



NATO Parliamentary Assembly

SUB-COMMITTEE ON  
TECHNOLOGY TRENDS AND SECURITY  
(STCTTS)

MEDITERRANEAN AND MIDDLE EAST  
SPECIAL GROUP (GSM)

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**MISSION REPORT**

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**ABU DHABI  
UNITED ARAB EMIRATES**

**9 – 12 JANUARY 2018**

1. From 9-12 January, 32 members of parliament from 15 NATO member countries visited Abu Dhabi to discuss the broad geopolitical situation in the Gulf, the foreign and defence policy of the United Arab Emirates (UAE) and to participate in a Joint Meeting of the UAE's Federal National Council (FNC) and the International Renewable Energy Agency (IRENA). They also attended IRENA's third annual Legislators Forum. The visit was facilitated by the FNC, IRENA and the Danish Embassy and its Ambassador Merete Juhl (Denmark is currently the NATO Contact Point Embassy). The delegation consisted of members from the NATO Parliamentary Assembly's Sub-Committee on Technology Trends and Security (STCTTS) and the Mediterranean and Middle East Special Group (GSM). The group had the occasion to meet with UAE politicians; officials from the Ministries of Defence and of Foreign Affairs and International Cooperation, UAE; French and US military officers at the FNC's premises. They also met with former diplomats, historians, political scientists and cyber security experts at New York University's Abu Dhabi campus. The following is a summary of the key themes of the discussions.

## **I. THE UAE AND THE SHIFTING SECURITY, ECONOMIC AND CULTURAL EQUATION IN THE GULF**

2. The UAE is a close partner of Western governments and has become an active partner of NATO. It is one of four states of the Gulf Cooperation Council (GCC) to have joined NATO's Istanbul Cooperation Initiative. It has since been an active player, having, for example, supported NATO missions in Kosovo, Afghanistan and Libya. The country has opened a mission to NATO and recently agreed to a partnership programme to further practical operational cooperation. This includes a series of training programmes to advance Emirati leadership skills and facilitate its participation in collective missions. It is also working closely with a number of NATO members on military and security matters, including the United States, the United Kingdom and France. It has a special accord with the United Kingdom, for example, to help it in deterring threats and possible aggression. Both countries engage in planning to defend the region, and the British maintain an air support base in the country as well as a significant maritime presence in the region. In military terms, the UAE has an exceptional expeditionary capability, which it has deployed in Yemen where it is supporting the government against Houthi rebels. The country is particularly focused on anti-Daesh operations.

3. The UAE has also become a major commercial partner for many Western governments. For example, roughly 100,000 British citizens reside in the country and 6,000 British firms conduct business there. There are roughly 400 commercial flights between those two countries each week and the UAE represents roughly one-quarter of the UK's non-EU exports. Germany is also deeply engaged in the commercial life of the country, for which it is a major trading partner. For its part, France has 30,000 citizens working in the UAE, roughly 700 firms operating there, and trade valued at roughly USD 5 billion per month. The UAE, in turn, has significant investments in all of these as well as many other NATO countries.

4. For those Western governments with a significant presence in the UAE, there is a shared view that the country has become something of a model for the rest of the region. It is both moderate and tolerant, while its economy is rapidly diversifying so that it is ever less reliant on energy exports. It is currently 26th on the World Bank's Ease of Doing Business rankings, and it has been identified as having very low corruption levels. Emirati leadership is working to develop an exemplary court system, and this will only reinforce the notion that it is a country in which the rule of law is well established and transparent. It has also made great strides in advancing the position of women in society. Nine of the country's ministers are women and there are female fighters deployed in the air force. The country has a Minister for Tolerance, and another for Higher Education and Scientific Research.

