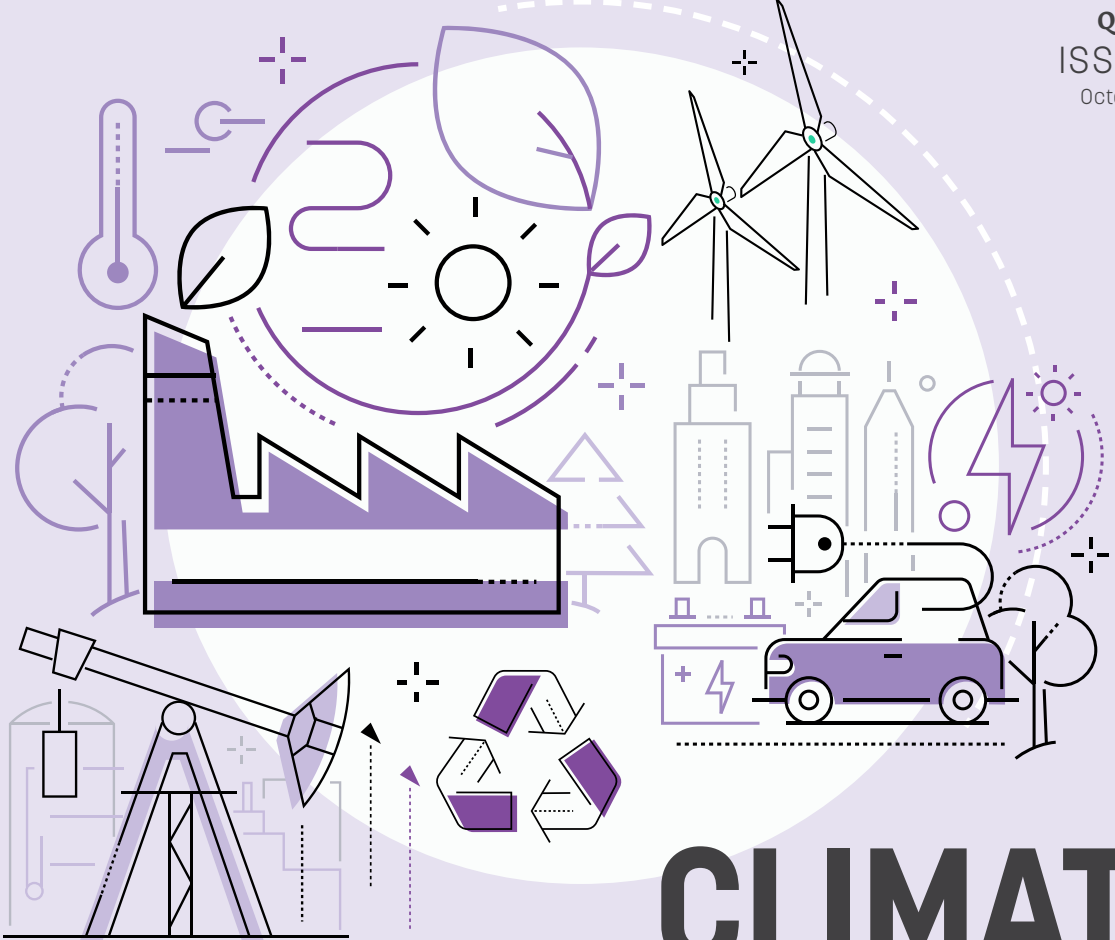


NEWSLETTER

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CLIMATE TECHNOLOGIES



INTERVIEW

**IT MUST BE REMEMBERED
THAT EVERY CHALLENGING
TRANSFORMATION ALSO OFFERS
GREAT OPPORTUNITIES**

DORUK IŞIL



INTERVIEW

**THE CLIMATE CRISIS CANNOT BE
SOLVED WITHOUT GOOD TECHNOLOGIES
BECOMING THE NORM**

DR. ÜMİT ŞAHİN

İKLİM TEKNOLOJİLERİ ÇOK MU PAHALI?

TTGV olarak, önümüzdeki dönemde özel sektörün uluslararası rekabetçiliği için büyük önem taşıyacağını düşündüğümüz iklim teknolojilerini odağımıza aldık. Bu çerçevede farklı destek programları yürüterek, söz konusu alanlarda ülkemizde kapasite artışı sağlamak için çalışıyoruz.

Üzerinde durduğumuz teknolojileri incelediğimizde (enerji depolama, yeşil hidrojen, karbon yakalama, sürdürülebilir çimento, alternatif protein, biyo/sentetik yakıtlar gibi) bunların, daha fazla sera gazı yayan daha kirletici teknolojilere kıyasla maliyetlerinin yüksek olduğunu; özel sektörün geleneksel yerine temiz bir teknoloji seçmenin ek maliyetine katlanmak istemediğini ve yeni uygulama riskini almaktan kaçındığını görüyoruz.

Peki, bu yeni teknolojiler gerçekten pahalı mı? Geleneksel teknolojilerin gerçek sosyo-ekonomik ve çevresel maliyetlerini onlar için ödediğimiz fiyata dahil etmediğimiz için yanıtımız şu anda, evet.

Dönüşmemenin Maliyetine Dikkat

Bu analizi doğru yapabilmek için “dönüşmemenin” maliyetini iyi anlamak gerekiyor. Uzun yıllardır, çeşitli ekonomik modellerle yoluyla, iklim değişikliğinin çevresel etkilerinin yanı sıra ekonomik etkileri de hesaplanmaya çalışılmış. Bu hesaplamalar sıcak ve gelişmişlik düzeyi düşük ülkeler için ciddi negatif bir ekonomik etki öngörürken, daha soğuk ve gelişmiş ülkelerin bazılarında nispeten pozitif etki dahi ortaya koymuş.

Oysaki son yıllarda iklim değişikliğinin sosyo-ekonomik etkileri üzerine yapılan birçok yeni çalışma, bu değişimin tesirinin tüm dünya ülkeleri üzerinde, önceden öngörülenden çok daha yüksek bir refah kaybına sebep olacağını ortaya koyuyor.



HANZADE SARIÇİÇEK

TTGV Genel Sekreter Yardımcısı

'National Bureau of Economic Research (NBER)'in 2024 yılında yayınladığı çalışmaya göre, iklim değişikliğinden kaynaklanan makroekonomik zararların daha önce düşünülen altı kat daha büyük olduğunu tahmin ediliyor ve 1°C ısınmanın dünya Gayrisafi Yurtiçi Hasılasının (GSYİH) %12 oranında azaltacağını öngörüyor. Aynı çalışmaya göre, bu ısınma, %29'luk refah kaybına ve karbon ton başına 1.065 dolarlık bir Karbon Sosyal Maliyeti oluşmasına sebep oluyor.(1)

IMF tarafından 2019 yılında yayınlanan başka bir çalışma, her ülkedeki iklim koşulları ve sıcaklık artış oranına göre değişiklik gösterse de iklim değişikliği politikalarının yokluğunda soğuk veya sıcak, zengin veya fakir tüm bölgelerin 2100 yılına kadar kişi başına düşen GSYİH'nda nispeten büyük bir düşüş yaşayacağını öngörüyor. Mesela, ABD için yapılan çalışma GSYF düşüşün %10.52 olacağını, Paris Anlaşması koşullarına uyulması durumunda ise düşüşün %1.88 ile sınırlı olacağını öngörüyor. (2)

İklim Değişikliğinin Farklı Etkileri

İklim değişikliği, çevresel etkilerin yanı sıra ayrıca ekonomik, sosyal ve politik etkileri de barındıran çok önemli bir süreci ifade ediyor. Küresel sıcaklık düzeylerinde meydana gelen artışlar ve şiddetli hava olayları; tarımsal üretimde kayıpların yaşanması, sürdürülebilir gıda arzının tehlikeye girmesi, sanayi üretimi için gerekli olan ham madde girdilerinin tedarik edilememesi, emek yoğun sektörlerde işgücü verimliliğinin azalması, üretim ve verimlilik düşüşleri, turizm sektöründe kayıplar, ısı stresi ve çevresel kaynaklı sağlık etkileri gibi oldukça önemli makroekonomik etkilere sahip. Küresel ısınma sonucu deniz seviyesinin yükselmesi, okyanuslarda asiditenin artması, balıkçılık ve tarım gibi geçim kaynakları üzerinde oluşacak baskı gibi çeşitli sebeplerle yaşanacak kontrolsüz göçler, sosyal ve kültürel değerlerde kayıplar da göz ardı edilemeyecek etkiler arasında.

