CLIMATE CHANGE

29/2018

Implementation of Nationally Determined Contributions

Islamic Republic of Iran Country Report

For our Environment

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Implementation of Nationally Determined Contributions

Islamic Republic of Iran Country Report

by

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Introduction to the project

This country report is part of the "Implementation of Nationally Determined Contributions" (NDCs) project (FKZ 3716 4111 80), which considers NDC implementation in 10 countries: Colombia, Ethiopia, Georgia, Indonesia, Iran, Kenya, Marshall Islands, Morocco, Peru, and Viet Nam. This project places a special emphasis on identifying potential barriers to NDC implementation and mitigation potentials which could go beyond the current NDCs.

The country reports analyze the NDCs in terms of their robustness and coherence with other national or sectoral plans and targets, and put them into the context of additional mitigation potentials and other national circumstances. For countries where coal plays a critical role in consumption or national production, the analysis covers further details on this sector, including the economic relevance and local impacts of coal production or consumption. The content is based on available literature from research and public sector information on policies and institutions.

To be able to analyze the content in more detail, the authors focus the research on a number of relevant fields of action. The fields of action were selected based on historic and projected sectoral emissions development, comprehensive literature on GHG mitigation potentials, identified barriers and emissions reductions as well as feasibility, costs, and co-benefits.

The project was suggested and is financed by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, supervised by the German Environment Agency and carried out by independent think tanks - NewClimate Institute and Wuppertal Institute. The country reports are a continuation of similar previous efforts (project numbers 3713 41 102, 3711 41 120, 360 16 022, 364 01 003 and 363 01 128) and aim to inform policy makers and the interested public about the implementation of NDCs in individual countries. The choice of countries is based on developing countries with which Germany works closely on climate change topics.

The country reports are scientific in nature, and all suggestions are derived by the authors from careful analysis, having in mind the individual backgrounds of countries. They aim to increase knowledge about implementation of mitigation potentials to meet the globally agreed goal of staying within a temperature increase of 1.5°C or well below 2°C above preindustrial levels, without intending to prescribe specific policies.

Overview

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List of abbreviations

BAU	Business as Usual
CDM	Clean Development Mechanism
CNG	Compressed Natural Gas
COP23	Conference of the Parties 23 in Bonn
DoE	Department of Environment
EOR	Enhanced Oil Recovery
G77	Group of 77 at the United Nations
GHG	Greenhouse Gas
HDI	Human Development Index
INDC	Intended Nationally Determined Contributions
JCPOA	Joint Comprehensive Plan of Action
LMDC	Like Minded Group of Developing Countries
LPG	Liquid Petroleum Gas
MENA	Middle East and North Africa
MRV	Measurement, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NC2	Second National Communication
NC3	Third National Communication (Draft)
NCCO	National Climate Change Office
OPEC	Organization of the Petroleum Exporting Countries
UNFCCC	United Nations Framework Convention on Climate Change

1 Part I: Summary

1.1 Country background

The Islamic Republic of Iran (hereafter referred to as Iran) is located in Western Asia and is the second largest country in the Middle-East, with a population of 80.3 million in 2016. Climate change is a significant threat to Iran, which is most obvious in the water scarcity the country faces with declining rainfall, exhausted groundwater reserves and evaporating lakes and rivers (DoE, 2015; HBS, 2017).

Iran is an upper-middle income economy and the second largest economy in the Middle East and North Africa (MENA) region (World Bank, 2017a). It became the fastest-growing economy of the MENA region in 2016, after the implementation of the Joint Comprehensive Plan of Action (JCPOA), otherwise known as the nuclear deal.

Iran has a key role in the global energy supply due to its abundant **oil and natural gas reserves**, and is a founding member of OPEC. Hence, the most important economic sector is the **energy sector**, with oil exports accounting for almost 33% of the government revenue and 15.8% of GDP (CBI, 2017). The estimated GDP growth for 2016 was 6.4%, and future estimates of GDP growth range from 3.5 – 4% by The International Monetary Fund (IMF) and World Bank to 8% in Iran's sixth Five-Year Development Plan.

Climate change strategy	✓
Green growth strategy	(✓)
Energy strategy aligned with CC/GG strategy	(✓)
Institutional coordination on climate change	(✓)
Renewable energy targets	✓
Level of NDC ambition (CAT rating)	n.a.

Politically the Islamic Republic of Iran includes elements of a parliamentary democracy, in which the Constitution affirms the independence of Executive, Legislative and Judicial branches of power from each other. All three are under the direction of the Supreme Leader, Iran's head of state and highest political and religious authority of the country, ranking above the directly elected president. The last presidential elections in Iran took place in May 2017.

Main responsibilities regarding climate change mitigation and adaptation lie with the Department of Environment (DoE), and therein in the **National Climate Change Office**. The DoE is a governmental agency under the supervision of the president. The bulk of Iran's mitigation potential lies in its energy sector, including supply and demand sub-sectors. As a result, **several ministries and agencies** play central roles in the country's climate-relevant policy architecture.

Iran has **signed but not ratified the Paris Agreement**. The Iranian Cabinet of Ministers approved the Agreement in July 2016 and sent it to the parliament for consent to ratification (European Parliament, 2017; WRI, 2016). At the time of writing, Iran had not deposited its instrument of ratification with the Secretary-General of the United Nations. In the international climate negotiations, Iran is a member of the G77 and the Like-Minded Group of Developing Countries (LMDC).

1.2 Emissions and energy use

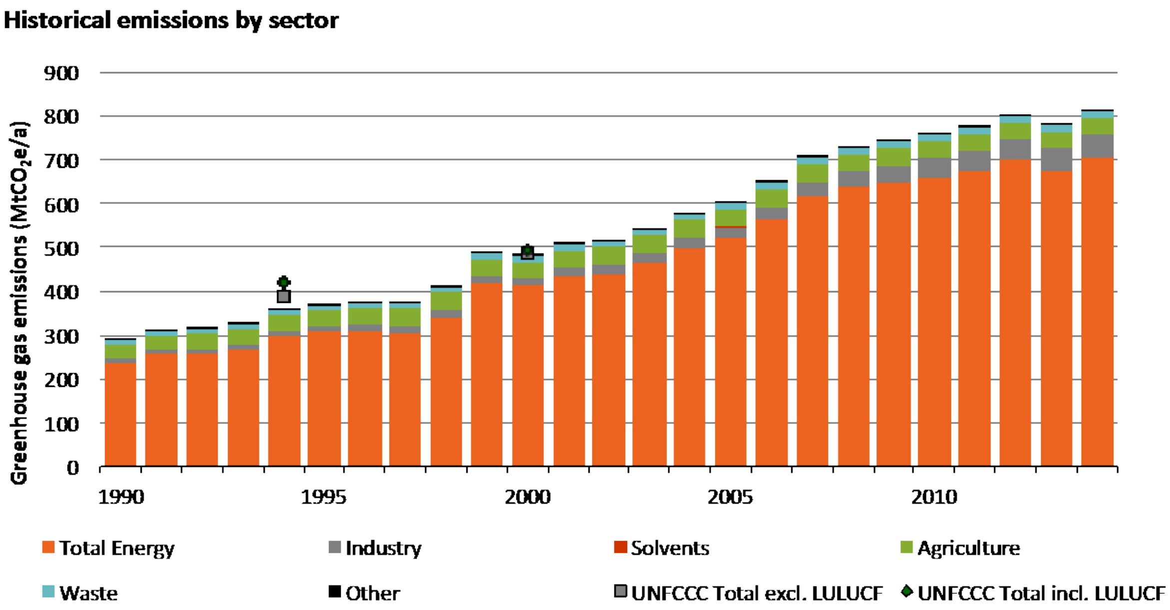
In 2014, Iran's GHG emissions reached an all-time high, with data ranging between 734 $MtCO_2e$ (excl. LULUCF) according to WRI and CAIT (2017) and 813 $MtCO_2e$ (excl. LULUCF) according to PRIMAP data (Gütschow et al. 2016, see Table 2). Iran features as **the 11th largest emitter of GHG** in recent rankings (WRI and CAIT, 2017), representing more than 1% of global emissions. In the last 25 years (1990-2015), Iran's GHG emissions have more than tripled (European Parliament, 2017).

Iran's emissions are dominated by the **energy sector which accounts for 87% of overall GHG emissions**. Among the sub-sectors, energy supply (power generation and refineries) is the top emitter, representing close to one third of emissions, followed by the two main energy demand sectors: transportation and buildings (residential and commercial). In terms of fuel type, emissions from natural gas represent a little over half of emissions, whereas petroleum products are responsible for most of the remainder (Ministry of Energy, 2014). Upstream emissions from gas flaring during oil extraction are an important source of emissions (Soltanieh et al., 2016). The business as usual (BAU) scenario of Iran's INDC foresees that energy-related GHG emissions will grow 4.7% each year until 2030, which would result in an increase of GHG emissions from approximately 700 $MtCO_2e$ in 2010 to over 1,700 $MtCO_2e$ in 2030 (DoE and UNDP, 2014).

Energy system. Primary energy supply in Iran added up to 236 Mtoe in 2014. Iran is an energy rich country, and a net exporter. The abundance of energy resources has often led to their mismanagement and inefficient use (Moshiri and Lechtenböhmer, 2015). In the past decade, energy consumption has grown by more than 50%, driven by the economic development, demographic growth, urbanization, and a highly subsidised energy market. The rapid growth has even led to supply shortfalls during peak times. Still, the annual electricity consumption per capita (~3,000kWh/capita) is less than half of Germany's (~7,000kWh/capita). Primary energy demand is met mostly by natural gas (61%) and oil (37%), with marginal contributions of coal, hydroelectric, nuclear power, and woody biomass. Over 84% of Iran's power generation is produced from natural gas (THC, 2017).

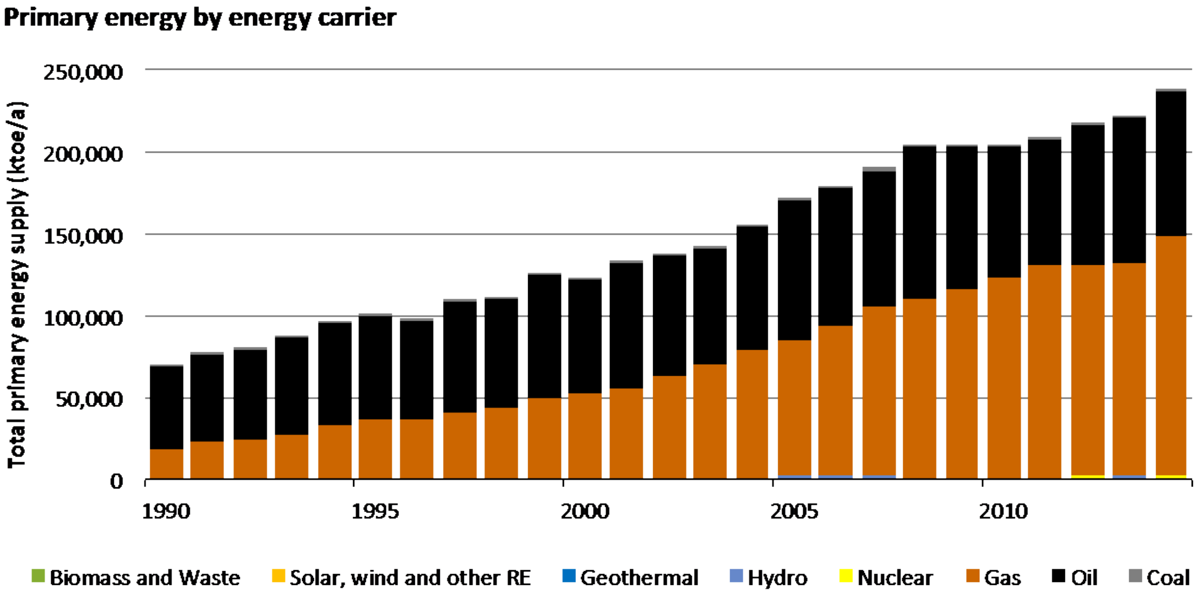
In order to curtail wasteful energy use and limit domestic demand growth, Iran has pursued an energy subsidy reform in the last two decades. Reforming the domestic energy market has been central in the agenda of the country's 5-year development plans of the country since 1995 (2nd, 3rd, and 4th Five-Year Development Laws). The Law on Energy Consumption Pattern was passed in 2010, and the second phase of reform was implemented in 2014. The essence of recent reforms has been to gradually raise the prices of domestic petroleum products, natural gas, and electricity, while promoting the participation of the private sector, the creation of energy service companies, and implementation of energy efficient technologies. Energy subsidy reform is crucial from a climate change perspective, however it has been slowed down by a range of factors. Among other things, reforms had an inflationary effect and contributed to Iran's growing budget deficit, and the amount of projected revenue from subsidy savings has not always been realised.