5. Those of non-Muslim faiths are free to practice in the country. Eighty-five per cent of the UAE's population is foreign, and this is one obvious reason why the government has adopted a policy of religious tolerance. It is clearly in the national interest to preserve social peace, which the UAE understands as a precondition for economic development. For example, many residents are

Catholics and a Mosque was recently renamed the Mother Mary Mosque, a decision which aptly captures the commonalities of the faiths operating in the country and the government's desire to build a stable and respectful relationship among all faiths. The country has also opened itself up to foreign ideas, culture and technology and this is perhaps most manifest in the important presence of the New York University, the Paris-Sorbonne University and the Louvre in Abu Dhabi. The UAE has also emerged as a key global player in providing development assistance. They have provided, for instance, roughly 2.5 billion USD in aid to Yemen for stabilisation and humanitarian assistance.

6. Even in energy markets, the country is diversifying its own sources of energy, despite its huge oil endowment. A large nuclear power station that is currently under construction will generate 25% of the country's electricity needs. The UAE has made major investments in solar power. It also hosts the secretariat of IRENA and strongly supports its agenda of advancing renewable energy development. Although it is a major exporter of petroleum, it takes the global climate action agenda very seriously and has made major investments to decarbonise the economy and prepare for the day when its own oil endowment has been exhausted. On the fiscal side, the leadership of the country has made an enormous effort to make the budget less dependent on energy exports.

7. The country's leadership perceives two overarching threats to its ambition: extremism and Iran. It sees both of these as major threats to the national project as well as to the UAE's ambition to contribute to the global agenda. As a result, the leaders keenly feel a responsibility to meet these twin challenges directly. There is compulsory national service for men and voluntary service for women.

8. The UAE sees both Saudi Arabia and Egypt as critical partners, and the UAE has been one of President Sisi's most ardent supporters in political and financial terms. Egypt receives a very large share of the UAE's overall foreign aid. The Emirati government sees the Muslim Brotherhood as posing a threat to regional stability and never embraced its rise to power in Egypt. The UAE also has a particularly complex but invariably close relationship with Saudi Arabia. There has long been something of a rivalry between the two countries, but it is encased within a broader framework of cooperation and a generally shared strategic outlook. Recently the relationship has grown closer both because of a shared sense of threat and a renewed impulse for domestic change and reform in Saudi Arabia itself.

## **II. CONFLICT IN YEMEN AND THE STRATEGIC OUTLOOK OF A NEW GENERATION OF LEADERS IN THE REGION**

9. In 2015, UAE forces took the city of Aden in a sophisticated amphibious military action that demonstrated the serious capabilities of the country's armed forces. Since that operation, their forces have expanded out and the military has worked to train Yemeni troops which are now operating on the front lines in this struggle. They have also deployed forces in the east to conduct counter-terrorism operations. The greatest casualties were taken after a Houthi rocket attack on an Emirati camp which caused 50 deaths. The UAE's leadership takes very seriously the notion that their country has a special role to play in security, stability and defining a path forward for the region and beyond. This invariably involves sacrifice. They have suffered serious casualties in the Yemen conflict but have not sought to obfuscate these fatalities. Rather, these sacrifices on behalf of the nation are celebrated on a national martyrs' day.

10. For some analysts, however, the Yemeni war has become a silent disaster. While hundreds of thousands of Syrians were able to flee violence and depravation, the Yemeni are stuck within the borders of their country and many are dying from violence, illness and hunger. Yemen is both the most populated and the poorest country on the peninsula, and this mass suffering has important consequences for the region and beyond. One speaker suggested that Saudi policy has been driven by a kind of new "domino theory" which is not so dissimilar to the thinking that animated US intervention in Vietnam. As was the case in Vietnam, the external protagonists, including Iran, seem to be engaging more deeply than they had originally expected. According to some analysts,

however, the view that the Houthis are simply puppets of the Iranian regime is problematic, because the insurgency itself was originally driven by very local issues including the absence of public services (for example, schools and hospitals in Houthi regions). Sectarianism has sadly been used as a mobilising device. From the perspective of some analysts, this is essentially an internal civil war in a weak state that has always been more a tribal confederacy than a modern state. For this reason, they do not believe it wise for the United States and Great Britain to engage in the fighting, although both have already done so. It is noteworthy, for example, that Norway has recently decided to cease arms sales to Saudi Arabia because of the conflict. Some are now arguing that Europe and the United States should use their influence to bring all sides to the bargaining table and work for a rapid cease fire to end human suffering in the beleaguered country.