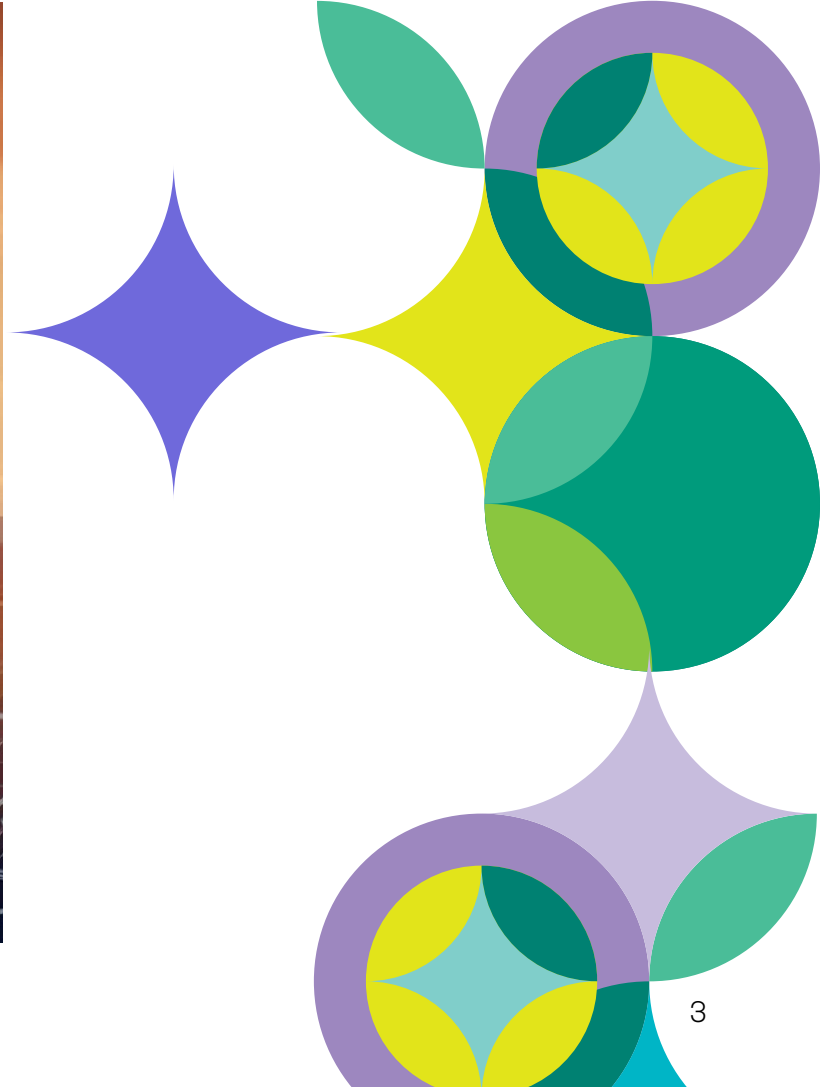


Tüm bu etkileri birlikte değerlendirmek, buna yönelik uzun vadeli, etkili ve sürdürülebilir stratejiler, politikalar, kaldıraç etkisi yaratacak teşvik ve destek modelleri geliştirilmek zorunluluğu bulunuyor. Paris Anlaşması gibi uluslararası uygulamaların ve bu tür politikaların bir sonucu geliştirilen karbon fiyatlandırması, karbon vergisi gibi mekanizmaların ciddiyetle ele alınması, samimiyet ve kararlılıkla uygulanması gerekiyor. Diğer yandan iklim odaklı teknolojilerin daha erişilebilir olmasını sağlayacak Ar-Ge ve sanayileşme çalışmalarının kamu, özel sektör ve sivil toplum eliyle desteklenmesi büyük önem taşıyor.

TTGV olarak, “Teknoloji Üreten Türkiye” misyonuyla, özel sektörün bu kapsamlı dönüşüme adapte olmasını destekleyecek özgün modelleri geliştirmek ve ilgili sektör paydaşları işbirliğiyle uygulamak için üzerimize düşen çalışmaları yapmaktan büyük memnuniyet duyuyoruz.

Referanslar:

- (1) The Macroeconomic Impact Of Climate Change: Global vs. Local Temperature, Adrien Bilal Diego R. Känzig, May 2024, Revised August 2024, Nber Working Paper Series (https://www.nber.org/system/files/working_papers/w32450/w32450.pdf)
- (2) IMF Working Paper Fiscal Affairs Department Long-Term Macroeconomic Effects of Climate Change: A Cross-Country Analysis* Prepared by** Matthew E. Kahn, Kamiar Mohaddes, Ryan N. C. Ng, M. Hashem Pesaran, Mehdi Raissi and Jui-Chung Yang Authorized for distribution by Catherine Pattillo October 2019 (<https://www.imf.org/-/media/Files/Publications/WP/2019/wp19215-print-pdf.ashx>)



THE CLIMATE CRISIS CANNOT BE SOLVED WITHOUT GOOD TECHNOLOGIES BECOMING THE NORM



DR. ÜMİT ŞAHİN

Istanbul Policies Centre (IPC) Climate Change Studies Coordinator at Sabancı University

INTERVIEW: Esra YAZDIÇ DEMİR
TTGV Kurumsal İletişim ve Medya Yöneticisi



The policies developed or attempted to be developed in the process of managing the climate crisis also determine the position of the countries in terms of scientific and social freedoms. While some countries assume responsibility for the climate crisis, others recognise the crisis even if they are not responsible for it and undertake to do their best. **So, what kind of a policy does Türkiye follow in the climate crisis? In this context, we met with Dr. Ümit Şahin, Coordinator of Climate Change Studies at Sabancı University Istanbul Policies Centre (IPC), who is one of the leading figures who works in this field in Türkiye.**

Pointing out that making climate policy resembles a sharp knife, Şahin states that the climate crisis cannot be solved unless good technologies become the norm and adds the following: **“We have become accustomed to the paradigm that someone else will develop the technology and we will purchase that technology. We need to get rid of this paradigm as soon as possible. Türkiye can become a serious technology producer. For this, a serious industrial policy is required to be developed and adopted.”**

[You can read the details of our interview with Dr. Şahin.](#)

Mr. Ümit, you are a physician. You have been working in the field of climate policy for a very long time. How did you make such a transition in your career?

I am a public health specialist. I have a master's and a doctoral degree in this field. I have been involved in environmental and ecological movements since my undergraduate years. I have been studying climate since 2004-2005. My doctoral thesis in public health was on air pollution in Istanbul and its impact on mortality. I am currently studying the impact of heat waves on mortality. I was also involved in the climate movement when it was first started in Türkiye.

Making climate policy resembles a sharp knife

How should we interpret the climate crisis at the policy level?

Every country has a climate policy process. They endeavour to eliminate the effects of climate change or to minimise their responsibilities. For this purpose, they set long and short term targets. In case the goal is to increase renewable energy capacity, they determine policy instruments to achieve this. Thus, the question arises whether this is a political process or a political process. The answer is both of them. Policy-makers, technical experts and, where appropriate, members of parliament closely monitor international processes and formulate the necessary policy instruments. Legislation is also necessary to ensure that the instruments conform to the law. In the development of these policies, there are of course the influences of established interests. Unfortunately, this system is still not fully established in Türkiye. Making climate change



policy is not a technical task. It has a technical dimension, of course, but if it did not have a political dimension, the climate change problem would have been solved long ago.

The policies developed or attempted to be developed in the process of managing the climate crisis also determine the position of the countries in terms of scientific and social freedoms. While some countries assume responsibility for the climate crisis, others recognise the crisis even if they are not responsible for it and undertake to do their best. So, what kind of a policy does Türkiye follow in the climate crisis? In this context, we met with Dr. Ümit Şahin, Coordinator of Climate Change Studies at Sabancı University Istanbul Policies Centre (IPC), who is one of the leading figures who works in this field in Türkiye. Sufficient technology and finance are available for this. However, special interests affect this. Making climate policy resembles a sharp knife. No matter how economically and technically strong you are, it is not possible to be successful unless you bring politics into the picture.

Türkiye must recognise its responsibility in the climate crisis

In comparison with the world, how would you evaluate the route of Türkiye in climate processes?

Türkiye is one of the countries in the world that has embraced and accepted climate change from the very beginning. Since 1992, when the first framework agreement was concluded, Türkiye has been involved in this issue. Türkiye has never been a climate denier like Trump, in other words, there has never been a group claiming that there is no such thing as a climate crisis. Everyone is aware of the importance of the issue. This is also seen in the COPs.



On the other hand, Türkiye unfortunately maintains the understanding that it has no responsibility in the climate crisis. In IPCC reports, it is stated that the Mediterranean basin is greatly affected by the crisis, and this is true. Drought has become a great danger. The number of floods has increased, as well as extreme temperatures. Everyone living in Türkiye can see that the climate crisis has begun to hit the country seriously even when they just look out of the window. The problem is global. It affects the whole world and its causes are global. Countries are not alone here. Some countries regard themselves as not responsible for the climate crisis. Unfortunately, Türkiye continues to support this understanding. Countries that have not yet grown and developed like the USA, Japan or Europe do not consider themselves accountable for greenhouse gas emissions, yet they account for 3 out of 4 greenhouse gas emissions. When you leave the responsibility only to developed countries, it is not possible to solve the climate crisis even if these countries fulfil this task 100 percent. The position of Türkiye is not consistent in this sense. Türkiye is a European country. From this point of view, when compared to Italy, Spain and France, there is nothing to defend for Türkiye to consider itself as a country that has no responsibility. In fact, on the basis of the climate policies of Türkiye, you will see a sentence in every COP

that Türkiye has no responsibility in climate change, but despite this, it carries out important policies. Under these circumstances, I think that no matter which technology is developed, it is not possible for the combat of Türkiye against climate change to yield any results. I think first of all, Türkiye needs to start by accepting its responsibilities. It must be emphasised that “the climate crisis is very important, and Türkiye is in a fragile geography, therefore we have to fulfil our responsibilities to stop this crisis”.

The very essence of climate policy is to decide to reduce emissions

So why do we hold back when it comes to taking responsibility?

For instance, when we analyse Türkiye, we observe that it aims to increase emissions until 2038. So, how will we reduce carbon emissions and how will a price be formed? First of all, a country needs to assume the responsibility to reduce its carbon emissions so that policy instruments on how to reduce these emissions can function. Türkiye will introduce an emissions trading system, but no price will be formed in the market because there will be no demand. This is because Türkiye does not have a target for reduction.

“The core of what is called climate policy is to decide to reduce emissions. For this to change, we are waiting for the renewal of the National Contribution Declaration with a real and absolute reduction target in 2025.”