Figure 1: Emissions profile of Iran



Data sources: Gütschow et al. (2016); UNFCCC (2016)

Figure 2: Energy profile of Iran, 1990 to 2014



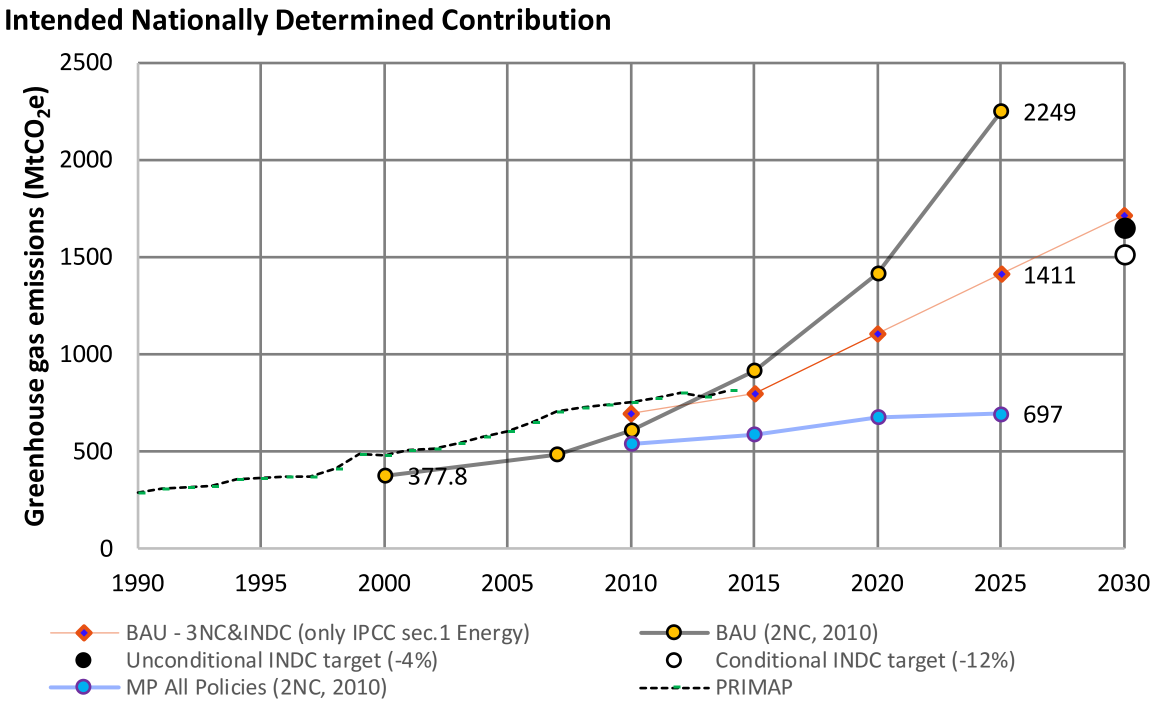
Data sources: IEA (2016a)

1.3 INDC and ongoing activities

Iran's Intended Nationally Determined Contribution (INDC) was published in November 2015, shortly before the Paris Conference of Parties (COP21). The INDC contains an **unconditional reduction pledge of 4%** versus a business-as-usual (BAU) scenario in 2030, and **a pledge of 12% reduction** versus BAU subject **to international financial and technical support** (DoE, 2015). It is important to note that both the unconditional and conditional pledges are subject to the removal of current sanctions and absence of sanctions in the future. The cost of implementation is expected to be around 70 billion USD, split into 17.5 billion USD for the unconditional reduction and 52.5 billion USD for the additional 8%.

An analysis by the European Parliament (2017) considers that the **pledges are relatively modest compared to the projected increase in emissions**. A series of bottom-up scenarios on Iran's future energy system (Moshiri and Lechtenböhmer, 2015) indicate that the cost-efficient potential emission reductions by 2030 could be around 40% against BAU with energy efficiency measures, and up to 50% if combined with renewable energy.

Figure 3: Historic emissions, BAU projections and pledge according to Iran's INDC (energy sector only)



Data sources: DoE (2015), DoE and UNDP (2014), Gütschow et al., (2016). NB: *only energy sector included in NC3 and INDC*. BAU = Business as Usual. MP = Mitigation scenario in NC2.

Ongoing activities. The strategic guidelines for climate action can be found in Iran's Second National Communication (NC2) (DoE and UNDP, 2010) and in the draft of the Third National Communication (NC3) (DoE and UNDP, 2014). The draft NC3 formulates the main mitigation actions required to achieve the INDC's unconditional and conditional pledges in the energy sector, but has not yet been submitted to the UNFCCC. In May 2017, Iran published a National Strategic Plan on Climate Change (UNDP Iran, 2017).

National energy and subsidy reform strategies have a strong bearing on the Iranian climate strategy. Some of the landmark climate-related energy policies include the Law on Energy Consumption Pattern Reform, the feed-in tariff for renewable energy and the energy price reform law, also known as the Targeted Subsidies Plan or Subsidy Removal Plan. An overarching measure of the 5th Development Plan (2011-2015) was the target to reduce energy intensity by 30%. The current Sixth Development Plan (2017-2021) contains no such overarching target, though it targets the reduction in energy use by 5% in buildings, the increase in renewable energy installed capacity to at least 5% of the country's total capacity by 2020, and a reduction of gas flaring by a minimum of 90% by 2021.

Four overarching barriers to realising Iran's mitigation potential can be distinguished: international trade sanctions, institutional capacities, access to energy-efficient technologies, and availability of capital. The effect of lifting of the sanctions on mitigation activities is seen as "double-edged sword": on the one hand, sanctions may impede the achievement of mitigation goals, by hindering foreign investments into low carbon technologies and, indirectly, technology transfer and financial international relations. On the other hand, strong economic growth – which could well be the result of lifted sanctions - could lead to higher emissions. The latter argument is however not fully backed by recent developments: average annual growth rate of emissions during the last sanctions period (2009-2014) was over 3.7%, which is lower than the 4.7% rate during the 2005-2009 but was still significantly high. Experts consulted suggest that part of the reason for the lower emissions growth rate during the last sanctions period was the increased use of natural gas in the energy mix.

Following a series of bilateral exchanges that emerged after the implementation of the nuclear deal, Germany is expected to participate in a number of cooperation projects (BMU, 2017a). Moreover, the German Federal Environment Ministry aims to support Iran in its implementation of national climate action targets. It is expected that this collaboration will be reinforced by the signing of the Memorandum of Understanding between the European Union and Iran regarding cooperation on climate change (Council of the European Union, 2017). This MoU, which sprang from the High-Level Conference on Climate Action and Sustainable Energy held in April 2017 in Tehran, was approved by the EU Council in October 2017, but is still pending signature. It foresees technical assistance with an emphasis on climate resilience as well as adaptation. Moreover, in 2016, the European Commission announced plans to launch a High Level Energy Dialogue on non-nuclear energy with Iran. Funded by the German International Climate Initiative (IKI) and underway since the summer of 2017, the Green Energy Centre is an example of a capacity-building project that aims to respond to the skills and training needs of Iran's emerging renewable energy sector (BMU, 2017b).

Although strategies, policies and laws on improving energy efficiency and promotion of renewable energy resources have been formulated in Iran since 1995, there are a series of challenges that hinder their implementation. These include the monopolistic and state-regulated nature of the energy market, unfavourable macro-economic factors and the modest success in promoting private investments in energy efficiency and renewable energies, whether from international or domestic investors.

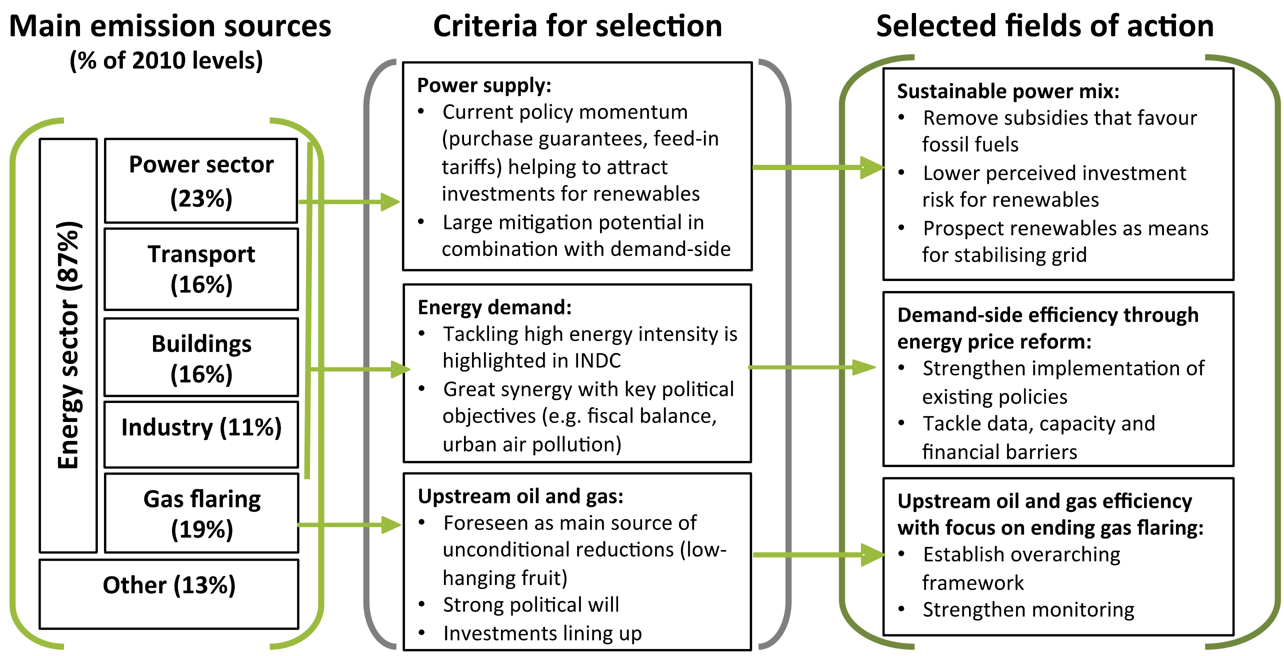
1.4 Further mitigation potentials and barriers

Further to the 4 to 12% reduction pledge (against BAU) presented in the INDC, there is considerable additional mitigation potential. Following a review of Iran's mitigation pledges, existing literature and expert interviews, three fields of action have been selected for this study based on their mitigation potential, feasibility, costs and potentials and co-benefits: demand-side efficiency through energy-price reform, upstream oil and gas efficiency (with an emphasis on gas flaring) and sustainable energy mix (with an emphasis on renewable energies).

The main criteria for the selection of these three areas is depicted in Figure 4. Iran's energy sector is almost entirely dependent on oil and gas and accounts for 87% of the country's overall GHG emissions. For this reason, all three fields of action belong to this sector. Among the sub-sectors, energy supply (power generation and refineries) is the top emitter, representing close to one third of emissions, followed by direct emissions from two main energy demand sectors: transportation and buildings (residential and commercial). Upstream emissions from gas flaring are a further major source of emissions, contributing as much as 19% to the country's overall emissions. The government's on-going efforts to reduce the energy intensity of the economy already address all three areas - energy demand, power supply and upstream oil and gas sector- and the INDC highlights these as well. Moreover, as will become apparent in later sections, there are currently low hanging fruits and important windows of opportunity in these areas, in particular in the context of the renewed international trade relations. The following is a brief summary of each area.

Demand-side efficiency through energy price reform: The removal of subsidies, enshrined under the government's "Targeted Subsidies Plan" and the "Law on Energy Consumption Pattern Reform" is a prerequisite for achieving energy efficiency. The government has instituted a series of energy efficiency measures to accompany the reform, but experts consulted suggest that the implementation of these measures needs to be strengthened. Moshiri (2015) recommends that the reform incorporates a specific timeline and measures to achieve energy efficiency. Moreover, targeted incentives and support to industry and households should be enhanced. Key sectors of focus are transport, domestic heating and appliances, and industrial equipment. It is also crucial to raise consumer awareness about potential savings from energy efficiency and the availability of appliances. Pilot audits in industry and the adoption of standards for buildings and industry are further avenues for action.

Figure 4: Selection process for proposed fields of action in Iran



Source: Authors

Upstream oil and gas efficiency, with an emphasis on gas flaring: best-practice examples across the world suggest that gas flaring and venting can be significantly reduced using a combination of incentives and penalties (World Bank, 2004). Countries such as Norway, the United States or Canada, require onshore and offshore oil producers to direct associated gas towards a market, power generation, or reinjection. Other key elements include maintaining a robust pipeline infrastructure and the incentivising of domestic gas markets (through fuel switching, promotion of CNG fleets, etc.). Increasing the accuracy of MRV is a crucial first step for Iran, where flare efficiencies of oil sites are not reported or even measured (current data are derived from visual observation or satellite measurements) (Soltanieh et al., 2016).

Investment in sustainable energy technologies, with an emphasis on renewable energy: Governmental stakeholders are increasingly acknowledging the potential for renewable energy in Iran, and various elements of the policy framework are being put into place, including the feed-in tariff. However, the INDC and other policy documents suggest there is also a strong commitment to combined cycle gas investments for the short term. Moreover, strategic planning for renewables is currently lacking. Iran's transition to a renewables-based future could benefit from transfer of policy innovations and best practice from other regions, in particular in the MENA region. The limits imposed on multi-lateral collaboration have to date hindered any significant collaboration in this area, but the sector has recently gathered significant momentum.

2 Part II: Full country analysis

2.1 Country background

Iran, officially the Islamic Republic of Iran, is the second largest country in the Middle-East and covers an area of 1.65 million km[2]. Iran is bordered to the north by Turkey, Armenia, Azerbaijan, Turkmenistan and the Caspian Sea; to the east by Afghanistan and Pakistan; to the south by the Persian Gulf and the Gulf of Oman, and to the west by Iraq.

Iran lies in the global sun belt. It therefore has not only vast underground fossil energy resources, but also enormous potential for harvesting solar energy. Moreover there is considerable geothermal and wind energy potential in different parts of the country (Supersberger et al., 2009).

Figure 5: Map of the Islamic Republic of Iran

Data sources: CIA (2017); MFA (2017)

Population. With a population of 80 million in 2016 (SCI, 2017; World Bank, 2017b), Iran has the second largest population of the region after Egypt. The rate of population growth declined from 2.6% p.a. in the beginning of the 1990s to 1.1% p.a. currently. Moreover, the average household size shrank from 5.2 persons in 1991 to 3.3 persons in 2016 (SCI, 2017). About 74% of the population lived in urbanised areas in 2014 (UN, 2017). By 2030, the population of Iran is forecast to reach 88.9 million (UNDESA, 2017).

