured in national policies (see section 4.2). Some local authorities capture these benefits by evaluating them on a project-by-project basis; however, this is a slow and fragmented approach to scaling up district energy.

Another emerging option is to create a revolving fund that allows cities to develop and sell built-out projects to the private sector, and to finance other areas in the city to achieve the longer-term vision of a city-wide district energy system. Toronto envisages such a revolving fund model following the successful sale of its Enwave heating and cooling utility to the private sector, netting the city council US$150 million (see case study 3.5).

This is similar to a model recently developed by R20 (Regions of Climate Action) to facilitate the development of bankable low-carbon and climate-resilient projects, and to reduce the energy-market investment risk for these projects. Through a trust fund, R20 sets up a local development team in a city to build capacity, aggregate customers and ensure bankable projects, leveraging a non-profit model. The team takes a share of the capital expenditure when the project gets invested (R20, 2014).

In some cases, long-term financing may still be required if the selling of district energy systems cannot achieve the price required, typically because heating or cooling from district energy is more expensive than next-available technologies because the full benefits have not been priced in. Section 4.2 discusses how national governments are levelling the playing field.

BOX 4.2 EU LEGISLATION ON HEAT PLANNING

EU legislation on energy efficiency* requires that regional and local authorities plan and design an urban heating and cooling infrastructure that utilizes all available renewable energy sources and CHP in their region. The overall objective is to encourage the identification of cost-effective potential for delivering energy efficiency, principally through the use of cogeneration, efficient district heating and cooling, and the recovery of industrial waste heat – or, when these are not cost effective, through other efficient heating and cooling supply options, and the delivery of this potential.

EU Member States are required to identify the potential for high-efficiency cogeneration and efficient district heating and cooling and to analyse the costs and benefits of the opportunities that exist in their country. They are required to take adequate measures to ensure that these opportunities are developed if there is cost-effective potential. Italy implemented this legislation on July 4, 2014**, and, in turn, the continued development of district heating and cooling in Milan is being planned in coherence with the reference legislation.

Source: EU, 2012

* In EU Energy Efficiency Directive 2012/27/EU, "efficient district heating and cooling" refers to a district heating or cooling system that uses at least 50 per cent renewable energy, 50 per cent waste heat, 75 per cent cogenerated heat or 50 per cent of a combination of such energy and heat. District heating is dealt with in Article 2 (where the definition of "efficient district heating and cooling" is provided, and in Article 14 of the EU Directive (Article 10 of the Italian Decree).

** Legislative Decree n.102

LONDON

CASE STUDY 4.1

LONDON'S DECENTRALIZED ENERGY DELIVERY UNIT

With €3.3 million (US$4.15 million) in seed funding from the European Investment Bank's ELENA facility, London established the Decentralised Energy Project Delivery Unit (DEPDU) in August 2011 to provide city boroughs and other project sponsors with technical, financial and commercial assistance in developing and bringing district energy projects to market. Whereas the Decentralised Energy Master Planning (DEMaP) programme (see section 2.2.2) helped build capacity, support local authorities in identifying projects (based largely on the London Heat Map) and create energy plans, the Decentralised Energy Programme provides support for the commercialization of such projects.

To date, the Greater London Authority has supported local authorities and other parties in taking seven district energy projects to market with a total investment of £42.3 million (US$53.2 million). The programme is actively supporting a pipeline of 22 district energy projects with a total investment potential of £304 million (US$382.3 million). Of these, five were in an advanced development stage in late 2014 and were expected to be brought to market within 12 months.

Through the programme, London also established the *London Heat Network Manual* (GLA and Arup, 2013) to provide standardized guidance for developers, network designers and energy producers on the delivery and operation of district energy projects (Gagliardi La Gala, 2014).

BERGEN

CASE STUDY 4.2

NORWAY: DE-RISKING DISTRICT ENERGY DEVELOPMENT AND INCORPORATING MACRO-ECONOMIC BENEFITS

Norway is the world's fastest growing district heating market. Traditionally, the country used its local hydropower resources for electric heating; however, two key drivers – renewable energy and energy efficiency – led to a new national vision on district energy. In 2010, Norway adopted a 10-year target to deploy 10 TWh of modern district energy by 2020, equivalent to 16 per cent of the heat market. The country aims to increase the use of district heating from renewable fuels, decrease the use of electric power for heating and increase the use of waste-to-energy plants to replace fossil fuels.

The Norwegian licensing framework has served as an enabling framework for district energy planning and implementation at the local level. The national government requires an aspiring district heat provider to develop a detailed development plan that includes evidence of the socio-economic and environmental benefits of district heating relative to other options. This provides the licence holder the validity to operate as the sole supplier of heat in a specified area, which de-risks investment, enables local authorities to mandate connections, protects consumers by establishing service standards and requiring tariffs to be competitive with the next fuel/technology alternative (in this case, electric heat), and provides a level playing field by requiring the socio-economic benefit analysis in the cost-assessment criteria.