11. One element of dynamism in the Gulf today is the emergence of young and energetic leaders in both Saudi Arabia and the UAE. Crown Prince Mohammed bin Zayed Al Nahyan of the UAE, while not the formal ruler of the country, has nonetheless put the country on the road to modernisation, social reform, economic and energy diversification, and regional ambition. Although Saudi Arabia is far more conservative in structure, its new generation of leaders seems dedicated to pushing for more fundamental changes. Saudi Arabia's dynamic Crown Prince Mohammed bin Salman has embarked on a series of daring reforms that will affect everything from the economy to women's rights. The UAE senses that it is well positioned to share its reform experience with its Saudi partners and that this could be an important moment for both countries. The UAE has constructed a significantly more open, cosmopolitan, and pluralistic society than that of Saudi Arabia, and its economy has been more successfully diversified. It sees itself as having something to teach its larger and more powerful neighbour while standing to benefit from Saudi Arabia's evolution. It is noteworthy, for example, that both countries coordinated the introduction of a VAT in 2018, which is symbolic of a new-found and shared desire to delink national budgets from energy revenues. This will infuse both states with a far greater degree of fiscal stability.

12. The speaker of the Federal National Council, H.E. Dr Amal Al Qubaisi, met the delegation and outlined the many ways the UAE has sought to prepare its society for the coming century. For example, it has created a ministry for Artificial Intelligence and another for Happiness. It has made major investments in technologies that will drive the so-called fourth industrial revolution. The country has also sought to raise education standards to very high levels for both men and women in order to lay the foundations for a knowledge rather than an energy-driven economy. Already today, carbon energy revenues only constitute 30% of the economy, and the goal is to drive this downward over time. She also discussed the country's efforts to promote renewable energy. She pointed out that Masdar city, near the Abu Dhabi airport, has been designed as a modern city run on renewable energy and one that could be a global model for cities of the future.

13. Women are being empowered in society, and this is not only apparent in the fact that the Speaker of the Federal National Council is a woman, but also that there are currently nine women serving as ministers. There is a very openly expressed recognition that UAE society cannot prosper without the economic advancement of women, and the Speaker told the delegation that no society can fly with only one wing. She also linked human rights to this dynamic. This is obviously an important message in UAE society, but it is also one that seems to have some resonance in Saudi Arabia which remains nonetheless more hesitant about embracing such ambitious reforms. The UAE sees itself as a role model in this regard and relishes the opportunity to work with its large and powerful neighbour on these vital but very delicate issues.

14. The ambition of the new leaders of Saudi Arabia and the UAE has also been projected into matters of security, which is perhaps best expressed by the Saudi-led intervention in Yemen. But one speaker suggested that this ambition has not played out as expected. The Yemen conflict is proving particularly intractable, and some analysts suggest that the actions of the Gulf states may have contributed to the rising presence of Iran in that country, although this is a matter of debate. Likewise, the decision to isolate Qatar and to apply pressure to it has not led to a quick resolution of the crisis. Rather, it seems to have created an important rift within the heart of the GCC while encouraging Qatari leadership to look for support elsewhere—including Iran, Turkey and India.