Economy. Iran is an upper-middle income economy and is the second largest economy in the Middle East and North Africa (MENA) region after Saudi Arabia. Iran is a member of the G77, the largest country grouping of developing countries. Its estimated Gross Domestic Product (GDP) in 2016 was USD 412.2 billion (World Bank, 2017a). The Iranian economy relies mostly on oil and gas production, agriculture and services. Iran has the world's second largest proven natural gas reserves after Russia, ranks fourth in proven crude oil reserves and is the second largest oil exporter in the Organization of Petroleum Exporting Countries (OPEC) (EIA, 2017). Economic activity depends to a large extent on oil revenues: in 2016, oil exports accounted for almost 50% of total export earnings, almost 33% of the government revenue and 15.8% of GDP (CBI, 2017).

Iran's crude oil and natural gas production growth declined over the last period of international sanctions and its economy stagnated in 2015. It however bounced back sharply in 2016 with the implementation of the JCPOA, at an estimated 6.4% GDP growth. Benefiting from the lifting of oil sanctions on Iran and a recovery in exports, the inflation rate has decreased, from 39% in 2013 to 9% in 2016 (FES, 2017). The Iranian government has laid out its economic policies and goals in the latest Five-Year Development Plan for the 2017-2021 period as well as in the comprehensive Twenty-Year Vision Document. On the economic front, the development plan envisages an annual economic growth rate of 8% and reforms of state-owned enterprises. However, the World Bank and the International Monetary Fund forecast annual GDP growth to continue at a rate of 3.5 to 4% in the near term (IMF, 2017; World Bank, 2017c). According to the latest economic outlook of the World Bank in October

2017, due to uncertainties over the full implementation of the JCPOA, growth prospects are modest (World Bank, 2017d).

Table 1: Key socio-economic figures

Iran			
Population [million], 2016	80.3	Urban population [% of total], 2014	73.9
GDP [current billion USD], 2016	393.4	Air pollution index (µg/m^3)	43
GDP per capita [current USD], 2014	5,442.9	HDI, 2016	0.77
Gini coefficient, 2013	38.3	Corruption index, 2016	29
Electrification rate, 2014	99.4%	Vulnerability, 2016	0.39

Data sources: ND-GAIN (2017), Transparency International (2017), UN (2017), World Bank (2017b); Human Development Index (HDI): 0 – 1, with 1 being highest; GINI Index 0 – 100, with 0 = equal income distribution; Corruption perception index from Transparency International 0 - 100(0=highly corrupt to 100=clean); Vulnerability: 0 – 1, with 1 being highest, element of ND-GAIN index. Air pollution index: annual mean concentration of fine particulate matter <2.5 microns in diameter.

Political system. The Islamic Republic of Iran was established after the Islamic Revolution of 1979. Its political system combines elements of modern Islamic theocracy with democracy. The system is comprised of a Supreme Leader, as well as the Executive, Legislative and Judicial branches of power. The Constitution affirms the independence of each of the three branches from each other, but all three branches are under the direction of the Supreme Leader. The Supreme Leader is elected by an Assembly of Experts on the basis of his leadership abilities, religious qualifications and popular esteem. The President is the head of the Executive branch and the highest ranking official. He is directly elected by popular vote to a four-year term, for a maximum of two terms (Nachmany et al., 2015). The last presidential elections in Iran took place in May 2017. Transparency International's 2016 Corruption Perception Index ranks Iran 131st out of 176 countries, which stresses that corruption is a challenge for the country.

Iran's nuclear agreement with the international community (officially known as the Joint Comprehensive Plan of Action, or JCPOA) is of key importance in its political system. It is described in detail in section 2.7.

Position in the international climate negotiations. Iran signed the Paris Agreement in April 2016, but has not ratified it. The Agreement was approved by both the Iranian Cabinet of Ministers and the parliament (the Majles) who then sent it to the Guardians Council for consent to ratification. However, at the time of writing, Iran had not deposited its instrument of ratification with the Secretary-General of the United Nations (European Parliament, 2017; UNFCCC, 2017a). There are no clear indications as to when ratification will take place.

Climate change is considered a significant threat to Iran and its adverse effects are recognised by Iran's population and government. The chief of Iran's delegation to the COP23, Majid Shafie-Pour (also spokesperson for the Like-Minded Group of Developing Countries[1]), stressed in Bonn that Iran is part

[1] Iran is member of the Like Minded Group of Developing Countries (LMDC), which advocates for a strong distinction between developed and developing countries, and their respective responsibilities and capabilities, within climate negotiations.

of the global effort to combat climate change and that *"the Iranian government is doing its best to adhere to the climate principles"* (DW, 2017). The most obvious effects of climate change in Iran are water scarcity and the rise of average temperature by 1.8°C over pre-industrial levels, higher than the global average increase (DW, 2017). The country faces declining rainfall, exhausted groundwater reserves and evaporating lakes and rivers, which in combination with increased temperatures lead to impacts on agriculture indirectly on migration (DW, 2017; HBS, 2017). According to the INDC, agricultural production and the economy in general have faced damages amounting to 3.7 billion USD (based on fixed prices) annually from 2015 to 2030 compared to 2010 (DoE, 2015).

Emissions. In the last 25 years (1990-2015), Iran's GHGs emissions have more than tripled (European Parliament, 2017). In 2014 they reached an all-time high, with data ranging between 734 MtCO2e (excl. LULUCF) according to WRI and CAIT (2017) and 813 MtCO2e (excl. LULUCF) according to PRIMAP data (Gütschow et al. 2016, see Table 2). Iran features as the 11th largest emitter of GHG in recent rankings (WRI and CAIT, 2017), representing more than 1% of the world's emissions. In 2014, per capita GHGs emission per capita for Iran (10.4 MtCO2e), were comparable to those of Germany (Table 4).

Iran's emissions are dominated by the **energy sector which accounts for 87% of overall GHG emissions**. Among the sub-sectors, energy supply (power generation and refineries) is the top emitter, representing close to one third of emissions, followed by the two main energy demand sectors: transportation and buildings (residential and commercial) (Figure 4). In terms of fuel type, emissions from natural gas represent a little over half of emissions, whereas petroleum products are responsible for most of the remainder (Ministry of Energy, 2014). Though difficult to quantify, upstream emissions from gas flaring are an important component of energy-related emissions. Although statistical data vary considerably due to lack of monitoring and differences in assumptions on emissions factors, in recent years Iran has ranked as the third highest producer of emissions from gas flaring (Soltanieh et al., 2016).

While emissions from LULUCF (land use, land-use change and forestry) have remained stable with a minimal contribution to the total GHGs emissions, the share of non-energy related emissions from the industry sector has grown steadily in the past two decades. There is however a considerable lack of publicly available information on emissions shares and trends by sector.

The business as usual (BAU) scenario on which Iran's INDC is based foresees that the energy sector will grow 4.7% each year until 2030, which would result in an increase of GHG emissions from approximately 700 MtCO2e in 2010 to over 1,700 MtCO2e in 2030 (DoE and UNDP, 2014). Future trends are described in more detail in section 2.4 below.

Energy system. Primary energy supply in Iran added up to 236 Mtoe in 2014. In the past decade, energy consumption has grown by more than 50%, driven by the economic development, demographic growth, urbanization and a highly subsidised energy market. Primary energy demand is met mostly by natural gas (61%) and oil (37%), with marginal contributions of coal, hydroelectric, nuclear power, and woody biomass.

Iran is an energy rich country, and a net energy exporter. The abundance of energy resources has often led to their mismanagement and inefficient use (Moshiri and Lechtenböhmer, 2015). In order to curtail wasteful energy use and limit domestic demand growth, Iran has pursued an energy subsidy reform in the last two decades. Reforming the domestic energy market has been central in the agenda of the country's 5-year development plans of the country since 1995 (2nd, 3rd, and 4th Five-Year Development Laws). The Law on Energy Consumption Pattern was passed in in 2010, and the second phase of reform was implemented in 2014. The essence of recent reforms has been to gradually raise the prices of domestic petroleum products, natural gas, and electricity, while promoting the participation of the private sector, the creation of energy service companies, and the implementation of energy efficient technologies. Energy subsidy reform is crucial from a climate change perspective, however it has been slowed down by a range of factors. Among other things, reforms had an inflationary effect and contributed to Iran's growing budget deficit, and the amount of projected revenue from subsidy savings has not always been realised. Subsidy reform is dealt with in further detail in section 2.6.1.

Over 84% of Iran's power generation is produced from natural gas (THC, 2017). The extremely rapid growth in electricity demand in the last decades has led to supply shortfalls during peak times. Still, the annual electricity consumption per capita (~3000kWh/capita) is less than half of Germany's (~7000kWh/capita). The government plans to expand generation capacity to meet domestic demand and increase its exports. Iran is a net exporter of electric power. It is worth mentioning that although the electrification rate is in total above 99%, in 2014 still 1.5 million people in rural areas had no access to modern energy (UNDESA, 2014).

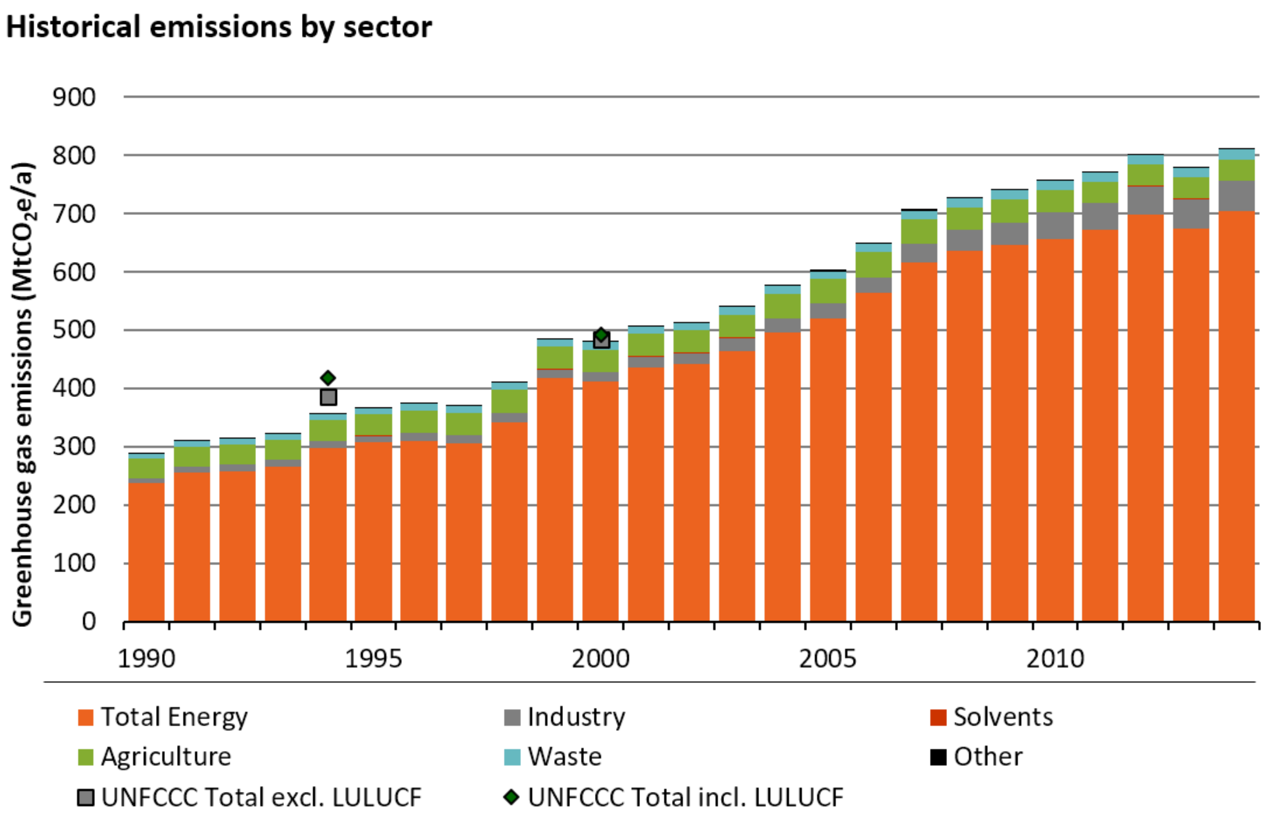
International sanctions have stymied investments across Iran's energy sector, especially affecting upstream oil and natural gas projects (EIA, 2017). Over 90% of Iran's gas production is for domestic consumption (Bloomberg, 2017).

Bilateral cooperation with Germany. For a long time there were no significant cooperation ties between Germany and Iran, including with regards to energy or climate-related investments funded by Germany. The nuclear agreement reanimated bilateral relations, and the German cooperation agency (GIZ) and other organisations have since supported meetings between Iranian and German experts to exchange knowledge and expertise on climate and energy policies, water resource management, urban development and environmental protection (GIZ, 2017).

In February 2017, high-level talks were held between Germany's State Secretary for the Environment and Iran's vice-president on Germany's support to Iran to implement its national climate protection targets (BMU, 2017a). At this occasion a Letter of Intent was signed with the aim of strengthening collaboration on low-carbon economies (BMU, 2017a). Moreover, the German Federal Environment Ministry aims to support Iran in its implementation of national climate action targets. It is expected that this collaboration will be reinforced by the signing of the Memorandum of Understanding between the European Union and Iran regarding cooperation on climate change (Council of the European Union, 2017). This MoU, which sprang from the High-Level Conference on Climate Action and Sustainable Energy held in April 2017 in Tehran, was approved by the EU Council in October 2017, but is still pending signature. It foresees technical assistance with an emphasis on climate resilience as well as adaptation. ,In 2016, the European Commission announced plans to launch a High Level Energy Dialogue on non-nuclear energy with Iran, though details are still to emerge.