These principles are a key best practice in both tariff regulation (see section 4.2) and devolved planning authority to the local level (see section 4.1.2). This is similar to the approach also taken in the EU with regard to cost-effectiveness assessments and local implementation (see box 4.2).

Norway has enacted several national policies that are key to district energy development. For example: all buildings over 500 m^2 must use 60 per cent renewable heat and are banned from electrical and fossil fuel-based heating (exemptions can be claimed for passive houses); installation of oil-only boilers is forbidden in all new and refurbished buildings; the landfilling of organic waste is prohibited; and 50 per cent of energy must be recovered from waste incineration.

Norway has a financial support scheme for renewable heat production for district energy companies and for small-scale renewable heat production, with a maximum of 30 per cent support per project (on average 15–20 per cent). The objective is to change the energy system by increasing the use of renewables in the heating sector – making the system more flexible – and to improve security of supply. Financial support is also available to encourage substantial investments in waste incineration plants.

Source: Hawkey and Webb, 2012; Euroheat & Power, 2013

4.3 ECONOMIC COMPETITIVENESS: A LEVEL PLAYING FIELD AND MULTIPLE BENEFITS

National governments are slowly recognizing the multiple benefits of district energy and are putting in place financial and regulatory measures to address pricing regimes that either do not account for the benefits of district energy systems, or that disadvantage them due to direct or indirect subsidies. This section reviews some of the common national measures that have helped create success in the 45 champion cities, recognizing that the measure required will depend on the specific national priorities, the technologies involved, their maturity, and on sector experience and history (IEA, 2012; Werner, 2011; Pöyry and AECOM, 2009). Government intervention to improve the competitiveness of district energy systems can be justified when it compensates for issues not recognized in the usual pricing structure (IEA, 2014b).

Brest, France

4.3.1 NATIONAL TAXES

Taxes on fossil fuel emissions (e.g., carbon taxes) have been used in Denmark, Sweden and Finland to even the playing field for district energy. A carbon tax demonstrates a preference for a long-term market solution rather than specific project support, reflecting the maturity of these markets (EcoHeat4EU, 2012; Werner, 2011). This is through the benefits of energy efficiency. In Sweden, a CO_2 tax was critical to the country's energy transition strategy. The City of Växjö noted that the CO_2 tax, which raises the cost of oil consumption in plants and in private homes, was key to district energy development, as consumers seek cheaper alternatives. Similarly, Gothenburg identified the CO_2 tax as the most important national policy for district energy in the city (see case study 1.1).

Penalties have played a key role in driving the development of district energy systems in Anshan. Air pollution emissions are penalized at the national level in China because of their detrimental effect on health: the central government discloses the 10 best and worst cities every month, and issues a performance evaluation of provinces. In 2013, Anshan was fined CNY7.8 million (US$1.3 million), and the fines will reportedly fund the "blue sky" project, an anti-pollution project launched in 2012. The regulation empowers provincial authorities to fine 14 cities for excessive concentrations of particulate matter (PM10), SO_2 and CO_2 (Ximeng, 2013). To prevent such penalties, Anshan is opting to develop and improve district energy systems, which are seen as a better value for the money than paying fines.

France, under the National Housing Commitment Act, has a policy stating that if a city can reach 50 per cent renewable or recovered heat in its district heat network, it will benefit from a 5.5 per cent reduction in the value-added tax (VAT). The purpose of this is to allow district heating to have a similar VAT level to other competitive heat solutions, such as gas and electricity (see case study 2.10).

Brest's district heating system currently benefits from this VAT reduction (from a normal VAT of 20 per cent), as 85 per cent of the heat demand is provided by a waste incinerator.

A tax on waste heat that is not recycled is a potential national policy measure that could improve the use of this heat. Cities have noted that industries often have little incentive to put waste heat into a district energy system, as it is not in their core business. Where taxes are not in place, national governments may offer grants and subsidies to indicate their recognition of the socio-economic benefits of district energy and/or to create a level playing field (see case study 2.11).

CHP plant in Łódź, Poland (top).
Historic façades in Frankfurt, Germany (bottom).

4.3.2 OPERATIONAL SUPPORT FOR CHP/ PRICING CHP BENEFITS

Pricing-in CHP benefits is important to creating a level playing field (see section 1 and section 2.4.3) (IEA, 2014b). In some energy markets, decentralized energy projects do not have full access to the electricity retail market and have to sell excess power into the wholesale market at much lower prices. This is a key barrier to entry for decentralized power producers that hope to participate in district energy schemes (IEA, 2014b). Offering better rates for the electricity produced in CHP plants can enhance revenue and reduce public funding requirements for district energy networks, as well as provide sufficient ROI to engage the private sector in delivery. Cities such as Velenje, Łódź and Frankfurt have been able to accelerate modern district energy as a result of national CHP policies. In their role as facilitators, local authorities can help suppliers of distributed energy avoid the centralized electricity market, as has occurred in London (see case study 4.3).

