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Science and Technology Driven Policy and Innovation Research Centre
Ερευνητικό Κέντρο Καινοτομίας & Διαμόρφωσης Πολιτικών με βάση την Επιστήμη & Τεχνολογία

Αναγκαίες Επενδύσεις και Οφέλη από την Προσαρμογή της Κύπρου στην Κλιματική Αλλαγή

ΚΥΡΙΑ ΣΗΜΕΙΑ

- Και οι δύο πυλώνες της κλιματικής πολιτικής (**μετριασμός** της κλιματικής αλλαγής και **προσαρμογή** στην ήδη συντελούμενη κλιματική αλλαγή) είναι απαραίτητοι για την ευημερία, την κοινωνική συνοχή και την οικονομική σταθερότητα στην Κύπρο.
- Υπάρχει σημαντική υστέρηση μεταξύ αναγκαίων και προγραμματισμένων επενδύσεων για την κλιματική προσαρμογή. Οι ανάγκες για επιπρόσθετες επενδύσεις έως το 2050 εκτιμώνται σε 3,4 δις. Ευρώ σε σημερινές τιμές, ή 0,4% του ΑΕΠ όλης της περιόδου, αλλά αυτή τη στιγμή έχει προγραμματιστεί λιγότερο από το 30% αυτών. Το ύψος των αναγκαίων επενδύσεων βρίσκεται εντός των δυνατοτήτων της κυπριακής οικονομίας.
- Αν δεν ληφθούν από τώρα επιπλέον μέτρα προσαρμογής, πέρα από αυτά που ήδη δρομολογούνται, κατά τις επόμενες δεκαετίες οι ανάγκες για ενίσχυση και αποκατάσταση υποδομών και για αποζημιώσεις από φυσικές καταστροφές μπορεί να εκτροχιάσουν τις κρατικές δαπάνες.
- Εκτός από τις οικονομικές επιπτώσεις, η κλιματική κρίση υπονομεύει και την κοινωνική δικαιοσύνη: η Κύπρος αναμένεται να είναι από τις χώρες με τις εντονότερες επιπτώσεις στα ευάλωτα νοικοκυριά. **Η οικονομική πολιτική δεν έχει περιθώριο να αγνοήσει την κλιματική κρίση.**

Investment Needs and Benefits from the Adaptation of Cyprus to Climate Change

KEY POINTS

- Both pillars of climate policy (**mitigation** of climate change through emissions reduction and **adaptation** to the already ongoing change) are essential for prosperity, social cohesion and fiscal sustainability in Cyprus.
- However, there is a significant gap between the necessary investments for climate change adaptation and those already planned. We estimate the need for additional adaptation investments up to 2050 at 3.4 billion Euros at today's prices, or 0.4% of the GDP for the whole period – but currently less than 30% of these are planned. The amount of investment needed is within the capacity of the Cypriot economy.
- Unless additional adaptation policies are implemented soon, beyond the very important measures that are already underway, the public expenditures to be needed in the coming decades for the rehabilitation of infrastructure and compensation for natural disasters may derail government spending.
- In addition to the economic impacts, the unmitigated climate crisis undermines social justice – Cyprus is expected to be among the countries with the most severe impacts on vulnerable households. **Economic policy cannot afford to ignore the climate crisis.**

"Our traditional system to cope with and respond to extreme climate events is being tested to the limits. This is why adaptation is no longer an option – but a necessity".

Carlo Buontempo, Director of Copernicus Climate Change Service, January 2025 (cited [here](#))

The background of our study

The global scientific community has now accepted that climate change is becoming a crisis. Efforts to limit and eventually eliminate greenhouse gas emissions are absolutely essential to keep the problem manageable, i.e. to achieve climate change mitigation. Progress is not as rapid as required but, thanks to progress in many green technologies and their cost reductions, the prospects for reducing emissions are better than ever.

At the same time, however, it is clear that some climate change has already taken place, some more will happen, and will probably be irreversible. Europe is warming faster than the global average, and the Eastern Mediterranean and Middle East region even faster. Therefore, alongside the emission reductions needed to mitigate climate change, measures are needed to adapt to the climate change that is already underway.