Türkiye has set a target to increase its emissions by 32 percent by 2030. What kind of a market will be formed? Of course, you can create an artificial market, but there will be no deterrent and the system will not work. Unless a serious target and strategy are set, these actions will remain merely on paper. Although good targets have been set for renewable energy in Türkiye, these targets are generally aimed at energy independence. In other words, it aims to reduce imports rather than reducing emissions. It may not seem to matter, but the core of what is called climate policy is to decide to reduce emissions. For this to change, we are waiting for the renewal of the National Contribution Declaration with a real and absolute reduction target in 2025.

Have you had a chance to examine the proposed climate law?

There was a draft text that we saw and it was not bad. I have no objection to this. It is a Law that mainly describes the Emission Trading System (ETS). When a real policy is not in place, establishing an ETS as much as you want will not be of any benefit.

Your speciality is temperatures. On this subject, you start with public health and endeavour to proceed in the climate process and explain the connection between these two. Could you please tell us a little bit about this?

Climate disasters such as hurricanes, floods, forest fires, heat waves, ... These are the natural disasters that are often in the news. We know people who lost their lives in floods. However, when compared to others, you can see that heat causes more casualties. Especially the elderly and those with chronic diseases, heart, kidney and lung diseases may have sudden deaths. Heat-related deaths occur due to heart attacks and dehydration. We learnt about hyperthermia at school, but when such a patient came to the emergency room, we never suspected that it was death due to hyperthermia. There is no such code in hospitals. Since the age of the patient is advanced, the cause of death is recorded as a heart attack. Elderly deaths are not emphasised too much. Since people who die from the heat are not recorded, both health authorities and

other people are not aware of the fact that heat is a public health problem and should be considered as a disaster. 20 years ago, either, the world was not aware of it. Let me illustrate this with an example. Chicago in 1994 and Athens in the 1980s also experienced heat waves. Although no one except experts had paid attention to it, when 70.000 people died in 16 countries in Europe during the 2003 heat wave over the course of one summer, the attention started to be drawn to this area. Because of the climate crisis, 61.000 people died in a heat wave in Europe in 2022. In Canada, 595 people died in one week about 2 or 3 years ago. These are calculated on the basis of the number of unexpected deaths. Just like during a pandemic, the number of deaths per day in each region and the impact factors are known. When you calculate these, you find out how many additional deaths are caused by different factors, for example temperature or air pollution. In the world, public health institutes calculate these figures. In Türkiye however, such a calculation has not yet been made. There are two studies conducted by the Public Health Department of Cerrahpaşa and IPM. We found that 4281 deaths occurred in 13 years between 2004-2017. This was published as an article in a peer-reviewed journal. All public health professionals around the world can calculate these figures. It has become the reasons for the official action plans of governments. We are trying to explain that heat causes deaths also in Türkiye.

Heat is the most important climate disaster

There are regions in Türkiye that are famous for their heat. Are we normalising the temperature?

The temperature is local. In Istanbul, 35 degrees is a heat wave, but Adana's heat wave is around 45 degrees, so it is normal. If you are born and raised in that region, even your metabolism adapts to the temperatures there. For example, the most deaths in Istanbul occur in May or June. There will not be so many deaths in August in the same heat. Each province determines its own heat wave threshold according to meteorological and mortality data. Heat is the most important climate disaster and this is

INTERVIEW

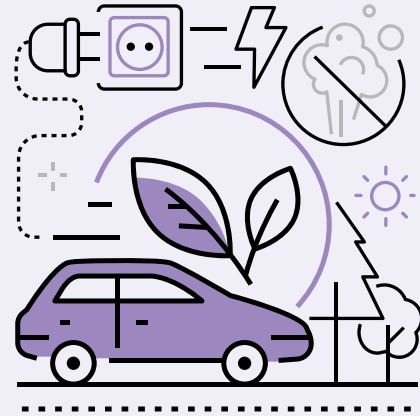
the easiest situation to find a solution. The Ministry of Health, local administrations and other authorities play an important role in this regard.

A lifestyle based on excessive consumption should be abandoned.

How do climate technologies help the climate crisis?

The basis of climate change is excessive consumption. Of course, the solution is technology, but if technology itself increases consumption, it will eventually cause problems related to the climate crisis. First of all, the cause of climate change is the burning of fossil fuels. The main reason for burning fossil fuels is the increase in energy consumption, transport, food production, tourism and consumption in all kinds of items and the increase in lifestyles that enable this. Our first goal should be to get rid of a lifestyle based on excessive consumption. However, in a world where 8 billion people live, it is not possible to sustain this lifestyle without good technologies. While reducing consumption and trying to establish a more ecological society and economic order, we have to sustain our lives with clean and good technologies. It would never be possible to solve the climate crisis without good technologies becoming the rule or the norm. Because the current economic order is based entirely on fossil fuels. The only way to get rid of fossil fuels is renewable energy. The only way to replace fossil fuels with renewable energy is not only to produce solar panels or wind turbines, but also to increase their capacity factor, to make them efficient, and to ensure that they produce energy continuously in more overcast and less windy weather. To make the necessary storage technologies cheap and accessible in areas where energy cannot be produced. To provide what we call flexibility in all energy-consuming areas, that is, both grid flexibility and a flexibility intertwined with storage in energy consumption in general. Making the consumption flexible is the job of technology. It is necessary to ensure flexibility both through digital methods and innovation in grid management. Flexibility must also be achieved by improving the conductors. The role of advanced technology, especially in the integration of renewable energy, is very important.

We have become accustomed to the paradigm that someone else will develop the technology and we will purchase that technology. We need to get rid of this



Sustainable technologies need to become mainstream technology

How would you evaluate TTGV's role and activities in this field?

One of my first jobs at IPM was to prepare an actor map. That was when I visited TTGV, which was also working on clean technology at the time. The role of TTGV is important for Türkiye. Nevertheless, this role should not be seen as a minor one. Türkiye needs to reach a certain stage that will change its entire industrial and technological policy. Clean, sustainable, new technologies need to become mainstream technology and industry. Otherwise, we will get nowhere other than saying that someone else produces technology and we purchase it. We need to generate the knowledge for this, and for this we need a free scientific environment.

paradigm as soon as possible. It is necessary to prepare an environment where technology can be developed and applied in a free academic environment by experts in Türkiye. Today, this is already achieved in the defence industry, but if the necessary investment, scientific environment and academic environment are provided, I am sure that Türkiye can become a serious technology producer in the fields of energy technologies and renewable energy as well as digitalisation, without getting too hung up on the issue of scale, especially in energy production, although some say that we cannot do this because we will never be able to catch up with the scale of China. However, a serious industrial policy is needed for this. This can also be a part of climate policy.



CLIMATE TECHNOLOGIES, COMMERCIALISATION AND VALLEYS OF DEATH

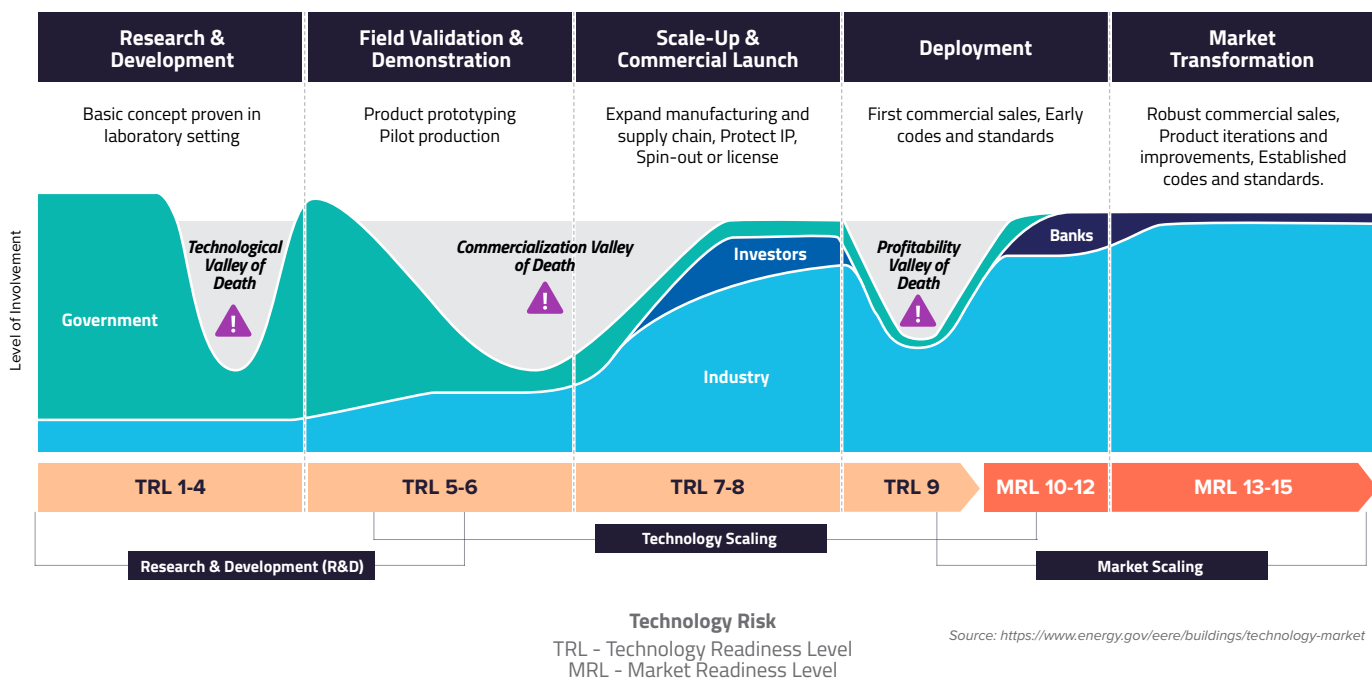


BETÜL TEKE SARIYER

TTGV Pioneer Project Program Specialist

One of the most important missions of the Technology Development Foundation of Turkey (TTGV) is to increase the international competitiveness of Türkiye and to bring technology together with the real world by improving the innovation capabilities of the private sector. In line with this goal, TTGV launched the Hit Thematic Development Programme in 2018. The programme provides the business development support needed in the commercialisation process to startups operating in certain thematic areas that are in the process of verifying the product-market match and have the potential to grow rapidly and create high added value.