A number of specific research collaborations are already underway. An example is the bilateral workshop on "Sustainable Transformation of the Energy System in Iran" supported by Friedrich-Ebert-Foundation, allowing an exchange between researchers (WI, 2017). In 2017 a joint project between German and Iranian researchers set out to foster skills and capacities on renewable energy technologies, and promote an envisaged Green Energy Center. The project is led by TU Berlin and supported by the International Climate Initiative (IKI) with around 1.5 million EUR (BMU, 2017b).

Figure 6: Emissions profile of Iran



Data sources: Gütschow et al. (2016); UNFCCC (2016)

Table 2: Emissions data from PRIMAP (2014)

Sector	$MtCO_2e$	Share in 2014
Total (excluding LULUCF)	813	100%
Total energy	704	87%
Industry	52	6%
Solvents	0	0%
Agriculture	37	5%
Waste	17	2%
Other	3	0%

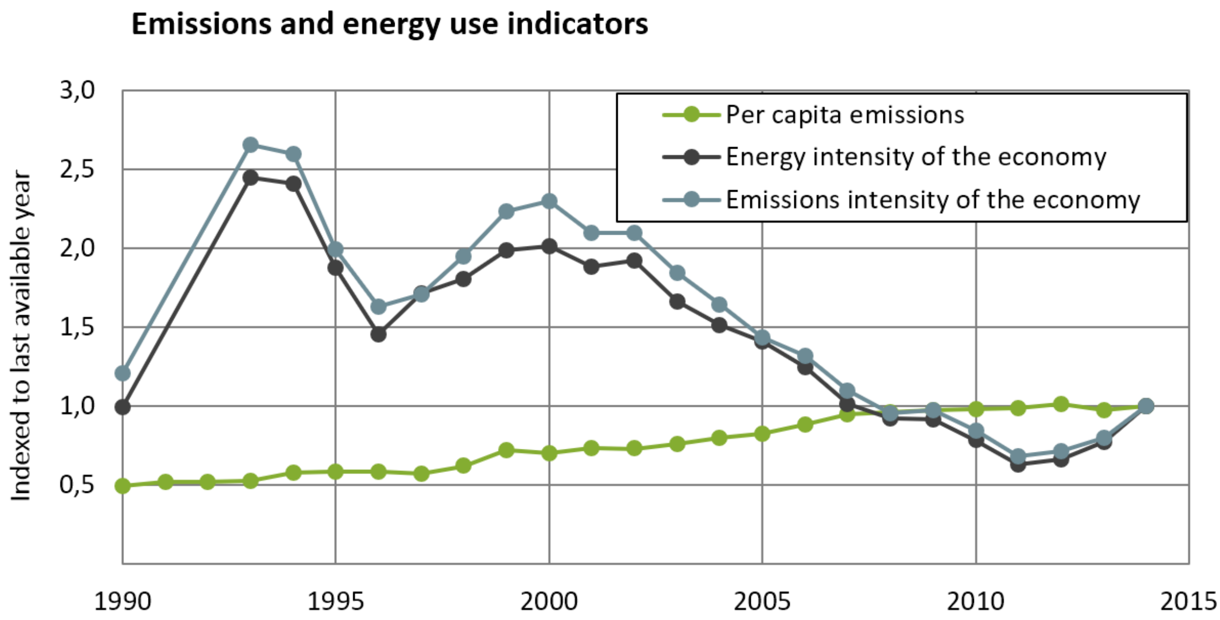
Data sources: PRIMAP database (Gütschow et al., 2016)

Table 3: Emissions data from UNFCCC (2014)

Sector	$MtCO_2e$	Year
Total (excl. LULUCF)	484	2000
LULUCF	9	2000

Data sources: UNFCCC (2016)

Figure 7: Iran emissions and energy use intensity, 1990 - 2014



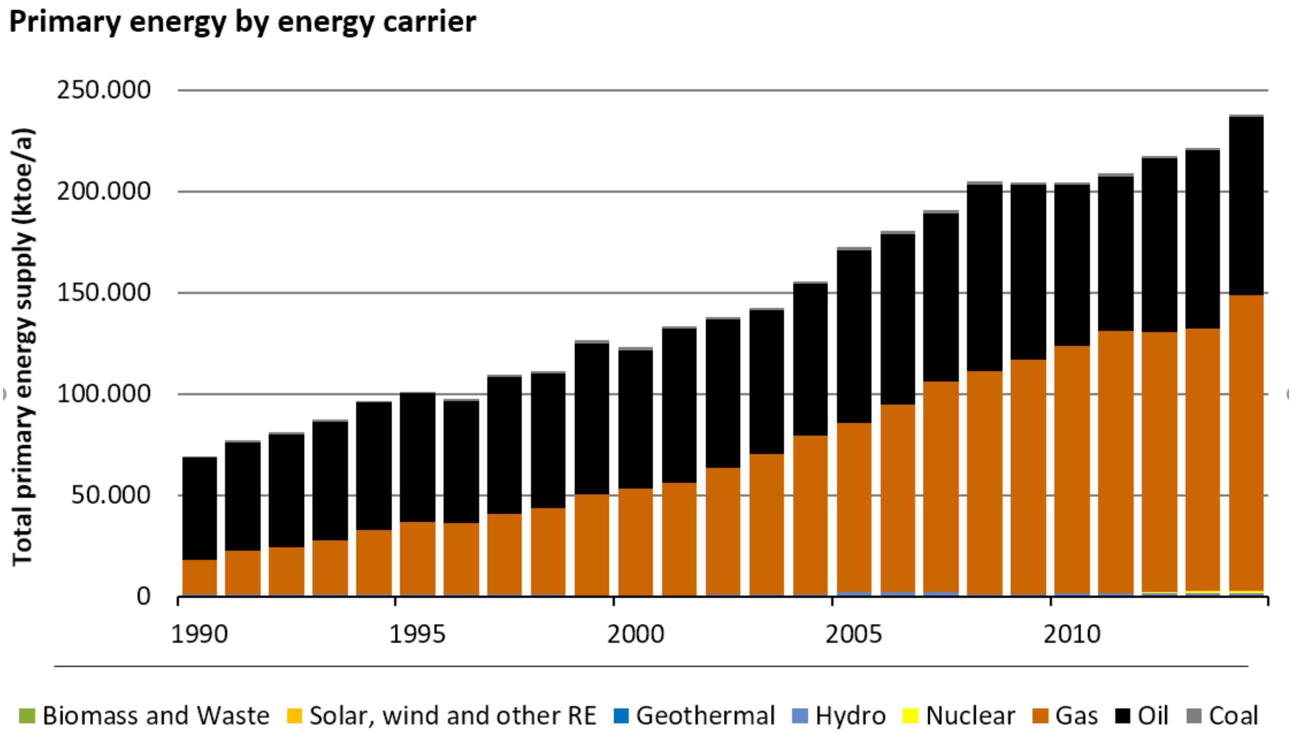
Data sources: Gütschow et al. (2016); IEA (2016b); ND-GAIN (2017); World Bank (2017e)

Table 4: Key emissions, energy and environmental data (2014)

Indicator	Iran	% change since 1990	World	Germany	Year
GHG/cap [tCO2e/cap]	**10.4**	+89% (5.51)	6.42	10.8	2014
GHG/GDP [tCO2e/mln 2017 USD]	**1,911**	-17,5% (2315.5)	592.6	225	2014
Energy/GDP [ktoe/mln 2017 USD]	**0.559**	+0.5% (0.555)	0.174	0.08	2014
Global share of emissions [%]	**1.0%**	+37.8% (0.74)	100%	1.8%	2012
Air pollution index (PM2.5)	**42**	-13% (48.3)	38	14	2014
Vulnerability index [0 – 1]	**0.36**	-12.2% (0.41 in 1995)	n.a.	0.23	2014

Data sources: Gütschow et al. (2016); IEA (2016b); ND-GAIN (2017); World Bank (2017e)

Figure 8: Energy profile of Iran, 1990 to 2014



Data sources: IEA (2016a)

Table 5: Total primary energy supply by fuel in 2014

Fuel	Primary energy (ktoe)	Share in 2014
Biomass and waste	517	0,22%
Solar, wind and other RE	30.8	0,01%
Geothermal	0	0%
Hydro	1,192	0,50%
Nuclear	1,165.4	0,49%
Gas	145,861	61,4%
Oil	87,929	37,0%
Coal	887	0,37%

Data sources: IEA (2016a)

2.2 Institutional set up

The main responsibilities regarding climate change mitigation and adaptation lie in the Department of Environment. The department is not a ministry but a governmental agency under the supervision of the president. The head of the department is also one of the twelve Vice-Presidents of Iran.

Within the Department of Environment, a **National Climate Change Office (NCCO)**, also called National Climate Change Working Group, was established in 1998. Its main responsibilities are the preparation of National Communications (NCs), the enhancement of capacities for GHG inventorying and MRV, the preparation of the national action plan for adaptation (NAPA), awareness raising and the mainstreaming of climate change into planning. The NCCO comprises the deputies of the most relevant ministries and is also responsible for the coordination of the Sub-committee for Climate Change under the National Committee for Sustainable Development (Grantham Institute, 2017). The Committee is organised into working groups, as well as two cross-cutting groups on mitigation and adaptation, which ensures that the policies and projects are relevant across sectors and regions. The organizational structure of the committee is presented in Figure 9, as shown in the NC2 (DoE and UNDP, 2010). Possibly a revised structure chart will be included in the NC3, currently under preparation. The department of Environment also supervises the National CDM Committee, composed of nominated members from key ministries and organizations (Nachmany et al., 2015).

The bulk of Iran's mitigation potential lies in its energy supply and demand sectors. As such, **other ministries and agencies** play central roles in the country's climate-relevant policy architecture:

- Supreme Energy Council, which oversees the energy sector, is chaired by the President and comprises the Ministers of Petroleum, Ministry of Energy, Ministry of Economic Affairs and Finance, Ministry of Industry, Mines and Trade, and Ministry of Agriculture, amongst others.
- Renewable Energy and Energy Efficiency Organization (SATBA), under the authority of Iran's Ministry of Energy. The Ministry of Energy is also responsible for water management.
- Operating under the auspices of the Ministry of Petroleum:
    - Iran Fuel Conservation Organisation (IFCO), established in 2000 with the mission to regiment fuel consumption in the energy chain from supply side to demand side through review and survey of fuel consumption trends and executing conservation measures nationwide. IFCO focuses on Article 12 of the Law on Elimination of Competitive Production Barriers and Financial System Improvement by designing and implementing performance-based energy efficiency programmes in different high-energy intensity sectors. Currently programmes focus on central heating systems of buildings, gas space heaters,, renewal of truck, bus, and taxi fleets, railway, as well as upstream oil, gas, and petrochemicals.
    - The National Iranian Oil Company (NIOC), owning a vast amount of oil and gas reserves, is one of the world's largest oil companies. Since 1951, NIOC has been directing and making policies regarding exploration, drilling, production, research and development, refining, distribution and export of oil, gas, and petroleum products.
- Other influential ministries include those of Roads and Urban Development, and Industry, Mines and Trade.

Iran signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and ratified the Convention in 1996. The **National Rules of Procedure for Implementation of the UNFCCC**, last revised in 2012, mandate all relevant ministries to develop and implement programmes leading to mitigation and adaptation of climate change.

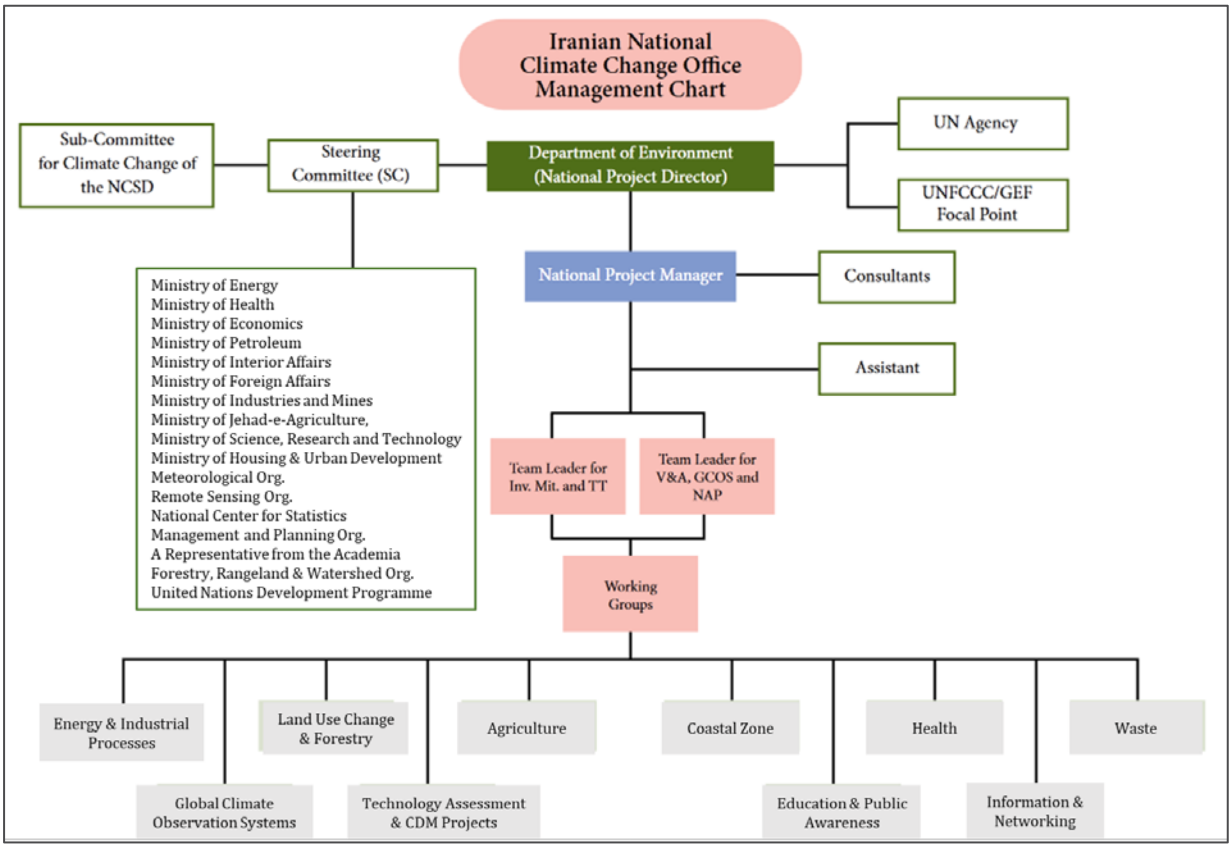
The current sixth Five-year Development Plan (2017-2021) does not make any mention of climate change. Nevertheless, in May 2017, Iran launched its National Strategic Plan on Climate Change (UNDP Iran, 2017). More details about it are given in section 2.5.1 below.