Mitigation (i.e. emission reduction) can be achieved primarily through technological and other measures that – to a large extent – have similar costs globally. This makes it easier to adopt e.g. EU-wide legal obligations for emission reduction, energy savings, penetration of renewable energy sources, etc. Conversely, adaptation to climate change cannot be regulated by uniform Europe-wide obligations, as it depends on local conditions and requires detailed assessments that vary from region to region. Uncertainty also plays a dominant role in adaptation, as climate change can evolve in an unpredictable (non-linear) way, is determined by interactions between natural phenomena that have not been adequately investigated, and sometimes leads to severe natural disasters that basic infrastructure, even in the most developed countries, is unable to cope with (as illustrated, for example, by the huge fires in the USA in 2024-25 and Canada in 2022 or the intense

and deadly floods in Germany in 2021 and Spain in 2024).

Despite great uncertainties, every country in the world must prepare and implement adaptation plans, both because all the main scientific bodies and international organisations agree that the costs of uncontrolled climate change will be higher and because most of the adaptation actions will have to be financed from public funds. As the European Environment Agency stated in its 2024 [European Climate Risk Assessment](#), the risks of the climate crisis affect the vast majority of public policy areas and should be treated as national security risks and in the same way as insurance companies treat their respective risks.

Therefore, **planning for adaptation to the climate crisis should now be included in a country's main economic and fiscal planning** – in the national budget, in the analysis of medium-term economic risks, in the assessment of debt sustainability, etc.

Currently, the Republic of Cyprus is at an advanced stage of reviewing its National Climate Change Adaptation Strategy (NAS), preparing a detailed vulnerability and risk assessment in all sectors of the economy and coming up with a large number of adaptation measures and policies to be implemented in the coming years.

While the NAS identifies almost all of the necessary projects, it is important to attempt to cost them in more detail, as far as possible, and to highlight the benefits of these measures against the damage that is likely to occur if adaptation measures are not implemented. With this in mind, starting from the NAS and taking further into account other government policies and strategic plans as well as results of other studies for Cyprus and/or other Mediterranean countries, we have attempted to assess:

- i. What are the current adaptation investment needs up to 2030/2050

- ii. Which of these investments are ongoing or planned with a specific budget and time plan
- iii. Which part of these investments must be covered by public or private funds
- iv. What are the damages from unmitigated climate change expected for 2050/2100.

The methodology is described on page 6.