The biggest difference that distinguishes this programme from other startup acceleration programmes is the “Check-up” process developed by TTGV and implemented specifically for each startup, and the “Dynamic Prescription Action Plan” that was created afterwards. The “Check-up” process, which was named with the inspiration of the health vertical, involves analysing the shortcomings and needs of the startups from A to Z, just like a comprehensive health screening before treatment in a hospital, and creating a special action plan, i.e. a “Dynamic Prescription Action Plan”, for the startup in line with this analysis.



This special recipe plan is prepared by mentors and TTGV team with deep knowledge in their sectors and a wide business network, and serves as a roadmap guiding the startups in the first year of the programme. Throughout the development process, the metrics set out in the recipe plan determine the strategic and business development steps that startups need to reach the first sale on their commercialisation journey. Furthermore, mentors and TTGV team continuously monitor whether the startups are on the right path or not.

The New Process

With the accumulation and experience gained from this programme, which has been carried out with a development methodology specific to TTGV since 2018, a new programme modelling process has been initiated in the climate technologies vertical, which constitutes the current focus of TTGV. Early-stage technology valuation and startup development programmes have been established for maturity levels in two different segments, namely “Pioneer Project Seed Programme” and “Pioneer Project Demo Programme”, to support the climate technologies ecosystem in Türkiye, to better identify the problems and solutions in this field, which

has a complex commercialisation and field validation process with multidisciplinary solution requirements, and to create scaling plans suitable for the market.

Analyses conducted during this transformation process have demonstrated that, according to their Technology Readiness Level (TRL), startups and technological products face various valleys of death in their development journey. Each valley of death represents critical challenges that must be overcome for startups or products to successfully enter the market and grow sustainably, as illustrated in the image adapted from the US Department of Energy’s Energy Efficiency and Renewable Energy Unit’s “From Technology to Market” study.

Valleys of Death

The first one of these valleys of death, the “Technology Valley of Death”, can be defined as the technical problems experienced by technologies observed at TRL 2-4 levels during the R&D phase. Technology Valley of Death can be defined as one of the most challenging stages that a new technology encounters during the transition from the laboratory environment to industrial application.



“Early-stage technology valuation and startup development programmes have been established for maturity levels in two different segments, namely “Pioneer Project Seed Programme” and “Pioneer Project Demo Programme”, to support the climate technologies ecosystem in Türkiye, to better identify the problems and solutions in this field, which has a complex commercialisation and field validation process with multidisciplinary solution requirements, and to create scaling plans suitable for the market.”

At this stage, several risks such as shortage of resources required for the development of the technology, technical problems and industrial harmonisation issues are encountered. Start-ups need adequate financing, strong R&D support and strategic planning to be successful in this valley. Moreover, it is crucial that the technology can be integrated into existing industrial systems. Universities, research organisations and government support play a critical role at this stage, but the availability of these resources cannot always be guaranteed.

Determining the area(s) in which the technologies developed in the lab environment at TRL 2-4 level in Türkiye can function, the technical requirements and mass production conditions for these areas, the development of intellectual property strategies specific to the area of use, possible licensing models and the definition of joint development processes with partners with sectoral experience/development infrastructure can be regarded as an important transition process in overcoming this critical valley.

The second valley of death is called the “Commercialisation Valley of Death”. The Commercialisation Valley of

Death refers to the difficulties encountered during the introduction to the market and commercialisation of this technology after the successful development of the technology in the laboratory environment. At this stage, start-ups face large capital requirements to produce their products on an industrial scale and bring them to market, but investors are often hesitant at this high-risk stage. In addition to the complex steps of scaling the product, optimising production processes and establishing supply chains, it is also critical to plan the market entry strategy correctly. At the same time, the technology needs to be adopted in the industrial environment and integrated with existing processes.

At this stage, field trials strengthened by strategic collaborations for the adoption of the technology in the industrial environment, achieving the right product-market fit and rapid adaptation to market conditions with addressable product iterations have a great importance. In the meantime, guidance from experienced industry experts and professionals will enable the startup to determine the right and flexible strategies during the market entry phase, enabling the startup to successfully exit this valley and enable the sustainable growth of the startup.

STAYING IN THE GAME AT THE INTERNATIONAL ARENA



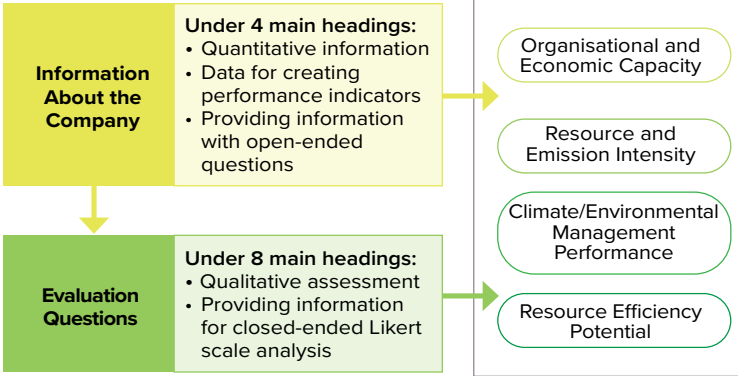
HAZAL AKBULUT BIYIK

Eco-Production Transformation Program
Specialist



The increasing need for environmental sustainability worldwide and the growing importance of issues such as transition to a low-carbon economy, resource and energy efficiency make it mandatory for industrialists to integrate a holistic and preventive environmental strategy into their processes. Furthermore, global priorities related to sustainability and climate change and the political, legal and commercial regulations they bring about are expected to create significant additional costs, especially for exporter companies. Urgent steps need to be taken to protect the competitiveness of industrialists and to prevent them from staying out of the game at the international arena.

The Technology Development Foundation of Turkey (TTGV) has developed the Eco-Production Transformation Programme to respond to this need. Within the scope of this programme, the applications made with the EkoReka Preliminary Analysis Tool, the methodology of which belongs to TTGV, were implemented in 2022 and preliminary analysis studies are currently continuing in various regions. The programme targets companies in critical supply chains and direct exporter industrial enterprises that will be severely affected by national and international regulations on climate change and green transformation. The aim of the programme is to conduct a 360-degree evaluation of companies to determine their capacities, maturity levels and basic needs, and then, when appropriate conditions are met, to proceed to the “Technical Feasibility and Investment Preparation” stage for prominent projects. Since 2022, around 100 companies have been analysed by the EkoReka Preliminary Analysis Tool and the analysis processes of more companies are currently underway. The questions in the EkoReka Preliminary Analysis Data Collection Form, which was designed using various form interfaces, macros and formulas on Excel, consist of two parts: information about the company and company evaluation questions. The first part, company information, consists of four separate categories including quantitative and qualitative data, and the second part consists of Likert scale-based, five-choice evaluation questions. Three of these evaluation questions gathered under 8 main headings are evaluated under the heading of “Resource Efficiency Potential” and five under the heading of “Climate/Environmental Management Performance”.



Resource Efficiency Potential Evaluation

The first three main topics in the company evaluation questions are analysed under “Resource Efficiency Potential” and the impact potential of a company to ensure resource management is evaluated. According to the multiple-choice questions here, the success scores of the companies are revealed.

With the “Resource Efficiency Potential Evaluation”, approximately 100 companies were analysed on the following three main topics:

1. Impact of Resource Consumption and Waste/Emissions on Costs

In this heading, where the average is **3,2** out of 5 full points, it is observed that resource and energy consumption affect the costs of companies at a relatively high rate and creates a potential here.

2. Studies on Climate Change and Resource Efficiency in Planning (Not Yet Realised)

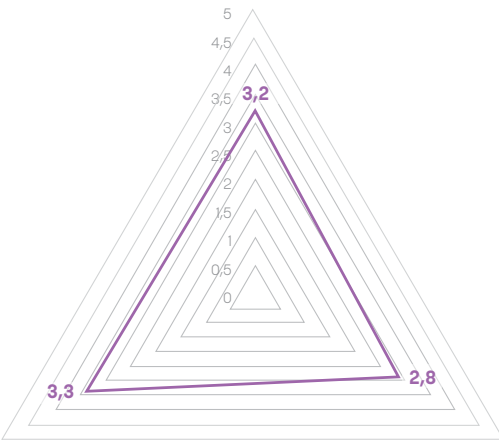
An average score of **2,8** out of 5 full points indicates that companies have not yet developed sufficiently in this area and that planning is insufficient.

3. Impact of Market Conditions, Markets and Customer Relationships

As a result of the evaluation, it is seen that this category is the highest rated category with an average score of **3,3** out of 5 full points, and it stands out that this category has a relatively high potential in terms of resource efficiency.