In the realm of adaptation, a Vulnerability and Adaptation (V&A) Assessment was conducted by the National Climate Change office in 2014 and incorporated into the draft NC3. The NC2 put forward a number of resource management strategies to tackle climate vulnerabilities, including the vulnerability of Iran's economy to response measures taken by Annex I countries to reduce their oil and gas demand. The Iranian government has as yet not prepared a National Adaptation Plan.

The adverse effects of climate change have become increasingly evident in Iran over the past decade, and the Iranian government acknowledges this in its INDC. Expert interviews reveal that climate change adaptation measures are often seen as a priority over mitigation. Issues of particular concern are altered dust and sand storm as well as drought patterns in the semi-arid regions (Keramat et al., 2011; Khanjani, 2016; Modarres et al., 2016). Ministry officials are increasingly seeking advice on the links and synergies between climate change and food, water and energy security (also known as the 'Food-Water-Energy Nexus').

The institutional set up of Iranian climate policy is constrained by the limitations in multi-lateral cooperation. A number of international support commitments that were under discussion after the nuclear deal was struck were put on hold in 2017 following statements of the president of the United States regarding plans to "decertify" the deal and of the president of France requesting negotiations with Iran regarding ballistic missiles (see section 2.7). Much of the country's policy steps to date have been supported by UNDP, with finance from the Global Environment Facility. Experts consulted have pointed out that UNDP and GEF will not support Iranian climate policy initiatives as of 2018.

Figure 9: National Climate Change Office Management Chart



Source: DoE and UNDP (2010)

2.3 MRV of GHG emissions

Iran submitted its first National Communication to the UNFCCC in 2003, providing GHG inventory data for the year 1994. The Second National Communication (NC2) was submitted in 2011, with a more detailed inventory presenting calculated emission data for the year 2000 and projected data for 2010-25.

A Third National Communication is in the making and drafts are partly available online (DoE and UNDP, 2014), offering inventory data for the year 2010 and projections until 2030. The draft Third National Communication (NC3) provides more detail on the emissions of each sector than the previous communications. No Biennial Update Reports (BUR) have been delivered yet. All three national communications have been prepared by the National Climate Change Office (NCCO, see above), with the support of GEF and UNDP.

In both submitted communications, difficulties of gathering activity data were stressed. Iran's national MRV system is being developed. The INDC suggests that it will be operational by 2020 (DoE, 2015). The NCCO is responsible for the coordination of data collection for the national GHG inventory, and ultimately for reporting to the UNFCCC. There are however no details on how current efforts are organised nor on the plans for implementing the MRV system by 2020. It is unclear whether any international donor agency has shown an intention to provide technical assistance or support capacity building in this realm. Personal communications with Iranian experts revealed that the process will resume once the Paris Agreement is ratified and the NDC approved.

The emissions inventory in the draft NC3, uses the latest (2006) IPCC guidelines and provides an example of the template that was sent to governmental agencies to report on activity levels. Due to a lack of national or local robust data, a Tier 1 approach was applied. National emission factors are however available for specific subsectors, such as the energy sector (IPCC Sector 1A, Fuel combustion activities) and the cement industry within industrial sector (IPCC Sector 2, Industrial Production and Product Use (IPPU) (DoE and UNDP, 2014).

2.4 Description and evaluation of the INDC

Iran's Intended Nationally Determined Contribution (INDC) was published in November 2015, shortly before COP21. The INDC contains an **unconditional reduction pledge of 4%** versus a business-as-usual (BAU) scenario in 2030, and **a pledge of 12% reduction** versus BAU scenario subject to the presence of **international financial and technical support** (DoE, 2015). It is important to note that both the unconditional and conditional pledges are subject to the removal of current sanctions and absence of sanctions in the future. The cost of implementation is expected to be around 70 billion USD, split into 17.5 billion USD for the unconditional reduction and an additional 52.5 billion USD for the additional 8%. No NDC has yet been published.

The INDC document itself does not present quantitative values for the BAU or mitigation scenarios and it makes no specific reference to the sources of emission reductions. It however states that international sanctions have prevented Iran from reaching previous targets for reductions (30% energy intensity reduction in the last Five-year Development Plan 2011-2015). It also states that its energy intensity actually increased as a result of the sanctions, which is in line with the data presented in Figure 7. The INDC moreover highlights the need for phasing out of energy subsidies in order to achieve the unconditional and conditional commitments. However, costs for such a measure are not presented.

Due to the lack of detail of Iran's INDC, no in-depth assessments of the pledges have been published to date. The underlying assumptions for the BAU and mitigation scenario in the INDC are however laid out in the energy sector chapter of the draft of Iran's Third National Communication (DoE and UNDP, 2014), which is described in more detail below. It is important to note that, although parts of this national communication are publically available, this document has not been submitted to the UNFCCC, nor endorsed by the government as its official position.

An analysis by the European Parliament (2017) considers that **Iran's INDC pledges are relatively modest compared to the projected increase in emissions.** Personal communications with Iranian climate policy experts suggest that there is a general consensus that both the unconditional and conditional commitments could be achieved relatively easily, including with measures against gas flaring and efficiency. For comparison, in their scenario analysis of Iran's future energy system, Moshiri and Lechtenboehmer (2015) find that the viable reduction potential of Iran's emissions could be around 40% versus BAU (with energy efficiency measures only), or up to 50% if combined with renewable energies. It is moreover important to stress that the baseline and mitigation scenarios in the INDC assume a very strong GDP growth of 8% per annum (in line with the current sixth Five-Year Development Plan). Under current conditions, even if the uncertainty around sanctions were to dissipate, this target can be considered ambitious, with IMF and World Bank forecasts pointing at a 4% growth in the near term (see Economy under section 2.1). In other words, emission growth projections may be overestimated.

Finally, the INDC document highlights the need for significant investments into adaptation - about 100 billion USD in total - and emphasises measures related to the water sector: infrastructure, demand management, increased efficiency, and new water resources.

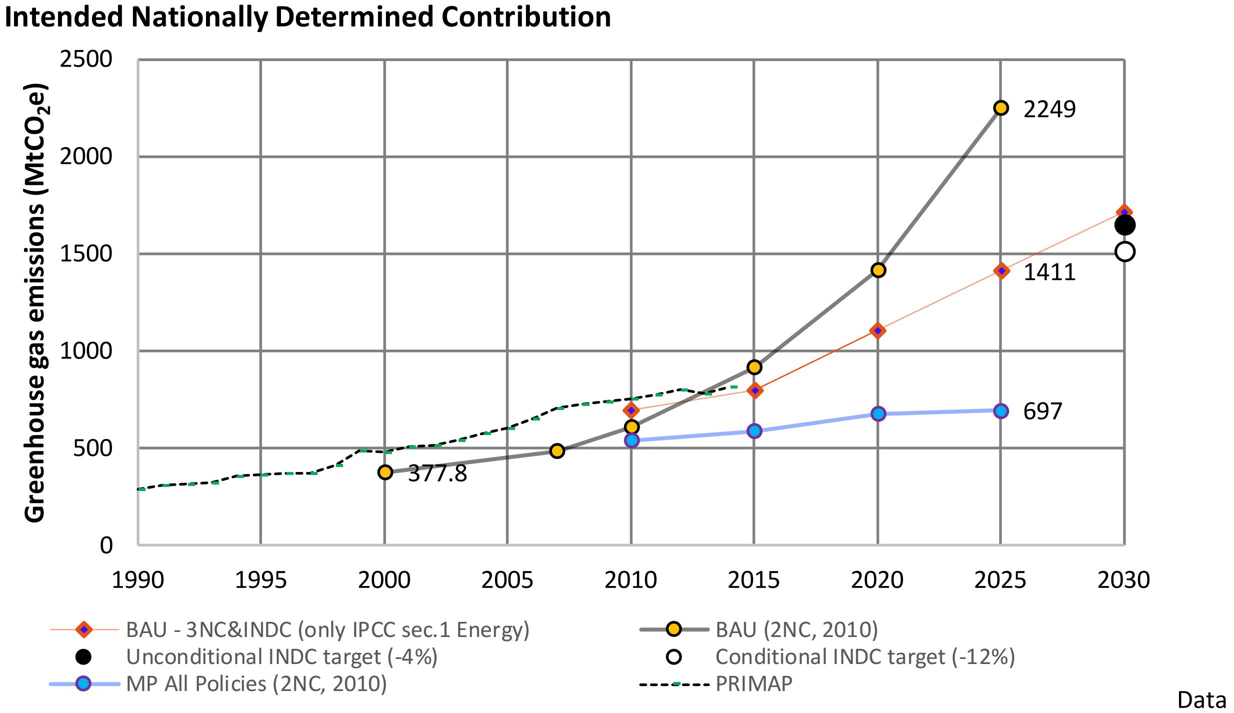
BAU and mitigation scenarios in Second National Communication, Draft Third National Communication and INDC

The figures of projected GHG scenarios presented in the latest officially submitted NC2 (DoE and UNDP, 2010) are quite different from the ones given in the draft NC3 (DoE and UNDP, 2014). In the NC2, the projected BAU emissions for 2025 are considerably higher, with 2,250 Mt CO_2e. The mitigation potential in the "All Policies" mitigation scenario is of 64%, bringing emissions down to 700 MtCO_2e by 2025. On the other hand, the NC3's projections are more moderate, with around 1,400 MtCO_2e and 1,700 MtCO_2e by 2025 and 2030 respectively, and a significantly lower reduction potential of 4-12% versus BAU (Figure 10).

The BAU scenario in the draft NC3 envisages an average annual emissions growth rate of 4.7%, for the energy sector as a whole, with the highest growth rate of 5.9% per annum in the transport sector. As a result, emissions more than double by 2030 (from approximately 700 MtCO_2e in 2010 to over 1,700 MtCO_2e in 2030). The mitigation scenario of the NC3, on the other hand, presents an overall reduction of 210 MtCO_2e by 2030, corresponding to the conditional 12% reduction target. The pathway to achieving the 2030 vision is almost linear, with a slightly slower rate of reductions in the 2010-2015 period. Reductions arise mainly from four subsectors: industry, natural gas supply chain (gas treatment facilities and transport and distribution work), electricity generation and transport, with shares of 2.85%, 2.71%, 2.26% and 2.24%, respectively. When summed together, the reductions from gas flaring and gas supply chain management constitute 70 MtCO_2e, which is equivalent to 4% of 2030 emissions. Expert interviews suggest that, while not stated explicitly in the INDC, these two measures constitute the unconditional mitigation pledge. Reducing gas flaring therefore seems to be perceived as a low-hanging fruit with considerable co-benefits and margin for additional reductions.

There are a number of discrepancies between the draft NC3 mitigation scenario and the INDC. The former assumes a 2015 start in reductions, while the INDC assumes a 2021 start. Moreover the **investment costs that the draft NC3 suggests** (12 to 38 billion USD) **are different from those stated in the INDC document** (70 billion USD). Communications with experts suggest that this may be partly due to differences in methodology (Net Present Value vs. total investment cost). The draft NC3 does not provide a whole-economy mitigation scenario across energy and non-energy sectors. The NC2 does present such an integrated perspective, which shows that the energy sector plays an overwhelmingly dominant part on the overall mitigation, with non-energy sector only marginally contributing to the 2025 vision. Expert interviews suggest that the same pattern occurs in the NC3.

Figure 10: Historic emissions, BAU projections and pledge according to Iran's INDC (energy sector only)



Data sources: DoE (2015), DoE and UNDP (2014), Gütschow et al. (2016). NB: *only energy sector included in NC3 and INDC*. BAU = Business as Usual. MP = Mitigation scenario in NC2.

2.5 Climate change mitigation policies and strategies

2.5.1 National Communications & Strategies

Key strategic guidelines can be found in Iran's NC2 and in the draft of the NC3. It is important to note that, although parts of the latter are publically available on the website of the National Climate Change Office, the draft NC3 has not been submitted to the UNFCCC, nor endorsed by the Iranian government as its official position.

In May 2017, Iran launched a National Strategic Plan on Climate Change (UNDP Iran, 2017). It is important to stress that this document is only available in Persian, and is not publicly available. Experts consulted report that the plan sets out strategies for mitigation, water resource management, agriculture, food security, natural resources, biodiversity and human health on a 15-year horizon and that it also identifies responsible organizations. The elaboration of the plan included the collection of a series of short-term and mid-term strategies based on studies by the Department of Environment. The list was then updated in collaboration with academics and experts from different organizations to reach achievable targets. It now contains about 60 mitigation-centered policies. The relationship between these policies and the Iranian INDC target of 4-12% reduction versus BAU is not explicit.