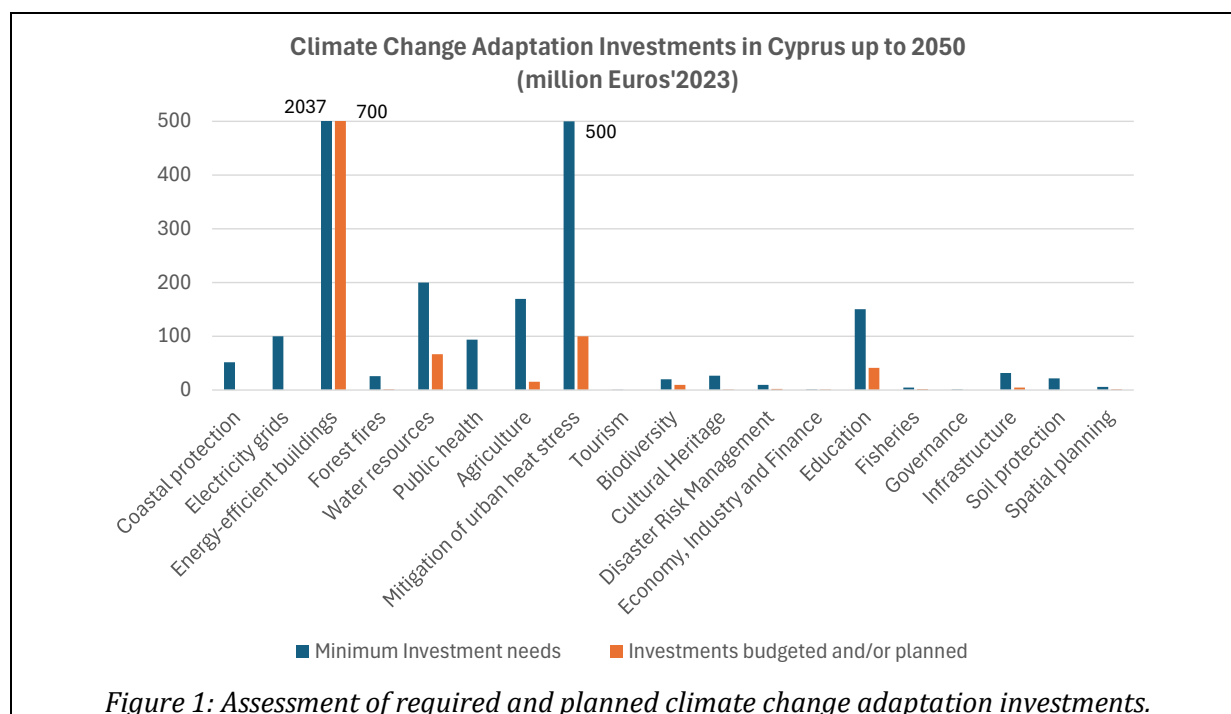
Results

Out of the questions we listed above, first we address (i) and (ii). As shown in Figure 1, across all policy areas there is a significant gap between the investments **planned** for climate change adaptation and those having been identified as **necessary**. The need for additional investment up to 2050 is estimated at 3.4 billion Euros at today's prices, or 0.4% of national GDP of the entire period. However, less than 30% of this is currently planned, i.e. projects worth about 950 million Euros.

The level of required additional investments is not prohibitive for the Cypriot economy since both the public and

the private sector have already implemented several measures to adapt to the existing climate conditions in Cyprus. For example, current expenditures to address water scarcity, to increase protection from forest fires and floods, to ensure availability of air-conditioned spaces in residences, offices, hospitals etc., are not recorded here because they are taking place anyhow irrespective of the extent and severity of climate change in the future. Hence the estimates of Figure 1 refer to **additional** investments aiming specifically to address future climate conditions in the country.

A significant part of the necessary investments (63% according to Figure 2) is related to energy efficiency related renovations of buildings, which contribute to both adaptation and mitigation of climate change. There are already legislative obligations through at least two recently revised EU Directives in this field – the Energy Efficiency Directive (EU) 2023/1791 and the Energy Performance of Buildings Directive (EU) 2024/1275.