For some CHP plants, the opportunity cost of heat production (reduced electricity production) can set a tariff that is sufficient to ensure that the CHP is profitable. For example, a reduction in heat efficiency of a combined-cycle gas turbine CHP plant from 50 per cent to 43 per cent in order to produce more heat (a 14 per cent decrease) could set the tariff for heat at 14 per cent of the wholesale electricity price (very low) (Gudmundsson and Thorsen, 2013). For other CHP plants, which may have must-runs enforced due to lack of backup capacity or for which running electricity alone would not pay off the CAPEX, higher heat tariffs may be required. If such tariffs are too high, CHP price support may be required.

Some countries have implemented CHP feed-in tariffs that are designed to encourage CHP development, given that its multiple benefits often are not priced into the business model. Yerevan has implemented a feed-in tariff for CHP to realize the benefits of district heating (see case study 4.4), and Germany's Combined Heat and Power Act targets 25 per cent of electricity to come from CHP by 2020. Such support is important given CHP's benefits in Germany, particularly its potential to incorporate high levels of solar PV onto the electricity system (see case study 1.3). Under the CHP Act, transmission operators must prioritize production from CHP plants, which also receive a top-up on the electricity price that they receive to a level dependent on their size. For new large plants, this will be US$20 per MWh, which is paid for by a "CHP surcharge" on electricity bills.

4.3.3 TARIFF REGULATION

Tariff regulation is an important aspect of district energy that can ensure consumer protection in a naturally monopolistic market. Tariff regulation is particularly important in ensuring consumer protection if mandatory connection policies are enacted (see section 2.2.4). Tariffs can be regulated in numerous ways: some are regulated so that district energy is priced at the alternative technology costs, and some are effectively indirectly regulated by controlling the profits of district energy companies or the costs that they can pass on to consumers. Often, where connection is voluntary, countries will rely on competition from other sources of heat or cooling to ensure fair prices.

Furthermore, tariffs can be applied at the same rate to groups of consumers (e.g., all residential customers pay the same tariff), or costs can be levied at specific customers, relating to the cost of network expansion to connect them. Levying specific costs at individual consumers can be important to insulate uninvolved consumers from costs, in order to serve a particular geographical region or consumer type; however, it could leave individual consumers with unfairly high heat tariffs.

TARIFF REGULATED AT ALTERNATIVE TECHNOLOGY COST. Some countries control tariffs through national policies requiring that heat or cooling be priced at the cost of the next-alternative technology. The main benefit is that consumers will always get a better deal than if the district energy network were not there. For mandatory connection policies, this is important, as consumers may not have a choice in whether they connect. However, this pricing model will not necessarily mean cheaper and less-volatile prices for consumers, often a key benefit of district energy. Countries where the next-alternative technology (such as domestic gas boilers) has high or volatile prices may consider a tariff regulated at the next-alternative cost to not be passing on the significant benefits of district energy.

LONDON

CASE STUDY 4.3

LONDON'S "LICENCE LITE": FACILITATING PEER-TO-PEER ENERGY SALES BASED ON NOMINAL "WHEELING" CHARGES FOR USE OF LOCAL WIRES

In May 2009, the U.K. regulator Ofgem introduced electricity-supply licence changes to allow generators of distributed energy to enter into arrangements with third-party licensed suppliers. As a result, distributed generators can be granted supply licences of their own without having to become a direct party to industry codes that govern the central trading arrangements.

Under Licence Lite, in order to sell the electricity, the "junior supplier" has to enter into a contract with a third-party "senior" supplier for electricity convenience services; the senior supplier is then responsible for transporting the electricity over the public wires using the relevant distribution network operator. The third party undertakes the installation of meters and any administration tasks, including the "change of supplier" process. The small supplier retains title to the electricity and "owns" the customer.

As of October 2014, no such permits had been issued. Barriers include uncertainty over what kind of terms should appear in the contract between a small supplier or district energy system and a third-party licensed supplier for electricity conveyance services, as well as a lack of interest from existing industry suppliers. Likewise, there is no real obligation on existing larger suppliers to offer such services to a small supplier or district energy system, nor are there any provisions or restrictions on the terms they can offer. Finally, the existence of the scheme is not well known.

The Greater London Authority wants to take the leading role in piloting Licence Lite by working with the boroughs (who become generators and suppliers) and purchasing their excess power at a higher rate. This is foreseen to help attract more than £8 billion (US$12.8 billion) of investment in electricity infrastructure in the city up to 2025.