The National Strategic Plan on Climate Change was originally intended as an appendix to the current sixth Five-Year Development Plan, outlining the Plan's approach to low-carbon economy. This was not approved by the Iranian Cabinet, but the following mitigation targets contained in the National Strategic Plan were brought into the main body of the Five-Year Development Plan:

- Increase share of renewables (including large hydropower) to 5% of total installed generation capacity by 2021,
- Developing market based measures to implement energy efficiency,
- Sustainable waste management,
- Curbing gas flaring by 90% by 2021, with a goal to control it completely after that date,
- Energy efficiency improvement of power plants,
- Decreasing energy consumption in the building sector by 5%,
- Restricting registration of vehicles lacking Euro IV standard,
- Industrial restructuring and modernization to achieve lower energy intensity, and
- Increasing the share of railway transport compared to other modes of transport.

In parallel to the National Strategy, the draft NC3 also formulates a series of mitigation actions required to achieve the INDC's unconditional and conditional pledges by 2030 in the energy sector (Table 6). The text states that the National Climate Change Office has drawn up these measures in close collaboration with the relevant governmental institutions. The level of detail of the measures proposed in the draft NC3 is comparable to those in the NC2, though the latter performs a more thorough analysis of the potential and cost implication of each measure, as well as a sensitivity analysis of the effect of different GDP growth assumptions.

Other than these documents, there is no further sub-national (regional or municipal) climate change strategy.

The NC2 also put forward a National Action Plan with specific tasks assigned to different members of the National Climate Change Committee. This plan was laid out in 2010 on the basis of the "National Rules of Procedure for Implementation of the UNFCCC and Kyoto Protocol" that were approved in 2009, and places a strong emphasis on adaptation measures. The progress on the status of implementation of this plan is not found in the draft NC3.

The INDC proposes further efforts in non-energy related industrial processes, forestry, sustainable agriculture and waste management, conditional to removal of sanctions and international support (DoE, 2015). It further states that the present and three forthcoming 5-year national development plans will be harmonised with the INDC and the national strategy for climate change. It also remarks that the INDC may be revised every five years or less as deemed appropriate.

Table 6: Mitigation measures in draft Third National Communication (NC3), Energy sector (DoE and UNDP, 2014)

Subsector	Mitigation measure
Household and commercial	Improving **energy efficiency** of **central heating** systems: reduction of natural gas consumption by 9.85 to 13.16 million m^3/day by improving energy efficiency in 500,000 sets of residential and 100,000 sets of commercial buildings.
Industry	**Decrease energy consumption by 1% annually**, via renewal of currently obsolete processing equipment and machinery. **Switching to natural gas** to decrease consumption of liquid and heavy fuels. Introducing **energy efficient technologies** (e.g. boilers and electric motors) in manufacturing and mining sector. **Promoting use of high temperature waste** heats via Combined Heat and Power (CHP) and Waste Heat Recovery (WHR).
Agriculture	**Fuel switching in agricultural wells:** Reducing diesel consumption by replacing diesel engines with electric submersible pumps in 217,000 water wells.
Transport	**Rail transport capacity expansion**: from 17.4 billion to 34.2 billion passenger-km/year in 2023; freight rail capacity from 21.7 to 75.8 ton-km/year in 2024. **Public transport expansion and efficiency:** Scrapping of 17,000 diesel buses and 140,000 gasoline taxis and introduction of 27,000 Compressed Natural Gas (CNG) buses and 500,000 CNG long-range-taxis; Extension of subway network in 8 cities (145 km in total). **Motorcycle and road freight efficiency:** Replacement of 400,000 gasoline powered 125cc motorcycles with electric bikes; replacement of 450,000 gasoline-fuelled pickups and 500,000 diesel trucks with CNG pickups and trucks.
Power generation	**Renewable energies**: 6 GW wind and 18.7 GW hydropower installed by 2030 (2013 capacities were 98 MW and 10 GW respectively). **Improved efficiency thermal generation:** Raising share of efficient combined cycle power plants with thermal efficiency of around 45% in generation mix from 27.3% in 2015 to 54.2% in 2025 (via retrofitting or new turbines). **Nuclear power:** Further 2 GW nuclear power installed with load factors as high as 90%. With a 1 GW nuclear power plant already operational, total nuclear-derived power production capacity would reach 3 GW.
Oil and gas activity *	**Recovery of total gas flared** in offshore and onshore oil extraction facilities. **Flare gas reduction** in gas treatment facilities. **Methane leakage reduction** in transport and distribution of natural gas.

* Interviews suggest these measures constitute an unconditional mitigation pledge.

2.5.2 NAMAs, carbon finance and CDM

There are no official Nationally Appropriate Mitigation Actions (NAMAs) in Iran. The Climate Change Office presented a hypothetical NAMA for the Energy Sector in 2015 (Nasseri, 2015). The twelve proposed high-priority projects were centered around energy efficiency, fuel switching, the development of underground and public transportation systems (with reductions estimated at 157 $MtCO_2e$) and the renovation of 65,000 trucks (ca. 93 $MtCO_2e$). Subject to the availability of international financial support, the goal of this hypothetical NAMA was to achieve a reduction of 400 $MtCO_2e$.

Iran ratified the Kyoto Protocol on 22 August 2005 and established its Designated National Authority (DNA) for the Clean Development Mechanism (CDM) in October 2006. A total of 26 small- and large-scale projects are listed under the CDM of the UNFCCC for Iran (UNFCCC, 2017b), some dating back as far as 2009, and some as recent as 2016. The overwhelming focus of the projects is on retrofitting or new installations of combined cycle gas turbines, as well as fuel switching. A few biogas, wind and gas flaring-related projects are also present in the list. The set of projects as a whole could achieve an estimated total of 8 $MtCO_2e$ certified emissions reductions (CERs). Expert interviews carried out by Alizadeh et al. (2016) revealed that lack of capacity and long-term planning as well as international sanctions are considered key barriers to CDM as a finance mechanism in Iran.

The INDC briefly mentions the integration in the international carbon trading markets as a mitigation measure (DoE, 2015).

2.5.3 Climate change related policies

National energy and subsidy reform policies have a strong bearing on the Iranian climate strategy. An overarching measure of the 5th development plan (2011-2015) was the target to reduce energy intensity by 30%. The current Sixth Development Plan (2017-2021) contains no such overarching target, though it targets reductions in energy use in buildings by 5%, an increase in installed renewable energy capacity to at least 5% of the country's total capacity by 2020, and a reduction of gas flaring by a minimum of 90% by 2021.

Some of the landmark climate-related energy policies are introduced here (drawing mainly from Grantham Institute (2017) and IEA (2017)), as well as consultations with experts, whereas their potential and the barriers hindering them are analysed in Section 2.6:

- The Budget for Purchasing Renewable Energy Electricity of 2013 , in accordance with Article 5 of the Electricity Industry Support Law, the annual budget laws, and the revised Feed-in Tariff law, stipulates that an additional duty (or solidarity tax) be collected from electricity consumers, except those of rural households, to be destined to Iran's Power Generation, Transmission and Distribution Management Company (TAVANIR), and spent exclusively on development and maintenance of rural electricity grids and generation of renewable and clean electricity.
- Article 12 under the Law on Elimination of Competitive Production Barriers and Financial System Improvement (2015), provides a legal foundation for the Ministries of Petroleum and of Energy, among others, to support and attract investment on energy and water savings.
- The 2010 energy price reform law, also known as the Targeted Subsidies Plan or Subsidy Removal Plan (more details in section 2.6.1).
- The Law on Modifying Energy Consumption Patterns, passed in 2011, which established the general guidelines for energy consumption. It aimed to reduce energy intensity by half in 2020 and called for the improvement of energy efficiency in power plants, industries, transport sector, and in residential and commercial buildings. This improvement should be promoted through the establishment of energy standards and labelling, financial incentives, among other mechanisms. Moreover, article 61 of this law obligates the Ministry of Energy to purchase electricity through long-term contracts with a guaranteed tariff.
- As of 2012, Iran passed laws on feed-in tariffs for renewable energy and a financial support mechanism to incentivise private sector investment in renewable energy. The tariffs and contract terms and conditions have been revised annually.
- The National Development Fund of Iran (NDFI), which was established in January, 2011, based on the fifth Five-Year Development Plan. The fund directs a portion of oil and gas revenues towards productive, sustainable investments.

Although strategies, policies and laws on improving energy efficiency and promotion of renewable energy resources have been formulated in Iran since 1995 there is a series of major challenges that hinder their implementation:

- The monopolistic and state-regulated nature of the energy market, which gives little room for market mechanisms to have an effect on energy prices and productivity, and few incentives to the private sector to participate in the energy market;
- Macro-economic factors: recurring inflation, economic recession and reduced annual budget due to dwindling oil revenues, coupled with the high fiscal burden of the subsidy reform have led to the government stalling reform (see section 2.6.1);
- Modest success in promoting private investments in energy efficiency and renewable energies, whether from international or domestic investors. The latter face the challenges of high cost of capital and lack of know-how (see section 2.6.3). International sanctions have been a further obstacle for domestic investors to cooperate with experienced international companies.

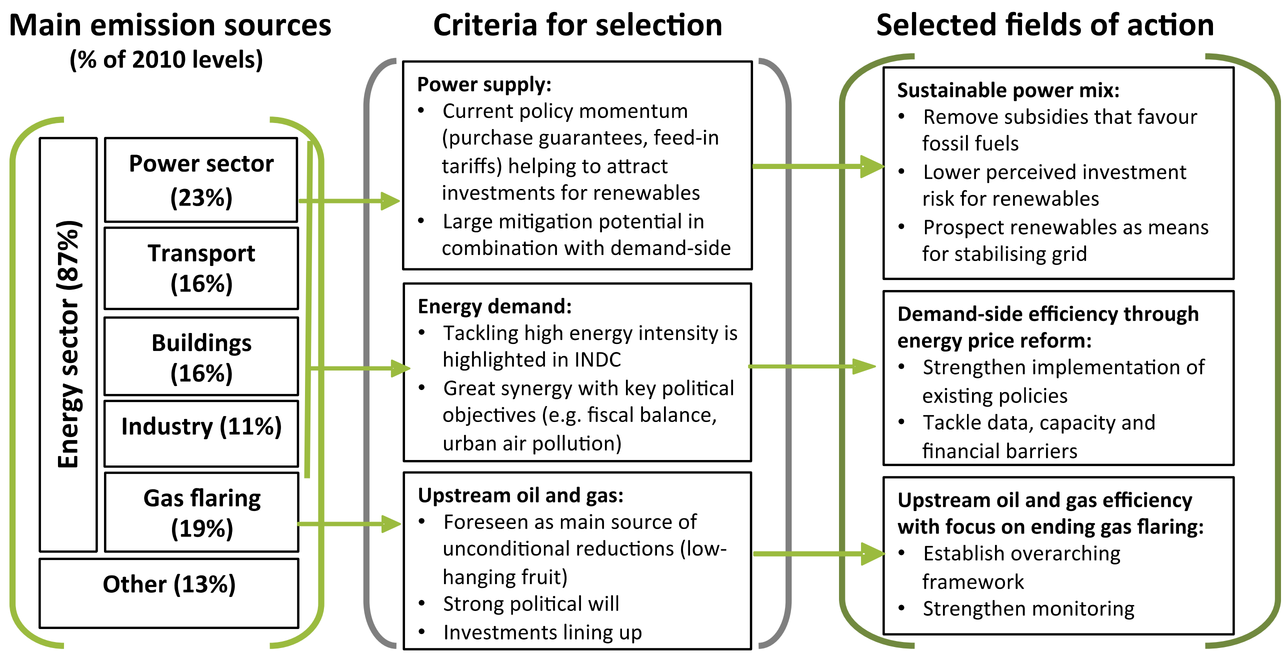
2.6 Additional mitigation potential

Further to the 4 to 12% reduction pledge (against BAU) presented in the INDC, there is considerable additional mitigation potential. Following a review of Iran's mitigation pledges, existing literature and expert interviews, three fields of action have been selected for this study based on their mitigation potential, feasibility, costs and potentials and co-benefits: demand-side efficiency through energy-price reform, upstream oil and gas efficiency (with an emphasis on gas flaring) and building a sustainable energy mix (with an emphasis on renewable energy).

The main criteria for the selection of these three areas is depicted in Figure 11 below. As stated earlier, Iran's energy sector is almost entirely dependent on oil and gas and accounts for 87% of the country's overall GHG emissions. For this reason, all three areas of focus belong to this sector. Among the sub-sectors, energy supply (power generation and refineries) is the top emitter, representing close to one third of emissions, followed by the direct emissions from two main energy demand sectors: transportation and buildings (residential and commercial). Upstream emissions from gas flaring are a further major source of emissions, contributing as much as 19% to the country's overall emissions. The government's on-going efforts to reduce the energy intensity of the economy already address all three areas - energy demand, power supply and upstream oil and gas sector- and the INDC highlights these as well. Moreover there are currently low-hanging fruits and important windows of opportunity in these areas, in particular in the context of the renewed international trade relations.

The following sections outline these three key areas and analyse the barriers hindering progress.

Figure 11: Selection process for proposed fields of action in Iran



Source: Authors

2.6.1 Demand-side efficiency through energy price reform

Moshiri and Lechtenböhmer (2015) estimate that the potential of Iran for reducing 2030 GHG emissions via demand-side energy efficiency could be around 40% versus BAU. Moreover, efficiency measures would deliver emission reductions at lowest cost. The INDC lists energy efficiency in the consumer demand sectors as one of its areas of focus, and specifically highlights the need to phase out energy subsidies in order to achieve Iran's unconditional and conditional commitments. The plan for concluding subsidy reform and implementing other accompanying energy efficiency measures – as well as their costs and co-benefits - are not presented in the INDC nor in the draft NC3.

Energy price reform has been pursued in the last two decades as a means to lower the country's energy intensity, and relieve the economy of a costly burden. While it affects all fuels including natural gas, its main focus is on the transport sector. A number of other energy efficiency policies have also been developed (e.g. standards and labelling for appliances), though not as part of a unified approach where price and non-price signals could complement each other (Moshiri and Lechtenböhmer, 2015).