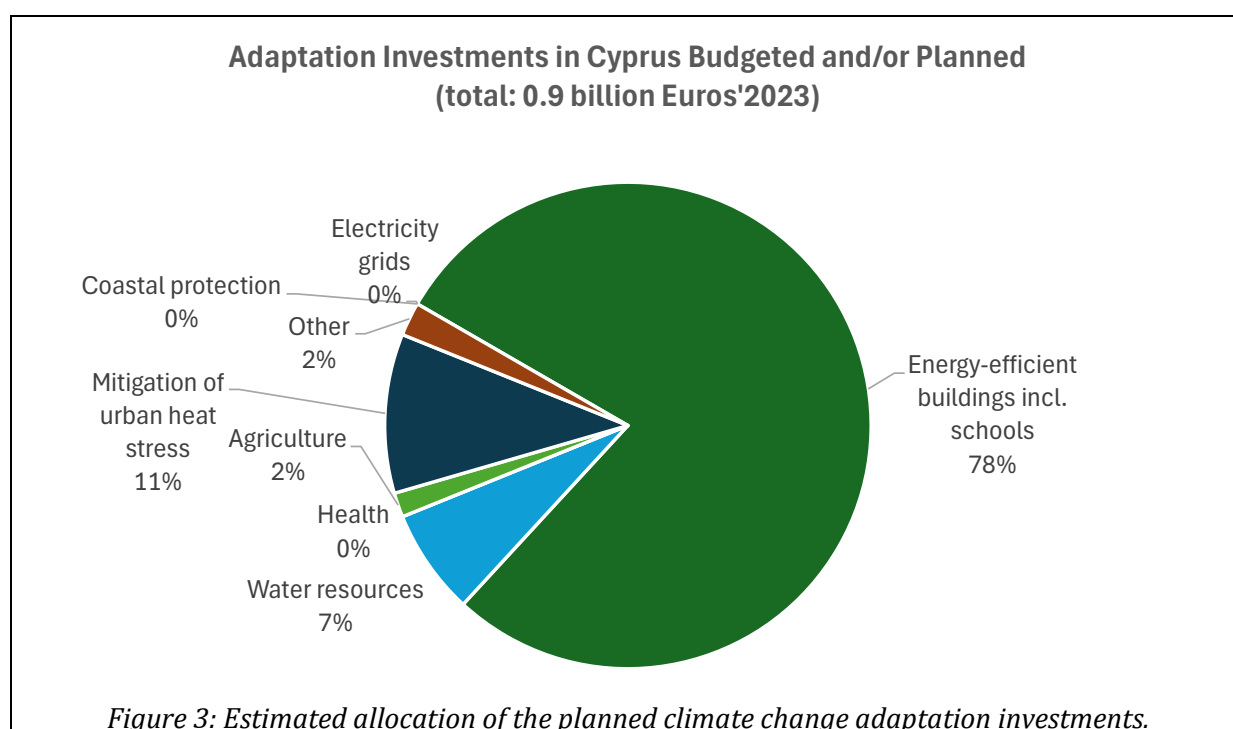
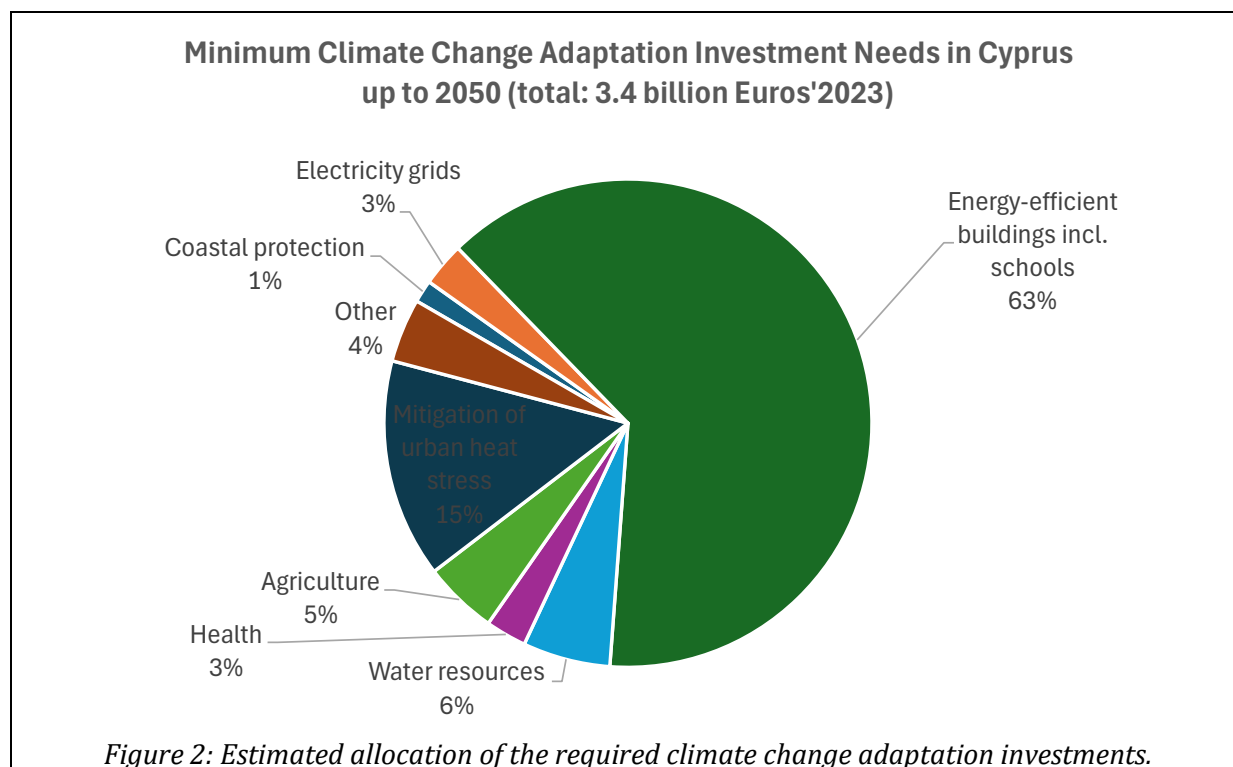
To implement these obligations, a substantial number of energy renovation projects in residential and non-residential buildings are underway, accounting for 78%

of the planned adaptation investments (as shown in Figure 3). The buildings sector is an illustrative case where a climate change mitigation project contributes to adaptation

and vice versa, while at the same time it has multiple additional benefits because it can also help reduce energy poverty and lower the country's dependence on fuel imports.