In this evaluation made on approximately 100 companies, 3 categories were analysed together:

The Impact of Resource Consumption and Wastes/Emissions on Costs:



Impact of Market Conditions, Markets and Customer Relationships

Studies on Climate Change and Resource Efficiency in Planning (Not Yet Realised)

- Turkish industry is **under significant cost pressure** in terms of resource consumption and waste management, and the development of resource efficiency and waste minimisation projects by companies has a high impact on reducing costs.
- Within the scope of the programme, deficiencies in the energy management system of companies, the highest cost items of which consist of raw materials and energy consumption, such as the chemical sector, are identified and project recommendations are provided within the scope of developing energy efficiency and clean production studies.
- It is noteworthy that although the impact of resource consumption and wastes/emissions on costs is high with a value of 3,2, companies should develop projects to increase their efficiency in this direction; however, the planned studies on climate change and resource efficiency are lower than expected with a value of 2,8.
- Even though the planned studies on climate change and resource efficiency are still few, they will become an important focus area for the Turkish industry in the future. In this process, companies should take proactive steps and develop strategies to adapt to global sustainability targets. Moreover, industrialists should be supported with information and awareness trainings in this field, and projects that can be carried out with incentive mechanisms should be researched.

- Another striking finding is that market conditions, markets and customer relations have the highest share (3,3) in the impact of resource efficiency. It is observed that customer demands have a high importance in reducing environmental impacts. In particular, the rapid change in global and local market dynamics, the increase in competition and the continuous evolution of customer demands require Turkish industry to concentrate on these factors and gain flexibility.

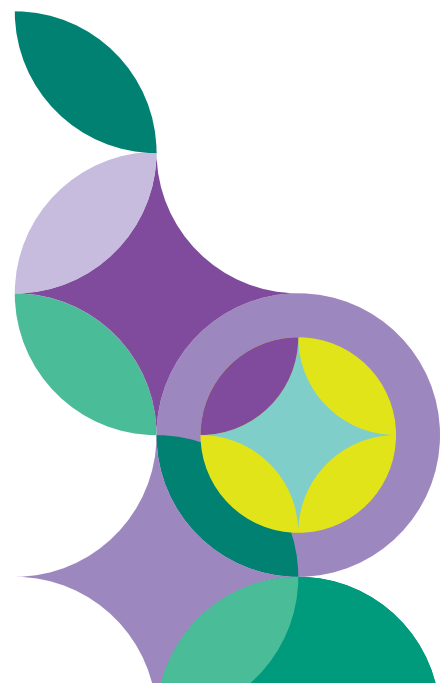
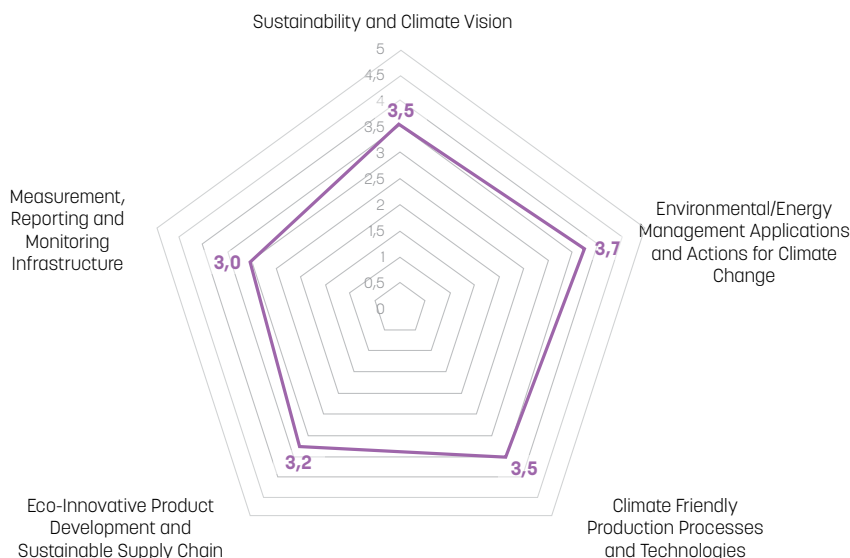
Evaluation of Climate/Environmental Management Performance

The other five main topics included in the company evaluation questions are analysed under “Evaluation of Climate/Environmental Management Performance” and the current performance of the companies is analysed. According to the answers given to the multiple-choice questions here, the success scores of the companies are determined.

Within the scope of Climate/Environmental Management Performance, approximately 100 companies have been analysed on the following five main topics:

1. Sustainability and Climate Vision

In terms of sustainability and climate vision, all companies within the scope of the project received a relatively high score of **3,5** points on average (out of 5 full points).



2. Environmental/Energy Management Applications and Actions for Climate Change

With an average score of **3,7** (out of 5 full points), this category stands out as the **highest rated category** in this evaluation area.

3. Climate Friendly Production Processes and Technologies

With an average score of **3,5** (out of 5 full points), this category demonstrates that companies have invested in climate-friendly production processes and technologies and have made some progress in this area.

4. Eco-Innovative Product Development and Sustainable Supply Chain

The average score for all companies in this category (out of 5 full points) was **3.2**, which is **relatively low compared to other categories**, indicating that companies are behind in this area, but still making progress.

5. Measurement, Reporting and Monitoring Infrastructure

This category, which has the **lowest score of 3,0** points (out of 5 full points), indicates that the measurement, reporting and monitoring infrastructure of companies is relatively weak.

When 5 categories were analysed together in this evaluation made on approximately 100 companies:

- Turkish industry has generally performed well in terms of adopting a specific vision and policy on sustainability and climate change issues according to the sustainability and climate vision category. It is observed that companies attach more importance to sustainability issues at the senior management level, train employees on these issues and integrate a sustainability perspective into all operational

processes, which is an important factor that will take them one step ahead, while it is also observed that the maturity level is higher in companies where senior management leads the green transformation.

- Regardless of the sector, global companies have the advantage of being managed from a single centre and therefore have more specific road maps for setting targets and implementing the necessary actions to achieve them.
- Furthermore, it is seen that having a visionary perspective of the umbrella organisations plays a key role for the green transformation of the companies and it is of great importance for them to play an active role in mobilising the companies.
- While the sustainable supply chain category scored relatively lower due to the difficulty of ensuring that all stakeholders in the supply chain are committed to the same sustainability objectives and the complexity of managing a large number of suppliers, this also indicates that sustainability applications have not been fully adopted in the supply chain.
- While measurement, reporting and monitoring infrastructure stands out as the category with the lowest score, this situation reveals that the Turkish industry needs to make further progress in monitoring and reporting sustainability performance. During this process, it has also been determined that water use is intensive especially in companies working in the textile and food sectors, but they are in a weaker position than other companies in the field of water and energy consumption measurement, reporting and monitoring infrastructure.



IT MUST BE REMEMBERED THAT EVERY CHALLENGING TRANSFORMATION ALSO OFFERS GREAT OPPORTUNITIES



DORUK IŞIL

Founder of Karbonomics, Climate
Entrepreneur and Consultant

INTERVIEW: Esra YAZDIÇ DEMİR

TTGV Corporate Communications and Media Manager

“Climate change constitutes the biggest challenge that humanity has ever faced. The solution is possible only if all humanity works together to achieve a great transformation. There are also great opportunities that will come with this.”

Climate change has changed our perspective on life. We have been adapting to a completely different world order in terms of daily life, working areas, transformation of professions and sectoral renewal. So, what should be done for the impacts that all these have created/will create on us? For this purpose, we came together with a specialist who emphasises the importance of decarbonisation of sectors in climate change, analyses its future impacts in depth and offers solutions. **Doruk Işıl, Founder of Karbonomics, Climate Entrepreneur and Consultant, and Former Vice President of Decarbonisation Solutions and CO2 Management at Paris-based Technip Energies.**

Mr. Doruk, thank you for accepting our invitation. It is invaluable for us to learn about the existential impacts of climate change and the solutions you offer according to your expertise. I know that you emphasise the importance of addressing the dangers and opportunities posed and offered by climate change equally. My first question is, what does decarbonisation mean to you, and why is it important for the world to decarbonise sectors?

First of all, I would like to express my appreciation to TTGV for carrying out a very important mission such as raising awareness on a vital issue such as decarbonisation, shedding light on technological developments and supporting these developments, and thank TTGV for inviting me to this interview.

Decarbonisation of sectors, which I perceive as total decarbonisation, holds great importance as it is the basic condition for eliminating the risk of climate change due to global warming, which poses the greatest threat to our life order both today and tomorrow. When we consider the existential dangers and impacts of climate change, it is apparent that this is the greatest challenge that humanity has ever faced. Its solution lies in the ability of all humanity to achieve a great transformation by working together, even for the first time in history, and in this sense, it has a unifying dimension.

The condition for this solution is to take climate change and its impacts under control by reaching Net Zero carbon emission level by 2050, limiting global warming to the target of +1.5 degrees and at worst +2 degrees, as targeted by the 2015 Paris Agreement.

For me, decarbonisation means the sum of all the actions we need to take, the investments we need to make, the habits we need to change, the various



value chains we need to transform and the many new technologies we need to develop in order to reduce all greenhouse gas emissions to net zero.

Returning to our question, the importance of decarbonisation is equivalent to the importance of stopping climate change caused by global warming. But what are the impacts and dangers of climate change? I think it is crucial to remember that every crisis also offers an opportunity for transformation and that the endeavour to find a solution will also create undeniable opportunities in order to prevent the existential danger I have mentioned and the enormous effort it requires, especially in these days when we have not yet fully found the solutions, from leading us to pessimism and then to frustration, in other words, in order not to “sink into despair” as we say in our beautiful Turkish. Mario Draghi, former president of the European Central Bank (ECB), also highlighted these important opportunities in his report on the Future of EU Competitiveness presented this week. With this approach, I will try to address the threats and opportunities together.