Background. In the late 2000s, Iran had one of the highest rates of energy subsidies in the world. Deteriorating economic conditions, new UN sanctions levelled against Iran, and the inequality in subsidy capture (the richer top quintile captured 65 % of the energy subsidies, while the bottom quintile only 8 % (Atansah et al., 2017)) lead to a breaking point. As a result, the government of Iran passed an energy price reform law, the Targeted Subsidies Plan or Subsidy Removal Plan, in 2009. In 2010 the price for one litre of gasoline was around 0.1 USD, one of the lowest in the world. By 2016, it had gradually increased to 0.4 USD/litre, ranking tenth in the list of countries with lowest petrol prices in the world (GIZ, 2016). Households and industries received generous compensation in the form of cash transfers, sometimes as high as 10% of a monthly wage (Hassanzadeh, 2014), which in turn contributed to a significant fiscal burden. A depreciation of the Iranian currency in 2012 resulted in a halt in the implementation of the second phase of the law, and the costs for subsidization still accounted for 12% of GDP in 2013 (Moshiri and Lechtenböhmer, 2015). The second phase resumed in

2014 and planned to raise prices by a further 20-25%. In reality energy prices have remained fixed, declining in real terms by over 60% over the last three years (Salehi-Isfahani, 2016).

Impact. This central and complex reform has achieved mixed success: the gap between domestic and international gasoline prices did narrow slightly, however the government's payments to households have sometimes exceeded the reform's savings (Salehi-Isfahani et al., 2015). The impacts of the reform on energy consumption were evident almost immediately. In the year following implementation, consumption of most energy products declined due to price increases: fuel oil (36.4% decrease), gasoline (5.6%), diesel (9.8%), kerosene (2.9%), LPG (10.6%), electricity (1.7%), and natural gas (1.5%) (Hassanzadeh, 2014). The reform thus seemed to curb a trend of growing energy consumption in the previous decade, however long-run assessments are still lacking.

In terms of energy efficiency achievements, the assessments are also limited by the short-run nature of the reforms. The relative price of energy must remain high for a relatively long period before its full effects on energy efficiency are felt. Moshiri (2015) notes that to date the reform has not been sufficient to trigger broad changes in energy consumption. Urban households show stronger response to price changes, but rural households, particularly mid-income households, require other non-price signals. No studies have to date have quantified the effect of subsidies on Iranian mitigation targets, though recent simulations by (Mousavi et al., 2017) show that subsidy reform has the potential to reduce emissions in the transport sector.

Prospects. The removal of subsidies is a prerequisite for achieving energy efficiency. The government has instituted a series of energy efficiency measures to accompany the reform, but experts consulted suggest that the implementation of these measures needs to be strengthened. Moshiri (2015) recommends that the reform incorporates a specific timeline and measures to achieve energy efficiency, just as timelines exist on the pricing of energy carriers, which are revised annually. Moreover, the current incentives and support to industry and households are insufficient. The reform foresees the earmarking of 30% of the earnings from subsidies reduction for efficiency improvements. Key sectors of focus are transport, domestic heating and appliances, and industrial equipment. It is also crucial to raise consumer awareness about potential savings from energy efficiency and the availability of appliances. Pilot audits in industry and the adoption of standards for buildings and industry are further priorities for action.

Co-benefits. The government's overall goal in energy price reform is to increase the country's economic competitiveness and use its oil and gas resources more efficiently. From the perspective of the Iranian government, GHG reductions are a marginal co-benefit of the reform. It is however acknowledged that perceived co-benefits such as improved air quality and health or reduced traffic congestion have contributed to public acceptance of what was initially an unpopular measure. Air pollution in Iran's major cities is among the highest in the world, and about 70-80% of air pollution in Tehran is caused by the transport sector (Atansah et al., 2017).

2.6.1.1 Barriers to implementation of the Energy Price Reform

Experience across the world has produced lessons on what are the obstacles to energy subsidy reform, and what triggers the ability of governments to continue efforts in the long term while maintaining public support and mitigating opposition (Atansah et al., 2017). A wide range of intertwined fiscal, macro-economic, political and social factors associated with fuel subsidies underscores the fact that reform is a vital contribution to sustainable development objectives more generally (Rentschler and Bazilian, 2017).

Financial: Iran's macro-economic context, with a relatively unstable exchange rate, recurrent inflation, and external shocks such as sanctions (and the current uncertainty surrounding them) has slowed down the reform. In turn, the reform has had an inflationary effect and has contributed to Iran's growing budget deficit. The amount of projected revenue from subsidy savings has not always been realised. Financial markets are also an obstacle, with energy efficiency investments suffering from the high cost of borrowing in Iran.

Political barriers: Criticism about the equity effects of the reform were one of the factors that led the Iranian parliament to delay phase two of the reform (the only study that was found on this matter actually countered this perception, showing that the reforms were relatively pro-poor (Salehi-Isfahani et al., 2015)). Faced with increasing scrutiny from public and private sectors, the government has taken steps to improve its targeting of cash transfers to exclude wealthier households from receiving transfers. However, there is as yet no systematic way of measuring welfare, and the government uses a proxy model to measure household wealth. Measuring the impacts of the reform on poverty rates is a further challenge for the government.

Implementation of energy efficiency policy: Iranian policymakers recognise that energy price alone will not have a dramatic impact on energy consumption. It is known that the cash transfer scheme, intended to alleviate the adverse impact of the reform on household budgets, can more than cancel out the price effect on energy consumption. Non-price measures can therefore be found both in the Subsidy Reform Plan and within other energy-related Iranian regulations.

However, experts consulted suggest that the problem is in the poor implementation of these policies, coupled with lack of data and capacities as well as the financial barriers mentioned above. For example, within the Subsidy Reform Plan state-owned companies supplied CNG as a substitute for gasoline. This was successful to an extent, with a rate of substitution of over 20% in 2015 (Ministry of Power, 2016). Poor infrastructure and weak involvement of car manufacturers in producing compatible bi-fuel vehicles remains however an obstacle for the CNG market.

Energy efficiency policies are however still relatively new and the accompanying markets are still in their infancy. The UNDP/GEF-funded Energy Efficiency and Environment in Buildings project (EEEB, 2017) and its core component, the Market for Energy Efficiency & Environment (MEEE), are examples of recent developments. Proposed by the Supreme Energy Council, the MEEE aims to enhance energy efficiency through the promotion of participation from the private sector and the creation of Energy Service Companies (ESCOs). This trade scheme stipulates that investors on energy efficiency projects will receive an additional remuneration per saved unit of energy based on export prices. In addition MEEE will include a market for energy saving certificates, based on international experiences.

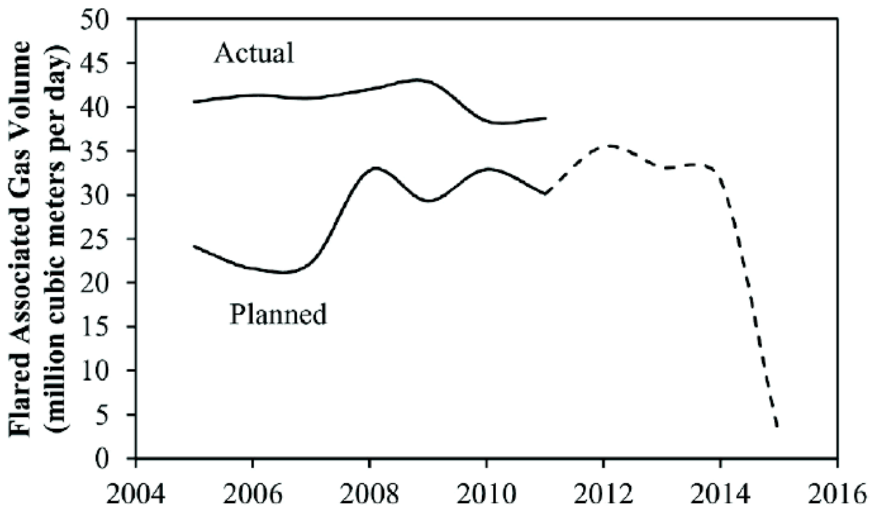
2.6.2 Upstream oil and gas efficiency (with an emphasis on gas flaring)

Though difficult to quantify, upstream emissions are an important component of Iran's energy-related emissions. Statistical data vary considerably due to a lack of monitoring and differences in assumptions on emission factors. A recent review by Soltanieh et al. (2016) estimates that, apart from wasting valuable energy resources, flaring contributes between 7 and 10% of Iran's GHG emissions, while the figures on the draft NC3's inventory for the energy sector suggest that the share could be as high as 19%. It is expected that flaring will decrease in the near term, even with no measures put in place, due to the share of oil extraction continuing its downward trend in comparison to gas extraction (see Figure 8 for past trend). Nonetheless, achieving the zero-flaring target remains a first priority for meeting emissions reduction goals. The scenario analysis in the draft NC3, which is the basis for the INDC's pledges, states that the potential for reductions from gas flaring and gas supply chain management stands at 70 $MtCO_2e$, which is equivalent to 4% of 2030 emissions. Expert interviews suggest that, while not stated explicitly in the INDC, these two measures constitute the core of the unconditional mitigation pledge. Reducing gas flaring therefore seems to be perceived as a low-hanging fruit with considerable co-benefits and margin for additional reductions.

Background. Oil-producing countries flare large volumes of the gas that accompanies crude oil to the surface. Excessive flaring occurs when it is not economical to recover or pipeline gas to a processing facility. This phenomenon is therefore closely related to barriers to the development of gas markets and gas infrastructure. Iran is among the top three gas-flaring countries after Russia and Iraq, and the World Bank's Global Gas Flaring Reduction Partnership (GGFR) estimates that Iran burned off or vented 16 billion cubic meters (bcm) of gas in 2016. Information on non-flaring related inefficiencies, such as leakages from distribution networks, is not readily available.

Impact. The Iranian Government and the National Iranian Oil Company (NIOC) have a plan in place to gather flared gas from 39 oil fields as well as from a the large-scale PSEEZ project (Pars Special Economic and Energy Zone) which is a complex of natural gas production and refining plants next to the South Pars/North Dome field (the biggest gas field in the world). However several factors, including the impact of sanctions, have led to a delay in the implementation of the plan (Figure 12).

Figure 12: Actual vs. planned flared gas volume in Iran



Data source: Soltanieh et al. (2016)

The usual way of utilising associated gas in Iran is to produce liquefied petroleum gas (LPG). In the last decade, reinjection for enhanced oil recovery (EOR) has become more common and several projects for power generation have been proposed, though none are at an advanced stage (Soltanieh et al., 2016).

The current 5-year Development Plan (2017-21) stipulates that the government should prepare the ground for private investors to launch gas-flaring reduction projects in all oil and gas upstream infrastructure by easing the terms and conditions of investment in an effort to reduce flaring by at least 90% by the end of the plan period. Since the lifting of sanctions in 2015, a number of investments are underway, and in particular the above-mentioned Pars Special Economic & Energy Zone (PSEEZ) is said to be set to receive USD 500 million in foreign investments for flared gas collection projects (PressTV, 2017). Moreover, various CDM projects also focus on reducing gas flaring (UNFCCC, 2017b).

Prospects. The sanctions and lack of international involvement particularly affected upstream projects, as the lack of expertise, technology, and financial investment resulted in delays and, in some cases, cancelations of projects. It is unclear how the recent renewed uncertainty around the nuclear deal has impacted these initiatives, nor whether any of the investment commitments have been put on hold. Experts consulted suggested that foreign companies do indeed appear to be moving slower than previously. Other investment risk factors, such as corruption, also deter foreign investors, though in general it is still an attractive market in which investors want to be positioned.

Best practice examples across the world suggest that gas flaring and venting can be significantly reduced using a combination of incentives and penalties (World Bank, 2004). Countries such as Norway, the USA, or Canada, require onshore and offshore oil producers to manage associated gas through transportation to a market, power generation, or reinjection. Other key elements include maintaining a robust pipeline and transportation infrastructure and the incentivising of domestic gas markets (through fuel switching, promotion of CNG fleets, etc.). Experts consulted suggest that the Iranian market is ready to use more gas but that obstacles include gas shortages in peak times like winter.

Increasing the accuracy of MRV is a crucial first step for Iran, where flare efficiencies of oil sites are not reported or even measured (current data are derived from visual observation or satellite measurements) (Soltanieh et al., 2016).

Co-benefits. The major co-benefit of mitigation through improved upstream efficiency in the energy sector would be economic: it is estimated that flaring costs the treasury USD 4-6 billion annually (Financial Tribune, 2017). The potential benefits in increased energy security and exports have not been evaluated. Gas flaring is a prominent source of local pollutants that affect the health of local communities but that can also be transported over long distances. Research into this area is scarce for Iran. The bulk of Iran's gas-flaring occurs at southern oil fields and the air of areas in which this takes place is often polluted (only 28% of gas flaring takes place offshore).

2.6.2.1 Barriers to implementation of upstream oil and gas efficiency

Lack of policy framework. An integrated plan for reducing gas flaring, with an appropriate mix of incentives, regulation, and monitoring is to date lacking in Iran. An analysis of the economic savings vs. the cost of such a programme is not available.

Financial. According to the latest estimates from the government, an investment of around 10 billion USD is needed to implement all the planned gas recovery projects (Soltanieh et al., 2016). Bilateral and multilateral climate change funds, particularly the Clean Investment Fund, provide financial assistance to the projects that are aimed at reducing gas flaring and venting, however this support is currently not available in Iran. Iran is also not a partner of the World Bank's Global Gas Flaring Reduction (GGFR) initiative, which has been supporting countries with finance and technical assistance since 2002 (World Bank, 2017f). !