Already, the excess power from several CHP plants in the GLA boroughs is going into the network, but because they are not being paid sufficiently for it, many CHP plants have been shut down. One borough, Haringey Council, carried out feasibility studies for two district heating networks, with the support of the GLA, and found that, assuming wholesale rates for CHP power, there was a funding gap in both cases that would require grant funding. If the CHP plants were given access to the retail market, however, this could provide enough ROI to remove the need for "grant funding" and instead engage the private sector. In other words, with changes in the market structure, it is possible to better engage the private sector to deliver schemes (Davidson, 2013).

CASE STUDY 4.4

YEREVAN: USING A MULTI-PART TARIFF TO ENCOURAGE EFFICIENT AND AFFORDABLE HEAT

Heat supply in Yerevan, and throughout Armenia, has changed dramatically over the last 20–30 years. The country has no domestic fossil fuel resources, and up until the 1990s, when Armenia faced an economic and energy crisis, the country imported natural gas to fuel district heating networks that supplied 90 per cent of residential and public buildings. By 1992, however, municipal district heating had virtually disappeared.

During the early 1990s, regular interruptions of gas imports forced the population to rely on individual heating solutions such as wood, kerosene and costly electricity. From 1996, gas supply improved and primary energy prices were liberalized, but district heating remained unused due to low reliability, poor maintenance and significant heat losses (up to 50 per cent in Yerevan's Avan district), which were related to extremely low payment collection rates in the first place (consumers opted instead for individual gas boilers and electricity). A 2006 assessment found that centralized heat production (using the existing district heat networks) was approximately 60 per cent more expensive than individual gas-fired heaters. The assessment was carried out during development of the United Nations Development Programme (UNDP)–GEF project, Armenia – Improving the Energy Efficiency of Municipal Heating and Hot Water Supply (2012).

This important project has the potential to restore vast amounts of Yerevan's – and Armenia's – district heat networks to provide heat that is safer, cheaper and more reliable than individual gas-fired heaters. Avan, a residential district in Yerevan with 32,000 residents, was selected as a pilot project. The district heating network had stopped supplying heat in 2003 (and hot water in 1994) and had previously operated at only 50 per cent efficiency. The existing state of the heat supply sector and the limited municipality budget made it clear that private sector involvement was necessary.

To reduce commercial risks and attract private sector involvement, the UNDP–GEF project team recommended regulatory changes that would guarantee electricity tariffs and heat tariffs for a project. The heat tariff was determined from on-the-ground market research that would ensure that the tariff was well below the cost of heat from individual house appliances, thus ensuring a high rate of connections to the improved district network. The heat tariff is multi-part, thus encouraging reduction in demand-side consumption, but the fixed element of the tariff ensures that the fixed costs of the connection are paid off. The electricity tariff was calculated to cover all other revenues needed to meet the required return on investment for the private sector. This final electricity tariff – a feed-in tariff – was close to the marginal thermal power plant on the Armenian power system.

The team recommended that a public-private partnership was the best model for reducing commercial risk and hence heat tariffs. The public sector role would be to have some ownership but also to remove institutional barriers and offer favourable conditions to investment. This led to the Yerevan municipality giving free use of heat supply assets to the new heat supply company.

An important factor in the development was the restoration and construction of internal networks in the apartments being connected. Such development was considered as a soft loan and would be paid off by a separate tariff rate. In addition, public awareness campaigns for local residents were seen as crucial for the project, as residents were very skeptical of district heating given its poor performance historically. They also had to be persuaded that the low heat tariffs could remain in place in the future.

The initial phase of connecting 10,000 residents is set to reduce energy consumption by 50.2 GWh annually and save 10,200 tons of CO_2-equivalent. In 2006, the heat supply company ArmRusCogeneration CJSC was founded, with the majority of shares owned by foreign investors and a minority held by the municipality of Yerevan.

Source: UNDP, 2012

Avan district, Yerevan, Armenia

Furthermore, district energy operators may not be able to pass on costs, which could mean unviable business models.

One potential issue with such regulation is that it does not necessarily require district energy companies to innovate and reduce costs, particularly if the fuel for the next-available technology is the same fuel used for district energy. For example, pricing district heating against the residential gas price may mean that the business model for district energy makes the most sense if it is mostly gas CHP producing the heat. Or, pricing district cooling against the residential electricity price may mean that electric chillers make the most sense, potentially ruling out other, lower-carbon technologies, such as absorption chillers. Such issues will be very country dependent, and each country must weigh the benefits of a regulated price based on alternative technologies against the negatives of such a price structure.