In some quarters, climate change is perceived only as the occurrence of events beyond what we are used to in our living conditions and the increase in the frequency and severity of natural disasters, but its real dangers are far beyond these. I believe that it is extremely important to explain these dangers to the public very



well in order to ensure the determination, the actions to be taken and the momentum needed for the great transformation we need to achieve I classify the dangers of carbon emissions and climate change for the world, our planet, under four main headings in my mind: health and environment, economic, social and political, and moral...

1. Hazards related to health and the environment

As global population and urbanisation increase together, we see that **respiratory and cardiovascular diseases** have become more frequent in urban and industrial areas where emissions are concentrated. By reducing emissions and accompanying air pollution, we will be able to reduce the risk of these diseases, protect public health more effectively and reduce health service costs, as well as allocate these resources to more important issues.

Furthermore, reducing emissions will help prevent the loss of **habitats and agricultural lands**, which has been accelerating due to rising sea levels and extreme climate events. Likewise, wildlife habitats, which have been rapidly diminishing, will stop accelerating ocean acidification and ensure the **protection of natural ecosystems and biodiversity**.

In this sense, one of the dangers that concerns me the most is the emergence of microbes, bacteria and viruses that have been kept frozen under the poles and permafrost regions for hundreds of thousands or even millions of years, that is, even before the existence of humanity, as a result of the accelerating thawing in these regions,

and the emergence of new epidemics and pandemics. I am afraid that pandemics that will emerge in this way will have health, economic and social impacts on a much larger scale than Covid-19.

2. Economic hazards

It is an inevitable fact that the health and environmental impacts of climate change, as well as the social and political dynamics I will talk about shortly, will have devastating effects on economies. The costs we will have to bear to cope with these far-reaching impacts and adapt our living environments to changing climate conditions will create extremely difficult burdens on personal, social and national budgets. Furthermore, unless we take the necessary steps for decarbonisation in a timely manner and at an accelerated pace to achieve 2050 Net Zero carbon emissions, the costs of meeting climate targets later on will be significantly higher. I am afraid that the burden of all these will be unbearably severe on the global economies, which are already fragile. What I want to say is that while it seems somehow possible to move towards this goal by bearing the perhaps heavy economic burdens that decarbonisation will bring, it is very clear that it is impossible to carry the opposite, i.e. the economic consequences of the impacts of climate change.

Here, we should also underline the significant **economic opportunities** that decarbonisation, i.e. moving towards the 2050 Net Zero target, will bring along with it. Undertaking this type of wholesale transformation will create long-term benefits for societies and economies.

For example;

- During the transition to low-carbon systems and technologies, R&D, training, transformation and investment expenditures to be made by the public and private sectors can create **additional employment, new business areas and economic growth** opportunities;
- Transition to **sustainable economy and development** can be supported as a result of securing the availability of resources for future generations through decarbonisation;
- Steps to be taken for decarbonisation, especially in the short to medium term, with a focus on digital transformation, renewable energy and increasing

energy efficiency, can support **price competitiveness** and reduce market risks.

- Companies that prioritise decarbonisation can achieve the **low carbon competitive advantage** that will be essential for the new economic order in the medium to long term as consumers and investors increasingly demand sustainable products and services.
- Ecosystems to be developed and competition to be created for the technologies required for decarbonisation and cost optimisation support **technological innovation and the transition to an entrepreneur society**.
- The financial sector enables organisations that make a convincing commitment and progress on decarbonisation and sustainability to access financial resources and services on better terms. By focusing on decarbonisation, it may be possible to reach these advantageous conditions and thus increase **financial resilience and competitiveness on a company and country basis**.

Decarbonisation and the technologies that are brought along with it trigger the creation of new value chains, and acceleration creates new opportunities and development opportunities for regions and sectors that have previously faced economic limitations. As an example, we can recall the opportunities that the previously unprivileged global south has seized in the energy transition.

3. Political and social influences and hazards

As a result of the rise of the sea levels triggered by climate change, we will witness a very important global impact resulting from the loss of living and economic activity areas of large populations living and farming in coastal areas and, to a significant extent, in the global south and in countries experiencing development difficulties. The first impact will be **rapidly increasing poverty and hunger** and the health and political problems that will follow. What we are talking about here is an unprecedented human tragedy. Since it will not be possible for the countries with limited resources where these populations live to carry this burden, the situation that will arise with the need for the support of industrialised countries will pose a problem that concerns all countries.

“Decarbonisation and the technologies that are brought along with it trigger the creation of new value chains, and acceleration creates new opportunities and development opportunities for regions and sectors that have previously faced economic limitations.”

Beyond this, **the need and desire of millions** of people who can no longer live in these regions to **migrate** to other, more prosperous regions **will accelerate**. These migration movements of 100 million or even billions of people will obviously have very important economic and political consequences. We all see the effects of the migration to Europe and America in recent years for partly similar reasons. You can imagine how big and destructive the wave that will be experienced as a result of the acceleration of climate change will be.

Besides these frightening effects and dangers, the political and social benefits that success in decarbonisation will bring to societies should not be forgotten.

Decarbonisation involves a transition from fossil fuels, which are mostly imported, to renewable energy sources. In this context, I think the most prominent benefit will be **increased energy security** and the **reduction of global problems and vulnerabilities based on the (hydrocarbon-based) energy geopolitics** of the last 80 years, **and the development of resilience against the problems and risks** posed to national economies by the market volatility created by these commodities.

Countries and companies that achieve progress and success in decarbonisation will be able to gain competitive advantages in global markets where new value and solution chains will be established, and will have the chance to rise to “playmaker” positions and **lead this new economy**. Furthermore, in these societies, it will be possible for environmental awareness to increase and become deep-rooted, especially among new generations.

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In my opinion, the most important benefit that will arise from the success that can be achieved in decarbonisation, the prerequisite of which is the work and solidarity of all stakeholders, societies and countries participating in the global society and value chains, will be **the establishment of a global consciousness and spirit of cooperation**. I would like to think that the first collective success to be achieved for humanity may lead to solutions in other issues.

When all of these very significant impacts and dangers are taken into account, and when the consequences of climate change will disproportionately affect our next generations, in other words, our children and children of our children, and vulnerable communities, I think it is a kind of moral responsibility to take action to protect them. This is the biggest dimension that has driven me to work intensively on this issue for the last five years, and to use my experience, vision and means to support the solution to the best of my ability.

Attention for the next 5 years

Is there a technology that stands out in decarbonisation? How would you evaluate the solutions provided by different climate technologies?

I categorise decarbonisation technologies and solutions into four groups in my mind: Energy Efficiency Solutions, Fuel and Energy Switching Solutions, Carbon Capture, Utilisation and Storage (CCUS) and Carbon Removal. I would like to present a panorama of decarbonisation technologies by touching upon their sub-expansions in a little while.

To achieve the 2050 Net Zero decarbonisation target, we need to reduce carbon emissions from 55 billion tonnes per year in 2022 by 39 billion tonnes per year and remove 9 billion tonnes of carbon dioxide from nature every year(1). To be able to comprehend the magnitude of these figures, let us recall that the carbon emissions of Türkiye in 2022 is 0,6 billion tonnes.

I do not think that any technology or solution is particularly prominent or more preferable due to the fact that the transformation we need to achieve and the decarbonisation we need to create in the next



25 years in order to achieve the climate targets is at such a tremendous level. I believe that achieving this target, which is already very high, will only be possible by rapidly developing and implementing all available decarbonisation technologies. In this sense, the next 5 years are very critical.

If you wish, let us briefly describe the technology and solution groups in question and briefly mention the limitations they present:

Firstly, Energy Efficiency technologies and solutions that make it possible to produce the same amount of



energy with less input or to produce more products with less energy. One of the best and rapidly expanding examples of this group is heat pumps. As this example shows, there are already mature solutions in this category, which can be utilised first-hand in many sectors and which can yield results. I think and hope that there will be a rapid diversification of technologies in this category in the years to come, and that we may even see disruptive innovations and technologies. For example, the discovery and development of semiconductors that can operate at normal ambient temperatures can provide a great support to decarbonisation through this category. There have been

promising developments in this regard in recent years. The fuel and energy transition group encompasses all solutions that shift us from fossil fuels to clean energy and make it possible to increase electricity to the targeted 40 percent of the total energy mix. The leading example is wind and solar-based renewable energy technologies, which have progressed significantly in the last 15-20 years and have already provided the greatest support for decarbonisation. Geothermal, wave and nuclear energy are also included in this group. Electric vehicles, which we have been utilising increasingly, and developing large-scale battery technologies are also among the most important examples of this group. On the other hand, hydrogen and its carriers, which have been developing rapidly in the last 5 years, also constitute important elements of this group. Hydrogen is a very important fuel replacement alternative, especially for heavy industry and transport, but it cannot develop at the expected pace due to the still unresolved issues in total energy density logistics and cost portrait. Electric blast furnace technologies that can enable the transition to electricity in heavy industry can also be added to this group. I think that fusion energy has the most important disruptive technology potential in this group. There have been significant developments in this field in the last two years, but it is currently very difficult to predict when it will be utilised. Nevertheless, it is an inevitable fact that it will provide a great support to total decarbonisation if it becomes a reality.

As a reflection of my professional background and the oil, gas and energy sector in which I have been working for a long time, I am very close to Carbon Capture, Utilisation and Storage, and I am convinced of its potential and inevitability for decarbonisation. I see a very high momentum in the development of technology and technology bricks in the entire CCUS

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chain. In 2022, I identified more than 200 emerging technologies and analysed the leading ones, and now this number has increased significantly. I expect increased investments in CCUS to support technology diversification and accelerate the adoption of second and third generation capture technologies, which I believe will lead to significant improvements in the efficiency and costs of the entire value chain.