At the same time, however, attention should also be paid to investments that have not been considered urgent for Cyprus until now. As Figure 3 illustrates, projects such as

protecting coastal infrastructure from sea level rise, enhancing the **resilience of the electricity grid** to heat waves, and mechanisms to **monitor public health** problems due to heat waves and communicable diseases, although identified in the National Adaptation Strategy, have not yet started to be adequately implemented.



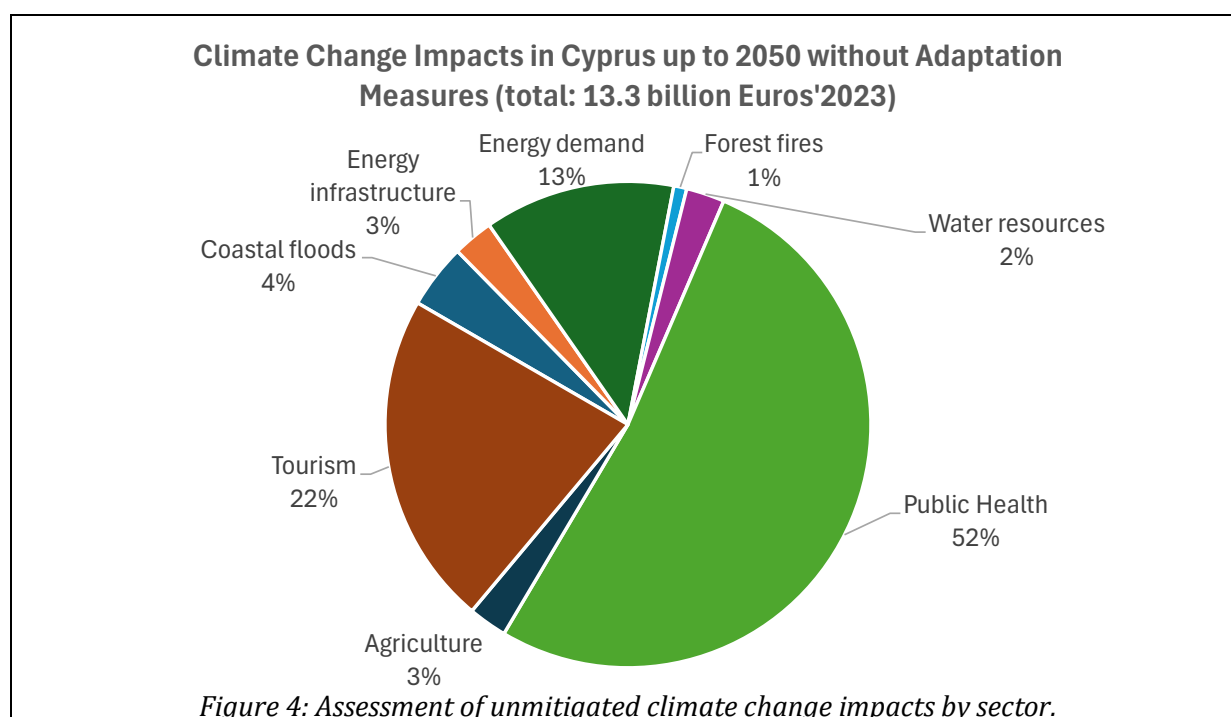
We now turn to question (iii) mentioned above, i.e. the amount of the identified investment that must come from public resources. We estimate that out of the 3.4 billion Euros of necessary investment, **over 70% (or 2.5 billion) should be provided by public funds** for the protection and upgrading of various infrastructures, as well as for grants to individuals and enterprises to take the necessary adaptation measures.

To address question (iv), Figure 4 shows the expected economic impacts of unmitigated climate change up to 2050, bringing together the most recent findings from analyses carried out either for Cyprus or from estimates for other Mediterranean countries and adapted to Cypriot conditions – see list of references at the end of this text.