In Norway, tariffs for district energy are regulated to be below the next-available technology, which is electric heating. In return for such regulation, district energy companies are given a monopoly over a licence area, which helps to ensure that costs are low enough for the regulated tariff (see case study 4.2). In Singapore, under the 2011 District Cooling Act, all commercial buildings in the Marina Bay district cooling zone are mandated to connect, and tariff controls prevent tariffs from exceeding the equivalent costs of chilled water produced by building-scale plants. The district cooling operator in Singapore is allowed to earn a baseline return based on its invested assets; however, once start-up losses have been recovered and the system achieves a critical mass of load for economic efficient operation, any financial gain above the baseline return must be shared equally between the operator and its customers. Therefore, customers are assured of long-term savings, while the start-up demand risks associated with a greenfield project are mitigated. Yerevan is successfully attracting consumers back to district heating by implementing multi-tariff structures that are priced to be similar to individual natural gas boilers and that also encourage energy conservation by having a significant variable charge (see case study 4.4).

■ **TARIFF REGULATED INDIRECTLY THROUGH CAPPED PROFITS AND PASS-THROUGH COSTS.** One benefit of this model of tariff regulation is that, when district energy is cheaper than the alternative technology cost, customers experience savings in energy expenditure. However, if in certain years district energy is more expensive (for example, due to falling gas prices), the consumer could potentially pay more than the next-alternative technology.

In Denmark, the national government determines which costs can be recovered in district heating prices, and these can then be levied on consumers. If a consumer is singularly responsible for a cost, such as the cost to connect a new home, the district heating company must ensure that this consumer pays the fixed cost. Although this is perhaps a fair model for connection, it can increase the proportion of fixed costs versus variable costs in the tariff, which can reduce the incentive for energy conservation (Chittum and Østergaard, 2014). National oversight ensures that district heating companies charge fair tariffs and do not pass on costs that should not be incurred by the consumer. Furthermore, consumers are able to evaluate their tariff against other tariffs nationally, as district heating companies must publicly report the breakdown of fixed and variable costs each year (Chittum and Østergaard, 2014).

The tariff regulation of passing costs on to consumers (as opposed to setting the price at the next-available technology cost) has meant that consumers in Denmark have enjoyed low prices for heat relative to other technologies, with 94.4 per cent of the heat sold by Danish district heating companies being cheaper to customers than an alternative individual heating solution (Chittum and Østergaard, 2014). Denmark also has profit controls on district heating companies, capping the profits that they can make and requiring excess profits to be used to reduce heat tariffs. Japan has taken a similar approach to heat pricing, where the Heat Supply Business Act fixes the tariff to include all initial costs, and the price is approved by the national government, leading to inflexible pricing.

In the Canadian province of British Columbia, district energy utilities are regulated by the British Columbia Utilities Commission, which enforces a capital structure and allowable return on equity, essentially limiting the profits of the utilities. This translates explicitly to the charging of an allowable average tariff. In Vancouver, public ownership also means that the tariff structure is extremely transparent, further encouraging connections (see case study 3.1).

■ **TARIFF NOT REGULATED.** In the absence of regulatory authority from the national level, local authorities can still influence tariffs through active participation in and ownership of district energy in their cities. This could be through concessions given out with requirements on tariff levels, or public ownership reducing costs and eliminating profits to reduce tariffs (see case study 3.2 on Bunhill Heat and Power). For some markets, competition between heat sources will be deemed sufficient to keep prices low. However, consumers will need to be protected due to the effect of long-term contracts, which could be five years (GLA and Arup, 2013). After all, district energy could be set slightly cheaper than individual heating/cooling solutions, but consumers will never own the connection to their property, whereas they would own, and have paid for, a boiler or air conditioner after 10 years, and such ownership should be accounted for in pricing formulas. Industry standards of contracts to consumers should be developed, as well as services that can advise consumers on the best heating option.

The *District Heating Manual for London* (GLA and Arup, 2013) recommends setting district heating prices against the cost of the next-alternative technology, which in the U.K. is normally natural gas boilers (the manual recommends the same for district cooling prices). Such tariffs are unlikely to be regulated heavily in the future, and individual district heating companies could use varying tariff structures. Such a model is likely to work well, particularly because mandatory connection is unlikely in London and because district heat networks will be developed, with many heat sources being from gas CHP. As London decarbonizes heat further in the future, different pricing structures are likely to emerge, particularly if district heat costs diverge from gas prices.

For countries where energy is subsidized at the consumer level (for example, for electricity or natural gas), such subsidies should be considered by the relevant authority and also be allowed to pass through district energy prices. For example, in a country with district cooling, if electricity prices to residential customers are subsidized to be flat throughout the day and low, then 1) such low prices should be allowed to pass through district cooling prices to keep district cooling competitive, and 2) flat-priced electricity tariffs should be passed to the district cooling operators, or subsidies somehow should be redirected to storage at the district cooling level, stimulating more-efficient and timely electricity use.

4.4 VERTICAL INTEGRATION

Also referred to as subnational integration or multi-governance approaches, effective vertical integration is needed to optimize planning, coordination and monitoring of developments between different levels of government, from national/federal to state/provincial and local. Considering that each level of government has its specific mandate and responsibilities, effective vertical integration between different levels of government is increasingly important, especially in the context of addressing climate change (mitigation and adaptation), sustainable development and energy security.