And finally, Carbon Dioxide Removal (CDR). These technologies, which are indispensable for achieving Net Zero, are classified into two main groups as nature-based solutions (NBS) and technological carbon removal (Engineered CDR). I believe that reaching the required 9 billion tonnes of annual CO₂ removal capacity is predominantly based on technological carbon removal solutions. Direct air capture (DAC), carbon capture with biomass energy (BECCS), and carbon mineralisation, the first-generation technologies of which have already reached the maturity of implementation, and ocean carbon capture, which is still in its infancy in terms of efficiency and cost, are included under this technology group. These technologies, which are still in their infancy in terms of efficiency and cost, need to be applied more widely to accelerate learning curves.

Among the criteria that should be considered when evaluating the solutions provided by all these technologies, I can list factors such as current technology maturity, technological development and innovation potential, time to market, integration potential, raw material and resource needs, regional and sectoral advantages, scalability, reliability, social and environmental impacts, cost effectiveness, life cycle emissions, emission reduction potential, and compatibility with sustainability goals.

When analysed with these criteria, it can be seen that all technology groups have many advantages and disadvantages. Answering your question from this point of view, I do not think that there is a technology that stands out especially on the basis of these criteria.

My realistic approach is that it is essential that we rapidly develop all these technologies, accelerate innovation in their disadvantageous dimensions and implement them on a large scale. Because it seems that we do not have the luxury of thinking about which bucket to pour water with while a huge wildfire is raging.

How do carbon capture technologies progress? What are the investment trends, financing and application examples of this technology?

In my opinion, it would be more accurate to analyse this separately as the development processes in core technologies and pioneer projects.

We need the development of different technology families for carbon capture in emission intensive industries, as we already have first generation capture technologies that have reached the technological maturity required for the process or flue gas compositions, energy integration, CO₂ release conditions and other similar applications in each industry, but the development of the various core technology families that will form the portfolio we will need to efficiently capture carbon in all sectors is currently at the TRL 4 to 7 levels. Fast-tracking these technologies towards maturity by supporting them with test-and-implementation opportunities and funding is crucial for decarbonisation.

Moreover, pioneering projects in many sectors have been rapidly progressing towards implementation. First-generation carbon capture and storage (CCS) technologies, first implemented in coal plants in Canada and the United States in the last decade, are now rapidly expanding to other critical sectors. Cement in Norway, steel in Belgium and France, waste recycling in Norway and the Netherlands, biomass energy, natural gas conversion, blue hydrogen and refining sectors in England and industrial zones in England and the Netherlands have entered the realisation phase of “lighthouse” projects involving carbon capture and storage “hubs”.

These pioneer projects have been progressing with financing models based on state and European Union subsidies, and subsequently on mandatory carbon credit markets (ETS). With the increasing visibility of these pioneering projects and the realisation of the indispensable importance of carbon capture in the decarbonisation process, the acceptability of CCUS technologies has been increasing rapidly. For example, Germany and France, which were not very keen on carbon capture a few years ago, have included it in their national strategic programmes in the last year.

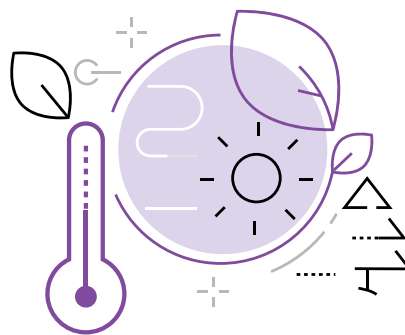


What are the challenges and opportunities in this area? How do groups from different industry sectors approach this issue?

Despite all these positive pioneering developments, I believe that carbon capture is still ‘going against the wind’, as financing challenges will persist unless market-based business and revenue models are established, and this remains as the biggest challenge to the transition from pioneering projects to the rapid growth that is needed to achieve the carbon capture capacities required for 2030 and net-zero 2050. I see that this limitation, as well as the shrinking access to venture capital due to high interest rates in western economies in the post-Covid era, has also had a negative impact on the acceleration of technological development.

As the major challenges specific to Türkiye, I can list the fact that public-based financing support has not yet been clarified, that our country is not included in the European ETS, that a national carbon sink area has not yet been identified and related infrastructure development has not yet progressed, that the emission intensity of the Turkish electricity grid is high, and that digitalisation in some sectors has not yet progressed very far.

Consequently, the steps to be taken by the public and private sectors in these areas and the cooperation to be established between stakeholders for this purpose will also offer important opportunities.



“With the increasing visibility of these pioneering projects and the realisation of the indispensable importance of carbon capture in the decarbonisation process, the acceptability of CCUS technologies has been increasing rapidly.”



“Raising awareness across sectors requires a coordinated effort between the public and private sectors. While the private sector takes the steps I have mentioned, the public sector needs to very quickly establish a base action plan and roadmap based on national net zero targets, as well as the systems and policies that encourage and regulate carbon pricing, renewable energy targets, sectoral regulations and decarbonisation.”

Sectoral dialogue must be established

What kind of a path do industrialists need to follow in this sense?

We all see that decarbonisation constitutes an important issue for the Turkish industry, whose main market is Europe and western countries. The CBAM regulation, which is entering into force, also increases the need for acceleration of this issue. When we put the fact that carbon capture is an inevitable solution for many branches of the industry on top of this, it has a great importance for our future competitiveness that we prepare for transformation by entering a rapid action period as a country.

For this purpose, there are many different steps that industrialists can take collectively in order to raise awareness in the sectors and mobilise the system. The first ones that come to mind can be listed as establishing sectoral dialogue on the subject, accelerating the necessary public opinion and investment activities to reduce Turkish electricity grid emissions, supporting NGOs and stakeholders on the subject, taking initiatives to encourage sensitivity and action before government bodies, and pioneering the rapid development of regional “hubs” and national sink areas.



The actions they can undertake on their own include setting science-based measurable and time-limited corporate decarbonisation targets, analysing their carbon footprints in detail, evaluating energy efficiency, waste reduction and transformation opportunities in the first step, and then creating Carbon Capture and Storage-based transformation plans, following the best applications, focusing on R&D activities focused on technology development and continuous improvement, enabling pilot applications of emerging capture technologies in their facilities, evaluating the impacts of the low-carbonisation of the end products that their products are inputs to in the markets, and developing business and revenue models in order to make their investments.

What needs to be done to raise awareness in the sectors? What kind of a path is followed in terms of policies abroad? How should the public and private sector react?

Raising awareness across sectors requires a coordinated effort between the public and private sectors. While the private sector takes the steps I have mentioned, the public sector needs to very quickly establish a base action plan and roadmap based on national net zero targets, as well as the systems and policies that encourage and regulate carbon pricing, renewable energy targets, sectoral regulations and decarbonisation.

Political leadership and public structures abroad, particularly in Europe and the United States, have made significant progress in the last decade, both in meeting social demands and grasping strategic transformation opportunities. I also believe that the focus of the global financial sector on issues related to sustainability and decarbonisation has been a very important driving force in this. However, due to the challenges we have mentioned, I also observe that the industry has not yet achieved the same speed in terms of realising decarbonisation.

As far as I can see, sectoral awareness in Türkiye is in the process of being formed rapidly due to the demands of foreign customers and the obligations imposed by CBAM. It is very important and valuable that the private sector, public and political leadership work in coordination to bring this critical issue to the forefront

of the agenda, that NGOs act as opinion leaders, and that valuable organisations such as TTGV raise awareness and shed light on the developing decarbonisation technologies and solutions in a manner to guide the public and private sectors.

I strongly believe that Türkiye's fast solution-oriented, enterprising, productive and success-driven young population and dynamic industry offer a great advantage, and that Türkiye can achieve great success in the field of decarbonisation provided that it is supported and led in the right direction.

(1) I provide these round figures based on the Emissions Gap Report published by the United Nations UNEP organisation in November 2023.



“I strongly believe that Türkiye’s fast solution-oriented, enterprising, productive and success-driven young population and dynamic industry offer a great advantage, and that Türkiye can achieve great success in the field of decarbonisation provided that it is supported and led in the right direction.”

CAN NUCLEAR ENERGY BE AN ALTERNATIVE SOLUTION TO CLIMATE CHANGE?



RABİA ÖNEN TÜZGEL

TTGV Pioneer Project Program Specialist

Major changes and transformations have been taking place in many sectors within the scope of combating climate change, and one of the areas where these changes are felt most intensely is the energy sector. While the rapidly increasing energy demand worldwide brings energy security and sustainability concerns to the forefront, the environmental impacts and limited reserves of fossil fuels increase the interest in renewable energy resources. Nevertheless, renewable energy sources, by their very nature, pose some challenges in ensuring uninterrupted and reliable energy supply. At this point, options such as nuclear energy with a low carbon footprint, which is suitable for continuous energy supply and can be used in energy-intensive industries, comes to the forefront.

The biggest advantage of nuclear energy, which emerges as a strong option in the fight against climate change due to its low carbon emissions, is that it is a strong supplementary in terms of carbon emissions compared to other renewable alternatives and provides a significant advantage in terms of energy supply security. Thanks to its high energy density, the ability to produce large amounts of energy with a small amount of fuel and to provide uninterrupted energy are among the most important parameters that enhance energy supply security. On the other hand, safety and waste management play an important role in the development and acceptability of nuclear energy technologies.