15. The UAE's involvement in the Yemen conflict is driven largely by its deep concerns about Iran and Iranian ambitions. Its leadership shares Saudi apprehensions that the absence of authority in that country would open the door to extremist organisations like Al Qaeda and Daesh. The UAE is currently the second largest aid provider to Yemen and is providing support to underwrite healthcare, water supplies, energy generation, transport and government, and support for civil society. Today, an estimated 14.1 million Yemeni are confronted with severe food shortages. The UAE position has also become a vehicle for expressing solidarity with Saudi Arabia, which unambiguously took the lead in this intervention. For the same reason, the UAE government initially took a tough line on the government of Haider al-Abadi in Iraq as the leadership felt that he was in Iran's pocket. But more recently this view has shifted, and the UAE is now working to demonstrate that Iraq has friends in the Arab world and that there are alternatives to Iran. Likewise, UAE authorities strongly oppose the role Hezbollah continues to play in Lebanese national life. On Syria, the government appears to have come to the view that President Assad is the lesser of two evils, as the opposition is seen to be dominated by extremists. In the same way, its active engagement with Libya is animated by a desire to push back against extremism, particularly in a country that is resource-rich and close to key friends in Europe and Egypt. The government has thus remained engaged in Libya and has worked closely with the French government and the UN Special Envoy to work out a solution to the Libya's political crisis. Some of the meetings aiming to establish a roadmap to resolution have been convened in Abu Dhabi. The UAE has supported the Libyan national army and has sought to unify the military under one leader and one minister. The UAE has also become more engaged in the Horn of Africa. They have built a base in Yemen and are working closely with the governments of Somalia and Ethiopia. In some respects, it has been competing with Turkey for influence in this region.

16. As suggested above, the UAE has consistently taken a position against violent extremism in the region. It works against these forces both domestically and internationally and the effort includes control over money transfers and remittances, control of charities, asset freezes, intelligence cooperation with regional and international partners, and active military operations against terrorists in theatres from Yemen to Afghanistan. It also hosts the Hedayah Centre, which is an International Centre of Excellence for Countering Violent Extremism. The Center conducts research and fosters international cooperation to coordinate efforts in countering extremism. The UAE has also joined with the United States to establish the Sawab Centre to counter Daesh propaganda as part of its contribution to the international coalition against terrorism.

17. UAE officials also see their closer ties with NATO as part of this broad effort. It participates in NATO's Istanbul Initiative and last year signed an agreement for an individual partnership programme which covers a broad range of areas for cooperation with the Alliance including arms control, chemical weapons, gender issues, energy, the law of armed conflict, public diplomacy, logistics, border security, command and control, civil emergency planning and disaster management. UAE military personnel are now participating in a range of NATO training courses and participating in exercises, one of which the UAE will host in 2020. All of this should facilitate the UAE's participation in select NATO and bilateral operations. It is worth noting that the UAE participated in the Kuwait operation in 1991, as well as missions in Afghanistan, Libya, Lebanon.

18. The US 380th Air Wing is based in the UAE. The base delivers air power in support of the fight against Daesh. Operations are planned at the US base in Qatar. US air assets are also in place to maintain security in the broader Gulf region and to defend it from threats emanating from Iran or transnational terrorist organisations. The United States also operates a Patriot missile defence system in the country. US forces, which have been based in the UAE since 1996, also work closely with regional and international partners on a range of issues like command and control, and joint training, and the United States shares a training centre with the UAE.

19. The French navy maintains a naval base in the UAE and it too works closely with the host country. Some UAE pilots train with the French and some fly Mirage aircraft. Many UAE officers take courses in France and this along with joint and regional exercises has helped deepen bilateral ties and enhance interoperability. The vast uninhabited space of the country's desert is a perfect region for conducting air exercises.

### III. THE IRANIAN CHALLENGE

20. The Iranian challenge was a constant theme of the visit to the UAE. The UAE's leaders believe that Iran is intent on exporting its revolution and that it compulsively interferes in the internal matters of neighbouring states. In their view, it is responsible for the proliferation of weapons in the region to proxies who pose a broad threat to stability. The government of Iran is seen as highly sectarian and its missile development and nuclear programmes are considered existential threats to the UAE. The UAE has felt encircled by Iran and Iranian proxies in Lebanon, Syria, Iraq and Yemen and it has sought to promote an alternative strategic vision for the region. Moreover, it has allocated funds and in some cases deployed its military forces to manage this threat. The UAE claims that three of its islands are occupied by Iran and this too is a serious impediment to relations. Interestingly, however, the two countries maintain diplomatic ties, and the Emirate of Dubai continues to trade with Iran.