New multi-level governance models are needed to ensure the timely engagement of all government levels involved in low-emission development, and to mutually reinforce each other's roles and activities. Vertical integration also directly relates to improved measurable, reportable, and verifiable (MRV) actions and results. The MRV aspect aims to increase confidence in data, the process and the results – and can help ensure transparency.

District energy offers an effective level of engagement, with a wide range of action instruments available to local governments to lead, guide and drive developments in this area – aligning with national policies and plans. These include strategy, bylaws, policies, urban and spatial planning, using financial incentives and disincentives, supporting market development, and coordinating stakeholder engagement, among others.

Restoring Christchurch's landmark Diamond Jubilee Clock Tower after the 2011 earthquake.

Local government actions often complement, and in many cases go beyond, state and national policies. In turn, national governments often consider using successful subnational programmes as blueprints for national policies (REN21, 2014; Leidreiter et al., 2013; NREL, 2010). Christchurch's district energy technology and policy demonstration project is a test bed for potential scale-up and replication across New Zealand. China is experimenting with carbon trading at the local level before potentially launching such trading nationwide (Song and Lei, 2014; Climate Institute, 2013). In turn, many national and regional authorities across Europe are advancing incentives for district energy projects to reach their targets, as outlined in sections 4.1 and 4.2.

As cities become increasingly important for achieving national goals, they are playing a growing role in the design and development of "vertically integrated" state and national policies. Asia Pacific Economic Co-operation (APEC) has advanced its "Low Carbon Model Town" project using Yujiapu, China; Samui Island, Thailand; and Da Nang, Vietnam as the first three case studies. And in 2013, eight "model cities" in Brazil, India, South Africa and Indonesia began formulating low-emissions development strategies using a common methodology developed by ICLEI for local governments. Through such means, cities are exploring ways to tap into new climate financing mechanisms for emerging economies and developing countries, including Nationally Appropriate Mitigation Actions (NAMAs).

4.4.1 LEVERAGING NATIONALLY APPROPRIATE MITIGATION ACTIONS (NAMAS) FOR LOCAL EFFORTS

At the 2010 United Nations Climate Change Conference in Cancún, Mexico, Parties agreed that developing countries will implement Nationally Appropriate Mitigation Actions (NAMAs) that must be measurable, reportable and verifiable. A NAMA is any action that ultimately contributes to greenhouse gas emission reductions while addressing the development needs of a country. While a NAMA may encompass a specific project or measure to reduce emissions in the short term, it also may encompass policies, strategies and research programmes that lead to longer-term emissions reductions.

Although the role of local and provincial actors in climate mitigation is undisputed, there is a lack of replicable experience with successful multi-level government approaches in NAMAs. This includes strategies for how cities can leverage climate finance to support local authorities in undertaking actions, such as energy policies, that can provide strong national mitigation benefits that are not monetized but that can demand significant capacity and/or resources from local authorities. As seen in the case of district energy, national governments have started to provide incentives that can correspond to such public benefits (see sections 4.1 and 4.2). However, local, provincial and national governments continue to face barriers in coordinating efforts to optimize synergies and achieve joint policy objectives.

Two pilot approaches are under way in South Africa (see case study 4.5) and Indonesia, funded by the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). They provide some initial experiences to address this gap. This BMUB–IKI project on "Involving sub-national actors into national mitigation strategies through vertically integrated NAMAs [or "V-NAMAs]" supports developing country governments in their efforts to mobilize local and provincial actors for achieving national mitigation targets through cost-effective incentive packages and MRV systems.

4.4.2 SOME INITIAL EXPERIENCES WITH V-NAMAS

Initial experiences emerging from the two pilot V-NAMAs in Indonesia and South Africa under the BMUB/GIZ programme include:

- **OWNERSHIP FOR V-NAMAS STARTS AT THE NATIONAL LEVEL.** While the principal focus of V-NAMAs is to engage and motivate subnationals in the NAMA process, the initial step was still to place the V-NAMAs within the national-level institutional and climate strategy context.

- **OWNERSHIP FOR V-NAMAS IS TYPICALLY SHARED AT THE NATIONAL LEVEL BETWEEN THE LEAD AGENCY FOR NAMA DEVELOPMENT AND RELEVANT SECTOR MINISTRIES.** This is a complex task, and it took 6–12 months to establish a workable institutional arrangement. In Indonesia, the Ministry for National Development Planning (BAPPENAS), which has overall responsibility for NAMA development, took the lead and engaged with the Ministry of Public Works (PU) on developing a V-NAMA for municipal solid waste. Ultimately, other sector ministries also had to be engaged, such as the Ministry of Environment (KLH), for matters related to waste recycling as well as for MRV, and the Ministry of Energy for waste-to-energy matters.