At today's prices, the present value of these losses is estimated at 13.3 billion Euros. This means that the necessary adaptation investments (estimated at 3.4 billion Euros by 2050 as already mentioned) will help avoid most of the 13.3 billion Euro losses. Therefore, as many international studies have shown, **adaptation to the climate crisis brings multiple benefits which far outweigh costs and hence should be a priority in economic policy.**

The benefit of adaptation investments is significantly higher if the potential impacts up to 2100 are taken into account. Because of uncertainty about developments post-2050, we do not provide such cost-benefit estimates in this Brief. However, it is clear from the scientific literature that **the most severe climate change impacts are expected after 2050** and could multiply the damage costs if the adaptation measures included in the National Adaptation Strategy discussed above are not adopted on time. The above estimates should be regarded as conservative because they do not include:

- Impacts that may evolve in a non-linear way because some tipping points in ecosystems may have been passed.
- Severe weather events (prolonged heat waves, flash floods, severe water scarcity) which are considered to be rare but which, due to climate change, are becoming more frequent.
- Chain effects of an event (e.g. overheating of electrical cables, in addition to direct damage, leads to power cuts and possibly forest fires).
- Impacts that are still very difficult to quantify (e.g. loss of biodiversity or damage to cultural heritage sites).



Methodology

Our analysis consisted of the following steps:

1. We obtained the list of policies and measures (119 in total) that have been prepared by authorities and their consultants in the revised National Adaptation Strategy (NAS) that was put to public consultation in February 2025. It includes 119 measures in total, for 17 policy areas: Agriculture, Biodiversity and Ecosystems, Cultural Heritage, Civil Protection, Economy and Industry, Energy, Fisheries and Aquaculture, Forestry, Health, Water Management, Sea and Coastal Areas, Soil, Spatial Planning, Tourism, Transport and Buildings, Cross-sectoral governance measures and Cross-sectoral educational measures.
2. We attempted to assign costs to each one of these measures. The NAS document provides a fact sheet for each measure and a rough indication of its cost ('low-medium-high'), but this cost assessment had to be cross-checked and become more concrete. For this purpose, other strategy documents and scientific studies have been taken into consideration.
3. We considered that, in principle, the full list of measures of the draft NAS expresses the adaptation investment needs. Many of these measures have a medium-term horizon, i.e. up to 2030, but several others will take more time to implement. Since the NAS has the period up to 2050 as a strategic horizon, we consider these measures as expressing a large part of the investment needs up to 2050. In some cases, we expanded the needs with own information; for example, the NAS does not include in its measures the installation of new mobile water desalination units, which was announced in December 2024 to address exacerbating water scarcity, so we included it in the investment needs.
4. The NAS measures, however, inevitably do not cover all adaptation costs by 2050 as they mainly refer to new policies and investments. Hence, we also considered additional costs up to 2050 because the lifetime of some existing infrastructure has to be maintained or expanded some time between 2030 and 2050 – e.g. current desalination plants whose contracts with private operators will finish in the meantime and will have to be replaced or renewed so that the country secures constant quantities of desalinated freshwater in 2050.
5. In other cases, we assumed that some of the NAS measures do not incur additional adaptation costs, because it was clear from their description that they are general measures addressing already current challenges and are not adopted specifically for climate change adaptation. Examples of such measures are the installation of technologies to detect leakages in water distribution networks, flood protection plans, and existing forest fire protection measures. It must be clarified that these are absolutely necessary measures that will improve the country's climate resilience; we just do not consider them as additional measures because this would give a misleading picture about the additional adaptation investments that are necessary.
6. By checking the fact sheet of each measure, we obtained information about whether that measure (a) is ongoing, (b) has been partly or fully included in the plans and budgets of public authorities, or (c) there is no provision yet. In this way it is possible to determine those investment needs per policy area that are ongoing or already planned.
7. A comparison of the entire set of measures and the resulting total investment needs (from steps 3-5 above) with those already planned (step 6) leads to an assessment of the adaptation gap and the adaptation funding gap.
8. To assess the investment and maintenance costs of each adaptation measure, we consulted additional policy documents of the Republic of Cyprus, such as:
 - i. The [National Investment Plan of Water Works](#) of September 2024.
 - ii. The [Strategic Document](#) for measures related to the implementation of the Common Agricultural Policy in Cyprus in 2023-2027, which includes several investments and grant schemes addressing climate adaptation in agriculture, forestry, and biodiversity.
 - iii. The National Energy and Climate Plan and the National Building Renovation Strategy that were [submitted](#) to the European Commission in December 2024.
 - iv. The Ten-Year [Plan](#) for the Development of the Electricity Transmission System in 2024-2033.
 - v. The October 2023 [report](#) about the preparation of flood risk maps in the frame of the revised Flood Risk Management Plan.
9. To assess the costs of unmitigated climate change impacts, so as to compare them with the investment needs mentioned above, we used information from numerous scientific and policy reports – to the extent possible, with results specifically for Cyprus – see literature references at the end of this Brief. We also used preliminary findings from ongoing work that we are conducting for the Cypriot Ministry of Finance, in collaboration with the Economics Research Centre of the University of Cyprus, on the costs of climate change impacts per economic sector. Up to now it has been possible to assess economic impacts of climate change in 2050 (and sometimes in 2100) for the areas of energy demand, electricity grid resilience, heat-related mortality, water resources, agriculture, tourism, coastal infrastructure, and forestry.