21. Representatives of the Ministry of Defense (MoD) told the delegation that Iran has three strategic ambitions: it seeks to play a defining role in the Arab world; it wants to be a central player in the Islamic world, which it does through its relations with Shia and some radical Sunni groups. It also wants to build and sustain a powerful military presence that can shape the geo-strategic landscape of the broader Middle East to its advantage. The MoD believes that the nuclear deal has done little to temper these ambitions, and UAE officials still perceive a very aggressive and ambitious state on the other littoral of the Gulf. Officials are also highly mindful of continued Iranian efforts to interfere in the domestic affairs of Gulf states, which include weapons smuggling, the use of proxies including the Houthi rebels in Yemen, and military training for extremist movements. They cited continued Iranian intervention in Iraq and Syria as well as support for Hezbollah in Lebanon as matters of serious concern. Finally, they noted that recent anti-government demonstrations in nearly 60 Iranian cities point to serious dissatisfaction with the regime, the lack of civil rights in that country and the poor economic situation. But this recent unrest was essentially a leaderless phenomenon which Iranian security forces were able to quell through intensified security measures.

22. The fixation on Iran has also conditioned relations with other governments. The UAE is deeply disappointed that Iran has not used the opportunity the Joint Comprehensive Plan of Action (JCPOA) offers to engage responsibly with the international community. The UAE has detected no significant positive effect of Iranian general behaviour in the wake of that agreement, which was signed with Iran to curtail the development of nuclear weapons. UAE leaders, like their Saudi counterparts, harbour a particularly harsh view of the Obama Administration. While the UAE welcomed the JCPOA at the time, it worried that the Obama Administration's move reflected a desire to pull back from a decades-long US engagement with the region. The UAE, like Saudi Arabia, was also very sceptical of President Obama's initial embrace of the so-called Arab Spring and believes that the ensuing instability throughout the Arab world has been a tragedy which has strongly destabilised much of the Middle East and Northern Africa. It has very vocally supported the Trump Administration's hardline views on Iran, but it also harbours some concerns about the thinking animating President Trump's foreign policy vision. The US decision to recognise Jerusalem as the capital of Israel, for example, was strenuously opposed throughout the Gulf and could cause problems in the future. That decision points to potential limits in relations between the region and the current administration in Washington. There is also a degree of tension with European countries like Germany, France and the United Kingdom, all of which continue to support the nuclear deal with Iran.

23. The view of the United States throughout the region has been conditioned by other policies pursued by the Obama Administration. The failure to enforce President Obama's so-called "red line" on Syria's use of chemical weapons shook the region and undermined faith in US leadership. Since then, the Gulf monarchies have been more open to look to other countries for partnerships, even including Russia. Although there is little support for Syria's leader Bashar al-Assad, there is even less for an opposition which the Gulf sees as riddled with extremists who pose more of a threat to regional stability. They believe that Russian actions in Syria have cleared space for taking on extremists and that Russia deserves a modicum of recognition for this despite its close ties to Iran. The region has forged more ties with China and India and it clearly sees risks in tying itself too closely to a single great power.