Carbon Emissions of Different Energy Sources and their Energy Generation Potentials

Energy Source	Carbon Emission (gCO ₂ /kWh)	Energy Generation Potential (MW)
Nuclear Energy	3-24	1000-1500
Wind Energy	2-12	2-4 (per wind turbine)
Solar Energy	20-60	1-5 (per solar panel)
Hydroelectric Energy	1-30	100-10000
Natural Gas	400-500	500-1500
Coal	500-1050	500-1500

Especially in recent years, the development of next generation reactors and the improvement of safety measures and waste management have made nuclear energy safer and more efficient. The limited availability of fossil fuels and price fluctuations in global markets have also contributed to the re-popularisation of nuclear energy by increasing the demand for alternative energy sources. In recent years, in addition to conventional nuclear reactors, the next generation nuclear technologies such as Small Modular Reactors (SMR) and Micro Reactors have attracted attention as a new generation energy solution and expanded the usage areas of nuclear reactors.



The Rise of Nuclear Energy: Global Trends and Türkiye's Energy Strategy

According to the International Energy Agency's (IEA) "World Energy Investment 2024" report, global energy investments are expected to exceed USD 3 trillion for the first time in 2024, while USD 2 trillion of these investments are expected to be spent on clean energy technologies. Investments in nuclear energy are expected to increase particularly with the technological development of SMR and micro reactors.

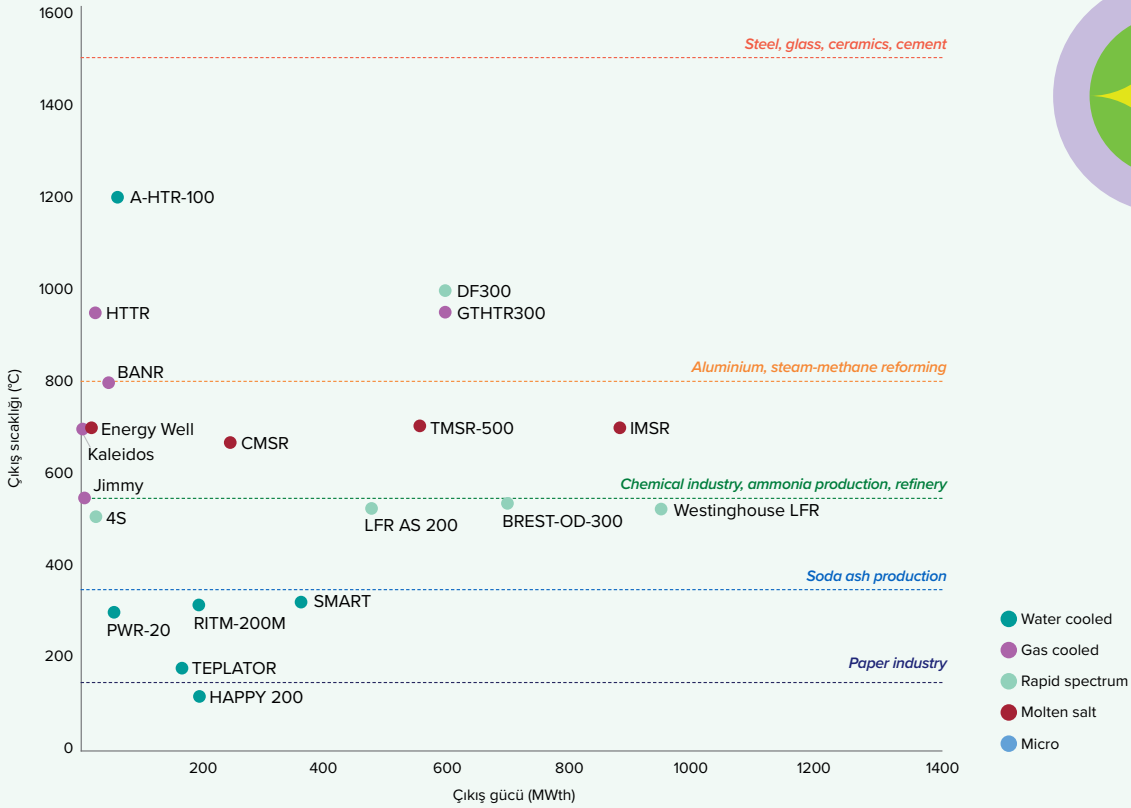
Türkiye regards nuclear energy as a strategic option in terms of critical issues such as energy supply security, economic growth and combating climate change, and plans to incorporate this type of energy into its energy mix for the coming years. Taking the rapid increase in the energy demand of the country among emerging economies and its dependence on foreign energy supply into consideration, the need for nuclear energy emerges as an important option. By the year 2050, Türkiye intends to have at least 5 GW of SMR capacity in its energy mix.

Small Modular Reactors (SMR): Flexibility and Economic Advantages

One of the driving forces behind the recovery in nuclear energy in recent years is the next generation of nuclear technologies such as Small Modular Reactors (SMRs) and microreactors. SMRs are characterised by their smaller and more flexible design than conventional nuclear reactors, capable of delivering up to 300 MWe of power, and their modular design allows them to be scalable to different energy needs and adaptable to various geographical conditions. The low construction and operating costs and relatively higher safety compared to conventional reactors make these reactors economically appealing.

SMRs also offer an ideal solution to increase energy efficiency in industries such as glass, ceramics, iron and steel, cement and aluminium with their high temperature reactor designs that can be used in industries with high heat requirements. High Temperature Reactors (HTR or HTGR) are reactors designed specifically for industrial applications, capable of generating temperatures between 750°C and 1000°C. High temperature reactors have significant potential to increase energy efficiency and reduce carbon footprint in the heavy industries of Türkiye. SMRs can also be considered as an ideal energy solution in rural areas or islands where the energy infrastructure of Türkiye is weak.

Comparison of thermal capacities of different SMR designs



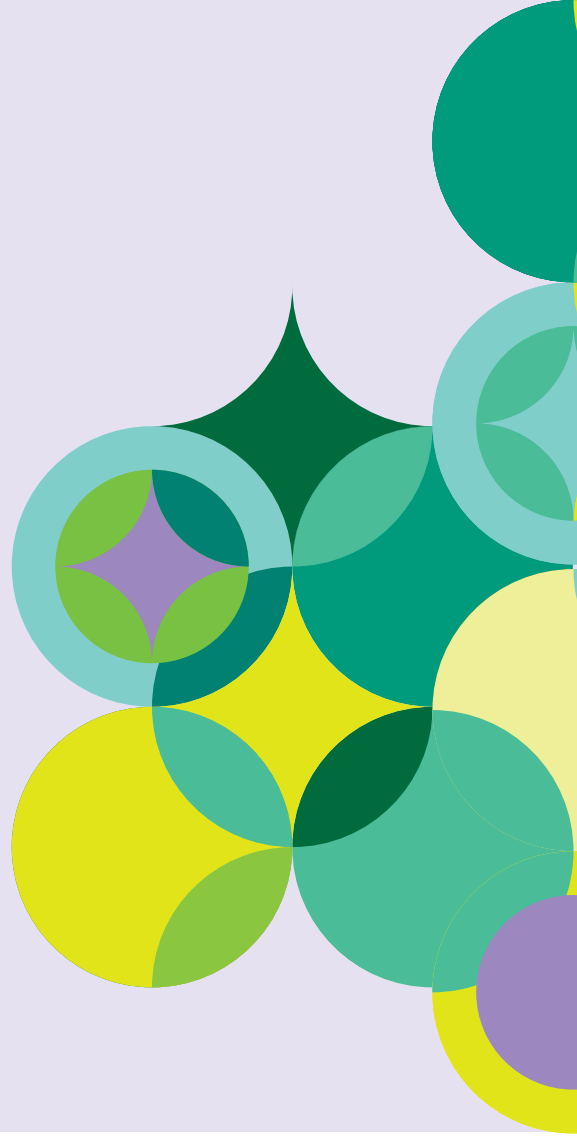
Micro Reactors: Flexible and Portable Energy Solutions

Micro reactors are portable and rapidly deployable small-scale reactors capable of generating up to 10 MWe of power. These features make them ideal for use in regions where energy infrastructure is limited, on military bases or in case of an emergency. In efforts towards strengthening security of energy supply, microreactors can play a critical role by providing flexible and portable energy solutions.

The portability of microreactors enables them to rapidly meet temporary energy needs. They can also be used in industrial applications such as hydrogen production and desalination. This flexibility demonstrates that microreactors can be utilised as a versatile and effective solution in the energy system of Türkiye.

In conclusion, next generation nuclear technologies such as Small Modular Reactors (SMR) and Micro Reactors have an important role to play in energy security, economic growth and combating climate change, and their potential role in energy strategies could be

critical for security of energy supply and sustainable development goals. High temperature reactors hold a significant potential to increase the energy efficiency and reduce carbon emissions in the heavy industry segments of Türkiye, while microreactors have the potential to strengthen the security of energy supply through their flexibility and portability. “High Temperature Reactors”, which represent a form of SMR for sectors with high temperature requirements, have the potential to fulfil the needs of the industry as an energy source with a low carbon footprint in the years to come. Nevertheless, High Temperature Reactors have not yet attracted the attention of the industry for a number of reasons such as their high investment costs, difficulties in the licensing process, and the fact that examples around the world have not yet been put into practice. In the event that SMR designs can exceed the 1500°C threshold in the following years, they may offer various opportunities for the deployment of nuclear energy in the heavy industry segments such as cement, iron-steel, glass-ceramics and SMR designs may herald a new era in the commercial use of nuclear energy where decentralised energy supply is accepted.



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