Our calculations are available [here](#) and [here](#) for comments and suggestions.

Policy recommendations

In addition to the provisions for natural disaster compensation, which are already considered in national budgets, the aforementioned necessary public investments to adapt to the climate crisis should be taken into account in the government's medium-term fiscal planning.

These measures should not be seen as a cost, but as an investment to ensure national security and social well-being, which is expected to deteriorate severely without adaptation measures. As we mentioned in a [previous Policy Brief](#), decisions taken must be assessed with reference not to the current situation, which is unsustainable, but to the new normal, characterised by the risks of climate change in the years immediately ahead.

Evidently, since the country's climate will change anyhow, both the choice of adaptation measures and their financing will have to be monitored both by the Environment Ministry and the Ministry of Finance, and may need to be adjusted whenever necessary.

For the next 10-20 years, impacts are expected to be influenced both by the natural variability of the current climate and by climate change of a relatively small magnitude, hence the uncertainty about the necessary measures is not great. The investments to be made with a relatively short lifetime, e.g. up to 20 years, are roughly known (e.g. new desalination plants, new fire prevention tools, early warning systems for health issues) and should proceed according to the recommendations of the revised National Adaptation Strategy.

When authorities have to decide about investments with a long lifetime extending to the end of the 21st century, e.g. strengthening coastal infrastructure or the electricity grid and planning interventions to alleviate the urban heat island effect, uncertainty increases because climate change by 2100 depends on the evolution

and interaction of various natural phenomena and the extent of emission reductions achieved by humanity. In such cases, planning should take into account the possibilities of different climate scenarios and include continuous monitoring systems so that infrastructure can be strengthened if the effects of the climate crisis become worse.

As far as public finances are concerned, barring any major negative surprises regarding the impacts of the climate crisis by 2050, public financing of adaptation measures is probably within the capabilities of the Cypriot economy, provided that public spending is redirected towards the required adaptation projects. However, it should be borne in mind that for the period beyond 2050, when the worst impacts of the climate crisis are expected, the sustainability of public finances and public debt may be at serious risk. **Unless serious adaptation measures are taken now – at least those foreseen in the National Adaptation Strategy – public expenditures for infrastructure reinforcement and rehabilitation and for natural disaster compensations could derail public spending.**

The available scientific literature suggests that spending on early climate adaptation can have a [positive macroeconomic impact](#) and maintain fiscal balance. However, this requires timely action and appropriate reallocation of public spending. More generally, addressing the impact of the climate crisis leaves no room for complacency in public finances: as shown by a recent [study](#) on the public debt of many countries, **environmental sustainability is a prerequisite for long-term fiscal sustainability.**

Apart from the fiscal and wider economic consequences that are expected if no adaptation measures are taken, unmitigated climate change also undermines social justice. Globally, scientific [studies](#) have

shown that **climate change exacerbates economic inequality** within a country, especially in the hottest regions of the world such as ours. Another recent pan-European [study](#) carried out for the European Economic and Social Committee highlights that **Cyprus is expected to be one of the countries with the strongest negative impacts on vulnerable households** due to climate

change. Household expenditure on food, electricity and health services are projected to increase, and these expenditure categories are regressive, i.e. poorer households spend a larger share of their income on them. Negative effects on labour productivity and possibly a gradual loss in the value of household property can also be expected.

*The results presented in this Policy Brief are brought to the attention of the scientific community, with a view to revising the calculations in future months if errors or omissions are found. Because estimates of the costs of adapting to climate change are inherently uncertain, it may be useful to enrich them with results from additional studies that we may not have considered or from newer analyses that will be published in the near future. In any case, we underline that both pillars of climate policy (**mitigation** of climate change by reducing emissions and **adaptation** to the climate change already taking place) are simultaneously necessary for economic prosperity, social cohesion and fiscal stability in Cyprus. **Economic policy cannot afford to ignore the climate crisis.***

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