#### **IV. THE QATAR CRISIS**

24. The Qatari crisis has proven more intractable than some originally imagined, although tensions between Qatar and other Gulf monarchies have long been evident. This is worrying for Western governments which are convinced that the region's security interests would be better served by a more united GCC. There is little question that the Trump Administration's call for an "Arab NATO" is little more than a pipedream given the level of hostility between Qatar and its neighbours as well as the many other conflicting interests that shape the outlook of the region's countries. The divisions also weaken NATO solidarity, as Turkey has been working closely with Qatar and maintains a military base in that country, something which is not universally welcomed in the region. The United States also maintains a large base in Qatar although President Trump, at one point at least, indicated support for the Saudi-led effort to isolate that country. At the very least, it is important to recognise that the standoff with Qatar is not sectarian. The Qatari leadership is Sunni and has developed ties with Iran for reasons that have nothing to do with religion. Indeed, sectarian explanations tend to obscure the nature of the underlying power struggle at play in the region.

25. The other four GCC countries made 13 demands on Qatar as a precondition for a return to normal relations. Some of these, such as the closing of the Al Jazeera network, are not likely to be accepted. But, at least, these demands provide a potential itinerary for a practical dialogue. Kuwait is currently working to act as a mediator. Qatar currently seems to be moving closer to Iran, Turkey and India and away from its fellow GCC members. Saudi and UAE leaders may have to find a way to climb down from some of their demands in order to move towards resolving this unwelcome crisis, but this too could prove difficult. In any case, the current status quo is damaging to the region: it undermines GCC solidarity and prevents practical cooperation across a range of important challenges affecting the region as whole. The West should help mediate this crisis, but the Trump administration's mixed signals, for the moment at least, seem to have exacerbated the situation.

#### **V. CYBER SECURITY**

26. The delegation also visited the Center for Cyber Security at New York University Abu Dhabi campus. Hoda Al Khzaimi, the Director of the Center, outlined the interdisciplinary research agenda of the center. She also introduced its multinational staff and its work with the private sector, governments and a network of universities to develop new cyber security technologies and practices. The Center is currently working on security forensics, hardware security, smart cities and grids, threat intelligence and network analysis, cyber terrorism, conceptual cyber defense, transportation security, cryptology, and the proliferation of fake news. It is also working on defining what might be meant by cyber peace and the conditions under which countries might agree not to wage cyberattacks.

#### **VI. THE ENERGY SECTOR AND THE IRENA PARLIAMENTARY CONFERENCE**

27. On the energy front, the UAE is diversifying its own energy supplies despite its huge oil endowment. A large nuclear power station currently under construction will generate 25% of the country's electricity needs. The UAE has also made major investments in solar power, and it hosts the secretariat of IRENA and strongly supports its agenda of advancing renewable energy development. Although the country is a major exporter of petroleum, it takes the global climate agenda very seriously and has made major investments to delink the economy from oil and gas. H.E. Dr Amal Al Qubaisi, Speaker of the FNC, told the delegation that her country is preparing for the day when its own oil supplies will have been utterly exhausted—a day she said that should be marked by celebration rather than lament. On the fiscal side, the leadership of the country has made an enormous effort to make the budget ever less dependent on energy exports.

28. Members of the delegation attended a two-day parliamentary forum on renewable energy which was held just prior to the 8th session of the IRENA Assembly. The parliamentary meeting took

an important cue from the Global Summit of Women Speakers of Parliament held in Abu Dhabi in 2016 as well as from a declaration adopted by the Inter-Parliamentary Union (IPU) that parliaments need to do more to promote clean energy on a massive scale. H.E. Dr Amal Al Qubaisi told delegates that investments in renewable technologies ought to increase significantly if the world is to achieve agreed carbon emission reductions. She also noted that governments alone cannot finance this effort and that public-private partnerships will be essential. Parliaments, she added, have a central role to play in shaping the legal and legislative environment for a shift away from carbon energy to more environmentally sustainable solutions.