  In South Africa, the Department of Environmental Affairs (DEA, which has overall responsibility for NAMA development) engaged with the Department of Energy (DoE, responsible for energy efficiency and demand-side management support mechanisms for municipalities) and with the Department of Public Works (DPW, the owner of public buildings and responsible for building standards) to develop a V-NAMA for energy efficiency in public buildings at all levels of government, with a focus on provincial and municipal buildings. It could build on an existing taskforce on building energy efficiency that had just been set up between DoE and DPW, and which greatly facilitated the process. There is a need to clarify the roles, and manage expectations, of national agencies that invest efforts in developing V-NAMAs without being the primary beneficiaries (which should be the subnational actors).

- **SELECTION OF SUBNATIONALS TO PARTICIPATE IN V-NAMA PILOTS HAS BEEN TOP-DOWN, BUT DOES NOT HAVE TO BE SO.** Once they had agreed upon a workable institutional arrangement, the national-level ministries picked the subnational actors to participate, using a mix of technical and political criteria. For future V-NAMAs, a competitive and transparent process could be considered, whereby subnational actors are selected based on their motivation, demonstrated willingness to commit own efforts, and greenhouse gas reduction potential. Good practice on how to design a competitive selection process is available in other international programmes.

- **V-NAMA AS AN APPROACH: OPERATIONALIZING THE NATIONAL CLIMATE STRATEGY AT THE SUBNATIONAL LEVEL.** In Indonesia, V-NAMA is seen as part of the national action plan for reducing greenhouse gas emissions (RAN-GRK), which is broken down at the provincial level (RAD-GRK). V-NAMA is testing modalities for engaging municipalities in a systematic way, for example through establishing local V-NAMA coordination bodies, which regularly engage with the national and provincial level but also exchange experiences among themselves. In South Africa, V-NAMA is seen as part of the energy efficiency climate flagship programme of the national Climate Change Response Strategy. The V-NAMA gave the DEA a first opportunity to explore in practical terms how to design MRV mechanisms, which involves bottom-up reporting of climate actions at the local level – a valuable experience for replication in future NAMAs involving subnational actors.

- **V-NAMA AS FUNDING MECHANISM: DESIGNING A CLIMATE FINANCE MECHANISM FOR SUBNATIONALS.** National governments struggle to roll out their national climate programmes, including NAMAs, because often the climate finance mechanisms to accompany the programmes still need to be developed. Participating provinces and municipalities generally have the expectation that through the V-NAMA they would gain access to additional funding to realize their local priority programmes. At the local level, the line between what is climate finance or "regular" budget, and what comes from national or international sources, is often blurred and of limited relevance, as long as there is a tangible incentive and the access to it is not too burdensome.

SOUTH AFRICA

CASE STUDY 4.5

V-NAMA SOUTH AFRICA: A MODEL FOR HOW LOCAL AND NATIONAL GOVERNMENTS CAN SUPPORT EACH OTHER FOR A COMMON PUBLIC OBJECTIVE

In 2009, the South African government committed to reduce the country's emissions 34 per cent from business-as-usual levels by 2020 and 42 per cent by 2025. For an effective climate change response, the government approved the *National Climate Change Response White Paper* in 2011, introducing eight Near–term Priority Flagship Programs. The V-NAMA programme on energy efficiency in public buildings forms part of the Energy Efficiency and Energy Demand Management Flagship.

GIZ, under BMUB's International Climate Initiative, cooperates with three national ministries, four provinces (Eastern Cape, Free State, Gauteng and KwaZulu–Natal) and nine municipalities in this programme. Approximately 75 public buildings – such as administration buildings, schools and hospitals – build the test bed for the implementation of energy efficiency measures, MRV systems as well as business models to mitigate greenhouse gas emissions. The implemented MRV system will be based on existing reporting mechanisms in the field of energy in South Africa.

The proposal for the "Energy Efficiency in Public Buildings Programme in South Africa" V-NAMA consists of a financial and a technical component. In the financial component, it is envisaged to set up an Energy Efficiency Fund hosted by the Development Bank of Southern Africa (DBSA) to ensure a more cost-effective use of national grants. The fund would provide concessional funding to provinces and municipalities for effective energy efficiency interventions by piloting innovative subsidy mechanisms (such as reverse auctions, competitive grants, performance-based subsidies and pre-feasibility studies). An additional service planned within the financial component is to provide provinces and municipalities with centralized procurement, pre-qualified contractors, etc.

The technical component is divided into a policy and an institutional capacity component. The policy component is established to create enabling conditions for private investments in public building energy efficiency and for introducing green building standards for public buildings. An important part of the strategy is to enable private sector investments through energy service companies, for example through public-private shared-savings ESCO contracts. Thus, an important part of the policy component is setting up a standardized approach ("cookbook") to sign three-plus year contracts with ESCOs, which so far is a challenging activity for South African provinces and municipalities.