Regulatory and fiscal incentives. As part of Iran's initiatives to curb gas flaring, according to the Annual Budget Law of 2011 and a revision in the Annual Budget Law of 2013, the Ministry of Petroleum, via the National Iranian Gas Company (NIGC), was allowed to sell gas that would otherwise be flared at one third of the price of refined natural (non-flare) gas to the industrial sector. According to Soltanieh et al. (2016) this incentive has not been able to attract investment into gas flaring projects. The main reason is the insufficient price signal, as the price is still well below the average cost of collecting flared gas. As a result, some gas producers will only collect and market flared gas that is collected at low cost, and continue to burn the one that is more costly to recover, even when there is strong demand for additional gas in nearby areas. Soltanieh et al. (2016) identify the following techno-economic barriers to investment: small volume of certain sources of associated gases; remote geographical location; lack of engineering expertise; cost of purification, transport and injection; and lack of technology and capacity to use the collected gas in small-scale generators or convert it to liquid (GTL).

2.6.3 Investment in sustainable energy technologies (with an emphasis on renewable energy)

The INDC states that the electricity generation sector will contribute to reductions via an increased share of combined cycle gas plants, renewable energy and nuclear power in the energy mix. The draft

NC3 moreover specifies that these measures will combine to contribute a reduction of 2.26% from 2030 emission levels in the BAU scenario. In other words, all the supply-side technology-related measures in the power sector taken together contribute to a fifth of the total (unconditional plus conditional) 12% reduction pledge. Recent analyses (Aghahosseini et al., 2016; Ghorbani et al., 2017; Moshiri and Lechtenböhmer, 2015) of the potential of renewable energy in Iran to meet domestic demand quickly and cost-effectively would justify a more ambitious goal for the sector and demonstrate the feasibility of reaching high shares of variable renewable energy.

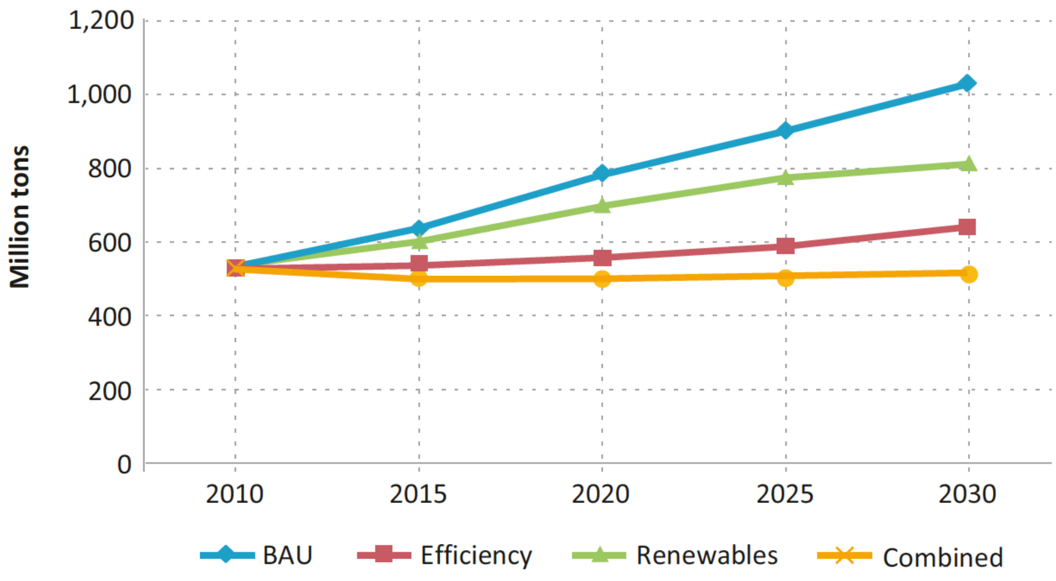
Background. The current contribution of low-carbon technologies to Iranian's energy mix is marginal. Output from hydropower, the only renewable resource of significance, was 14TWh in 2016, against 248TWh from fossil-fuelled power plants. The contributions of wind and solar are negligible at the moment but are expected to ramp up in the near term as technology costs continue to drop globally. As part of the government's plans to expand generation capacity to meet domestic demand and increase its exports, the Sixth Five-Year Development Plan (2017-2021) foresees that the share of renewables in total installed power generation capacity must be more than 5% by 2021. This would translate into 5GW of renewables-based capacity as the overall goal for the total increase in installed capacity is 100GW.

Various policy instruments, such as the feed-in tariffs introduced in section 2.5.3, are in place to support the achievement of this goal. The government has moreover streamlined policies to encourage private sector involvement in the energy sector, especially on the renewable energy front (McBride, 2016). These reforms include providing long-term leases on land at low fees for a period of 20 years, long-term guaranteed contracts for the purchase of electricity generated through renewable sources, and prioritising energy purchases from the private and cooperative sectors. As a result of these measures and particularly since the lifting of sanctions in 2015, the renewables sector has seen a number of investments. It is unclear to what extent the current diplomatic context may have put some of these developments on hold (see section 2.7 on sanctions as an overarching barrier). However, experts consulted indicate that the market for renewables other than hydropower, is expected to grow rapidly.

Impact. Based on a series of bottom-up scenarios on Iran's future energy system, Moshiri and Lechtenböhmer (2015) estimated that a reduction of over 20% of GHG emissions against BAU is feasible by 2030, based only on a renewables-based approach (combined with energy efficiency, the reductions would be of just under 50%) (Figure 13). The integration of large shares of variable renewable resources into the grid has also been investigated: modelling Iran's electricity sector up to 2050 and considering cost projections for electricity storage revealed that a renewables-based system is the least-cost solution among all the alternatives (such as CCS, gas with CCS, and nuclear energy) for achieving a net zero emission sector (Aghahosseini et al., 2016; Ghorbani et al., 2017).

Prospects. Governmental stakeholders are increasingly acknowledging the potential for renewable energy in Iran, and various elements of the policy framework are being put in place, including the feed-in tariff. However, the INDC and other policy documents suggest an equivalent commitment to combined cycle gas investments for the short term. Moreover, strategic planning for renewables is currently lacking in Iran. Iran's transition to a renewables-based future could benefit from transfer of policy innovations and best practice in other regions, in particular in the MENA region. However the limits imposed on multilateral collaboration have to date hindered any significant collaboration on this part (see section 1.1, sub-section "Bilateral Cooperation with Germany" for further details on the status of collaboration between Iran, Germany and the EU).

Figure 13: CO_2 Emissions in alternative scenarios



Data source: Moshiri and Lechtenböhmer, 2015

Co-benefits. One of the major drivers for an increase of the share of renewables in Iran is the need to diversify the energy mix, bringing down the country's dependency on fossil fuels. Renewables moreover provide the opportunity to "free up" gas that can then replace more carbon-intensive oil consumption. There is to date no comprehensive analysis of the economic and environmental benefits that could be brought about by this climate change mitigation area of focus in Iran.

2.6.3.1 Barriers to implementation of sustainable energy technologies

Energy subsidies. The recent drop in costs have made renewable energy technologies economically attractive to investors in many countries of the world. However Iran continues to be rich in fossil fuel resources, and subsidies still favour them. Paradoxically, Moshiri and Lechtenböhmer (2015) find that energy subsidies on the supply side actually contribute to low efficiency rates in power plants, which results in the marginal cost of electricity in Iran being higher than international averages.

Infrastructure. Iran's grid has transmission and distribution losses as high as 14.8% in 2015. This could actually provide a window of opportunity for renewable energy where it can stabilise the grid in key geographical locations.

Political will. The transformation from traditional fossil-fuelled to renewables-based infrastructure needs strategic and core planning. Although the importance of renewable energy is now routinely acknowledged, there is still no strong consensus among authorities and policy-makers that investment in the sector should be a priority, and a comprehensive plan for renewable energy is lacking. A strong perception that renewable energy technologies are immature and not competitive still prevails.

Regulation and incentives. Transaction costs, red tape and uncertainty with regard to policy change and implementation increase the perceived risks for investment in renewable energy projects, and counter the incentives provided by policy. For example, while the feed-in-tariff law is a positive step, but it is subject to government approval and therefore increases investment uncertainty. Furthermore, law enforcement mechanisms and penalties for violating the law are lacking.

International sanctions. Sanctions have strongly affected technology transfer and financing for renewable energy projects, making them more difficult and expensive. Technical assistance and skill transfer are only now starting to address local lack of expertise, though technical skills in general are not seen as a major barrier. The sanctions are also seen to limit domestic investment by Iranian companies. Based on anecdotal evidence, Kamali (2016) claims that the lifting of sanctions through the JCPOA has opened opportunities for sustainable energy: within two months of JCPOA signing, four contracts for solar projects were signed for approximately 1,150MW (for context, Iran's solar capacity grew from 53MW in 2005 to 67MW by 2011). Furthermore, Danish multinational Vestas committed to invest USD 100 million in Iranian wind infrastructure, and a German venture pledged to develop a 48MW wind farm. Finally, USD 75 million investment were pledged for developing a waste-to-energy plant. More information on the effect of international sanctions in general is available in the following section.

2.7 Overarching barriers to implementation of additional actions

International sanctions

The first US-sanctions on Iran were imposed in 1979 following the Iranian Revolution. In 2006 the United Nations imposed further sanctions and oil embargos when Iran refused to suspend its uranium enrichment programme. In 2012 the sanctions reached a climax with the World Bank cut all oil-related transactions with Iran and the EU banned Iranian oil exports as well as prohibited transactions with the banking, trade, and energy sector.

Iran's nuclear agreement with the international community - officially known as the Joint Comprehensive Plan of Action, or JCPOA - was reached in 2015 between Iran, the five permanent members of the United Nations Security Council – China, France, Russia, United Kingdom, United States, plus Germany- and the European Union. Under the agreement, Iran dismantled much of its nuclear programme and gave international inspectors access to sensitive sites. As a result, UN sanctions were lifted in January 2016.

There is no evidence on the effect that sanctions, nor their lifting, have had on Iranian climate policy in the past, nor any forecasts on how the issue may influence the future. Kamali (2016) describes the relation between Iranian sanctions and climate policy as a "double-edged sword": on the one hand, sanctions may impede the achievement of mitigation goals, by hindering foreign investments into low carbon technologies and, indirectly, technology transfer and financial international relations. On the other hand, strong economic growth – which could well be the result of lifted sanctions - could lead to higher emissions. The latter argument is however not fully backed by recent developments: average annual growth rate of emissions during the last sanctions period (2009-2014) was over 3.7%, which is lower than the 4.7% rate during the 2005-2009 period but was still significantly high. Experts consulted suggest that part of the reason for the lower emissions growth rate during the last sanctions period was the increased use of natural gas in the energy mix.

Iran's INDC illustrates the paradox: it highlights international sanctions as an overarching barrier to the achievement of the mitigation goals, while at the same time its BAU scenario assumes strong growth in GDP, and hence in emissions, as a result of the absence of economic sanctions. The INDC as well as other governmental publications suggest that sanctions have hindered progress on energy policy and infrastructure investments, just as they have done for all other aspects of the economy (following the intensification of sanctions from 2012 to 2014, Iran's economy contracted by about 9% (IMF, 2015)). On the other hand, the lifting of sanctions revived the oil and gas industries, and the Iranian economy in general, with an increase in energy demand expected as a result. At the same time, as discussed in section 2.6.3.1 above, the lifting of sanctions already opened opportunities for sustainable energy investments as well as wind and waste-to-energy projects.

The two year-old agreement has recently been endangered following statements of the president of the United States regarding plans to "decertify" the deal and of the president of France requesting negotiations with Iran regarding ballistic missiles. These developments have led to an uncertain investment environment in general. As regards climate investments, expert interviews indicate that a number of international energy-related investments have been put on hold.

2.8 Conclusions

Iran is a dynamic upper middle income economy and a key emitting country, ranking globally among the first dozen emitters with emissions almost as high as Germany's (with around 800 $MtCO_2e$, see Table 2). Moreover, Iran's emissions are steadily increasing, in particular in the energy sector. The business as usual (BAU) scenario of Iran's INDC foresees that energy-related GHG emissions will grow 4.7% each year until 2030, which would result in an increase of GHG emissions from approximately 700 $MtCO_2e$ in 2010 to over 1,700 $MtCO_2e$ in 2030 (DoE and UNDP, 2014). The INDC's pledges of between (unconditional) 4% and (conditional) 12% reductions against the BAU appear to be significantly lower than the mitigation potential outlined in alternative scenarios, such as in the "all policies" mitigation scenario in the NC2 and in recent academic literature (e.g. Moshiri and Lechtenboehmer, 2015). In particular, three fields of action have been selected for this study based on their mitigation potential, feasibility, costs and potentials and co-benefits: demand-side efficiency through energy-price reform, upstream oil and gas efficiency (with an emphasis on gas flaring) and the building of a sustainable energy mix (with an emphasis on renewable energy).

A key driver for climate action in Iran is the fact that Iranian society as well as the Iranian government are aware of the severe impacts that the country is already facing, including water scarcity, altered patterns of drought and of dust and sand storms, and that mitigation is of pivotal importance in every country, including Iran itself. Further drivers for action are the fact that the mitigation potential in the energy sector is vast, and that there are various synergies with other policy goals, such as in the case of energy subsidy reform.

This study finds that while targets or programmes are broadly in place, implementation is lagging. Iran is still to ratify the Paris Agreement and the relatively vague INDC published in 2015 has not yet been translated into an NDC. An accompanying implementation strategy with a more precise description of implementation measures is lacking. Overshadowing these is the uncertainty concerning international sanctions, which act as an important barrier to transfer and exchange of technology, capacity building and investments. Paradoxically, the lifting of the sanctions could also lead to increased fossil energy supply, inefficient use and emissions. Iranian policymakers may therefore want to carefully balance growth strategies with the need to limit emissions from heightened energy demand, creating new opportunities for low-energy development.

Meaningful, long-term cooperation through financial support and knowledge exchange with partners in the region and others is of vital importance. It is key that the momentum that has built in the last two years is sustained.

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