29. Adnan Z. Amin, the Director-General of IRENA, told legislators that IRENA stands ready to support parliamentarians dedicated to promoting sustainable energy solutions. He noted that the price of solar and wind power has fallen precipitously, and in parts of the world both are now a cheaper fuel than coal for generating electricity. IRENA believes that by 2019, in much of the world, renewable energy will generate electricity at costs approaching US 3 cents per kilowatt-hour which is highly competitive. Today, Mexico, Saudi Arabia and the UAE are producing electricity with sustainable energy at close to US 2 cents per kilowatt-hour. Battery storage costs are also plummeting as technology improves. This too is driving down costs while pointing to dramatic advances toward solving the problem of energy intermittency. For developing countries and particularly countries in Africa, off-the-grid renewable energy production is offering new possibilities for rural electrification, which is critical to development and the goal of lifting millions out of poverty. Governments around the world are now announcing ambitious renewable use targets and this makes eminent sense given the falling costs of deploying this technology. It is interesting to note that Germany recently met 100% of its electricity needs for several hours with renewable energy only. That particular event captures the direction in which this sector is headed.

30. The conference took a comprehensive look at renewable energy challenges and opportunities and linked these to impending technological revolution, climate change, health, and food security. Mr Amin, argued that the transition to renewable energy will be an agent of economic and job growth. He also pointed to the many ways sustainable energy is having a transformative impact on developing countries. He cited as examples the growing use of off-the-grid solar irrigation pumps and off-season food production made possible solar-heated greenhouses. In her remarks, Mariam Hareb Al Muhairi, the UAE Minister of State for Food Security noted that one-eighth of the world lacks food security, and desertification is only adding pressure to food supplies. She said that technological innovation is critical to resolving this problem and cited the case of fish farming as one element of a solution. The fourth industrial revolution is approaching, she said, but business needs to be incentivised and encouraged to move quickly to ensure that this change serves the broader international community.

31. Martin Chungong, the Secretary General of the IPU, talked about the contribution parliamentarians can make towards implementing the 17 Sustainable Development Goals and the ways in which the IPU is linking up parliamentarians across the world to share information and experiences in this vital area. He also noted that it is pushing to garner support for engaging the private sector in this process, as it will play a fundamental role in driving and financing these changes. This theme was also taken up by Saeed Abdullah Juma Al Mutawa, a member of the FNC, who stressed the importance of providing a legislative framework in order to engage the private sector directly in an industrial revolution in which renewable energy is slated to play a decisive role. Business is compelled to manage risk and needs a clear outlook on investment returns. This, he added, is why well-conceived regulatory legislation that facilitates market entry remains crucial.

32. Adrian Whiteman, a Senior Programme Officer at IRENA, discussed how sustainable energy will differ from traditional energy sources. He noted that energy in most societies is highly centralised, large-scale and largely reliant on fossil fuels. The scale of renewable energy generation is far more variable, and operating costs are lower. Renewable energy production can be local rather than centralised, and this marks a potential fundamental shift in the way we think about the economic, social and political structures surrounding the business. In short, this means that renewable energy production can be more democratically and locally managed.



33. As a result of these changes and the fact that solar power costs have fallen by nearly 75% in recent years, the share of renewable energy generation is rising quickly. But in order to meet fossil fuel reduction targets, a far higher rate of conversion to renewables will be essential. Given population growth, the current rate of conversion will actually result in an increase in greenhouse gas production. The challenge thus lies in galvanising growth to a far higher level. This will require a massive expansion in wind and solar power as well as bio-energy. Moreover, much of this change will be very local, perhaps even at household level. Off-the-grid energy production is soaring as private homeowners install solar panels. This is not only happening in developed countries but also in places like rural Africa, and it offers the potential to change a central plank of the development paradigm. With less need for energy grids and networks, renewables introduce new potential for rural electrification in poor countries. This, in turn, is opening novel vistas for broader economic development in these newly electrified regions. The spill-overs are myriad. Solar power pumps, refrigeration, and cell phone towers can all have a transformative impact in localities situated far from large cities. Irregular and high-cost energy production has long been a critical impediment to sustaining economic growth and attracting investment to these impoverished regions. The renewable revolution could fundamentally change this equation and open new channels for sustainable and consequential development.