The institutional capacity component includes setting up an institution to provide services for municipalities. Hence, less experienced and smaller municipalities will be supported in their energy efficiency proposals, procurement, MRV requirements, etc. So-called Energy Efficiency Managers will support provinces and municipalities in accessing funds and developing projects. Another part of the capacity component is to set up a Green Building Project Management Office to advocate, communicate and promote sustainable construction in the different spheres of government.

The proposed Energy Efficiency in Public Buildings Programme would, given appropriate international and national funding, lead to estimated annual reductions of 100,000 MWh of electricity consumption and 95,000 tons of CO_2 after five years of implementing efficiency measures in approximately 1,000 buildings. Two alternative scenarios have been developed, and other options are possible to meet donor- or investor-specific priorities. In addition to the high mitigation effect, the programme seeks to provide accompanying co-benefits such as energy consumption and related costs, improved service quality of public administrations in retrofitted buildings, job creation in different regions and on different skill levels, and better vertical and horizontal coordination between different spheres of government and government departments.

Source: Contribution from Tobias Zeller, Prema Govender (GIZ) and project country partners, 2014. A more detailed description of the case can be found at http://bit.ly/1wBHOzI.

In South Africa, as part of the V-NAMA development, an improved energy efficiency funding mechanism has been designed for municipalities, and in Indonesia a discussion has been initiated with the Indonesia Climate Change Trust Fund on how to give cities access to climate finance for improving their waste management (and thereby reduce greenhouse gas emissions). In both countries, the Ministry of Finance or National Treasury has emerged as a key V-NAMA stakeholder regarding questions of national climate finance, how to blend national with international and local funding, and how to effectively channel climate finance to subnationals.

■ **V-NAMA AS A FRAMEWORK FOR INITIATING A TRUST-BUILDING "VERTICAL DIALOGUE" ON LOCAL CLIMATE ACTION BETWEEN THE SUBNATIONAL AND NATIONAL LEVEL.** The relationship between national and subnational government is often characterized by a deep-rooted mutual distrust (e.g., "local government diverts climate finance to other uses", "national government is erratic in shifting funding priorities and wants to micro-manage without having the technical capacity", etc.). This leads to suboptimal implementation arrangements (e.g., management of local actions out of national ministries). Furthermore, there is often a lack of understanding (and respect) for the realities and priorities of local governments, leading to poorly designed national support programmes that fail to achieve lasting local results, such as grants for infrastructure investments that local governments are incapable of operating sustainably.

The V-NAMA pilots have initiated a more regular exchange in which the national government gains insight in local priorities and creative solutions, and the local government can understand some of the constraints imposed by national policies and international donors on support programmes. This communication channel has also improved the horizontal flow of information between sector ministries and between city-level agencies around climate action. It remains a challenge to institutionalize such mechanisms independently of the V-NAMA teams, which currently maintain and energize this dialogue through continuous communication, workshops and capacity-building.

■ **V-NAMA AS A PROMOTER FOR PRIVATE SECTOR INVOLVEMENT IN LOCAL CLIMATE ACTION.** Increasingly, the target of climate finance will not be (only) to support subnational governments themselves, but to attract stronger involvement of the private sector in delivering local services. For example, in South Africa, the V-NAMA proposes a "shared savings" business model for private ESCOs to engage for the first time, with their own capital, in energy efficiency in municipal buildings. The intention is to ensure financial sustainability of NAMA programmes once pilot initiatives and grant support have been exhausted.

Multi-stakeholder discussion on V-NAMAs in Durban, South Africa.

4.4.3 POTENTIAL APPLICATION OF V-NAMAS TO DISTRICT ENERGY

District energy at the city level presents a new and so-far untested opportunity to apply the V-NAMA approach. As demonstrated earlier, district energy holds substantial potential for greenhouse gas mitigation, which can be unlocked only via a pro-active local government in its roles as building owner, regulator and matchmaker between the supply and demand of waste energy. At the same time, the national government (and, depending on the country, provincial governments) plays a critical role in establishing transparent standards for regulating grid access, tariff setting and valuing ancillary services such as reserve capacity. Hence, a vertical integration of regulation and incentives will be a prerequisite for creating the environment for attracting public or private investments into the district energy sector.

In a developing country, one of the incentives might be to mobilize climate finance for district energy investments under a V-NAMA regime. To that effect, a group of motivated cities could approach the national government's lead agency for NAMA development to agree on a broad framework for a district energy V-NAMA, stipulating the key stakeholders at the national and local level (which are likely to include the ministries responsible for energy, buildings, and waste, as well as concerned city-level agencies and representatives from the energy company and private sector).

A feasibility study would need to examine in detail the greenhouse gas reduction potential, the financial viability of various business models, and the optimal design given the specific circumstances of the city area. Based on the results, a NAMA proposal could be developed describing a national mitigation programme combining strategic policy reforms, capacity-building, and blending of domestic, private, and, where needed, international climate finance sources.