34. There are obvious commercial and employment opportunities in the renewable sector, but there is also a sense that public support is critical to nudging investors in the right direction. Some public support is necessary to reassure private investors, and broadly agreed timelines can help discipline the process of transformation. Properly conceived regulation is also essential not only for the energy market per se, but also for end-users in the consumer, transport, heating, housing and home utilities sectors. Smart grids will vastly reduce waste and bring energy far more effectively and cheaply where it is most needed. Likewise, smart metering at home will either reduce demand or shift the flow of energy to where returns are highest. This is obviously an area where consumer awareness and engagement can be decisive. There are thus growing opportunities to move toward increasingly efficient energy production if regulation and consumer education are properly combined so that societies move to embrace the logic of this changing market. Generating energy for industry, however, might pose more of a challenge and of course, rebuilding housing stocks to make these more efficient represents a formidable and expensive challenge.

35. Andries Gryffroy, a member of the Flemish Parliament, also spoke about the opportunities afforded by off-the-grid energy development in poor countries. He first noted how low the price of solar panels has become. These systems are modular, reliable and affordable and they help diffuse rather than centralise economic decision making. One problem here is that the private sector is very oriented towards investing in large scale energy projects where both investments and returns are large. Small scale energy production is currently less attractive to investors and is seen as potentially risky. Reducing the scale of energy production also entails new political risks, as local authorities could create obstacles for a range of reasons that have little to do with the goal of meeting local energy needs. As such, Mr Gryffroy suggested that parliaments could make a difference in this area by devising legislation that lowers the risk to investors. Risk-sharing schemes could galvanise the spread of renewable technologies to developing regions. However, this must be done in a manner that does not distort markets.

36. Education represents another critical track for a rapid and effective move toward this new energy and economic model. Insuring that young people are broadly informed about the advantages and opportunities presented by shifting to renewable solutions will be critical to the broader transition. There is clearly an educational imperative if this energy transition is to be fully implemented.

37. While the revolution in solar and wind power is readily apparent, rapid change is also underway in the bio-fuel industry. Cities are increasingly harnessing biological waste to produce gas, and the output of biogas has tripled over the last ten years. This business is flourishing in Europe and in North America, but it is lagging behind in the developing world. IRENA has been looking into sugar cane as a potentially important fuel source, and a number of African countries including Tanzania,

Rwanda, Kenya and Uganda are currently studying how bio-fuel might best be incorporated into the energy mix.

38. A revolution is also underway on the user side of the equation. The market for electric cars is booming and cities are moving to encourage the use of zero emission cars. The world's auto industry is rapidly moving into this market and half today's new models are either electric or hybrid. Technological advance and digitalisation, in particular, are driving the move towards greater energy efficiency. But renewables can also be put to use for adaptation to climate change. Indeed, the revolution in renewable energies should alter perceptions of what might be achievable in terms of climate goals. Several conference speakers suggested that it may be time to set more ambitious goals as the technology changes and prices fall. One problem, however, is that there is a great deal of resistance to change, particularly from those that benefit most from the current energy mix. This poses yet another political challenge, particularly as large carbon energy companies often wield tremendous political clout. It is also worth considering that traditional energy company stocks constitute a major asset class: there could be a very disruptive movement out of these assets as renewables become increasingly attractive and storage technology advances. Coping with these disruptions will pose daunting financial challenges for many governments and the financial sector as a whole.

39. IRENA estimates that in order to meet climate change targets, the world will have to invest USD 25 trillion by 2050 in renewable energy. This means tripling the current annual investment in renewable energy. Much of this investment will have to come from the private sector, and the great challenge for the international community will lie in establishing frameworks both to encourage this investment and to create the conditions needed to generate sufficient returns. African leaders are increasingly ambitious on matters of renewable energy and the continent is likely to double its capacity by 2030. Other regions, most notably parts of Asia, have been less ambitious.

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