Solar-permissive model zoning ordinances: Rationale, considerations, and examples.

Prepared for Centre Regional Council of Governments and Centre Regional Planning Agency.
Centre County, Pennsylvania

Photo Credit: F P Becker. UAJA, Centre County PA

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Future versions of this document will include model ordinances customized for the Centre Region.

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ABSTRACT

This policy recommends the adoption of uniform zoning and land development ordinances across Centre Regional Council of Governments municipalities, with specific language permitting the construction of small solar photovoltaic (PV) installations, as a cost-effective method to facilitate private investment in solar electricity generation. Increased rates of PV installation supports the Climate Action Plans of both the Centre Region Planning Agency and the State of Pennsylvania, creates landowner opportunity to invest in sustainable development, and helps increase resiliency in times of electricity interruption and disaster.

In anticipation of future interest in solar PV installations, Centre Regional Council of Governments should propose a model zoning ordinance to facilitate such installations and to reduce potential legal challenges due to unclear or non-existent policies. The model ordinance should clearly define the components of such a system, define permissible use, and address other possible concerns, such as aesthetic considerations and impervious coverage.

SCOPE

The scope of this policy covers the inter-governmental organization in Centre County, Pennsylvania, known as the Centre Regional Council of Governments (COG), consisting of the following municipalities: State College Borough, College Township, Harris Township, Halfmoon Township, Ferguson Township, Patton Township, and includes non-voting representatives from The Pennsylvania State University and

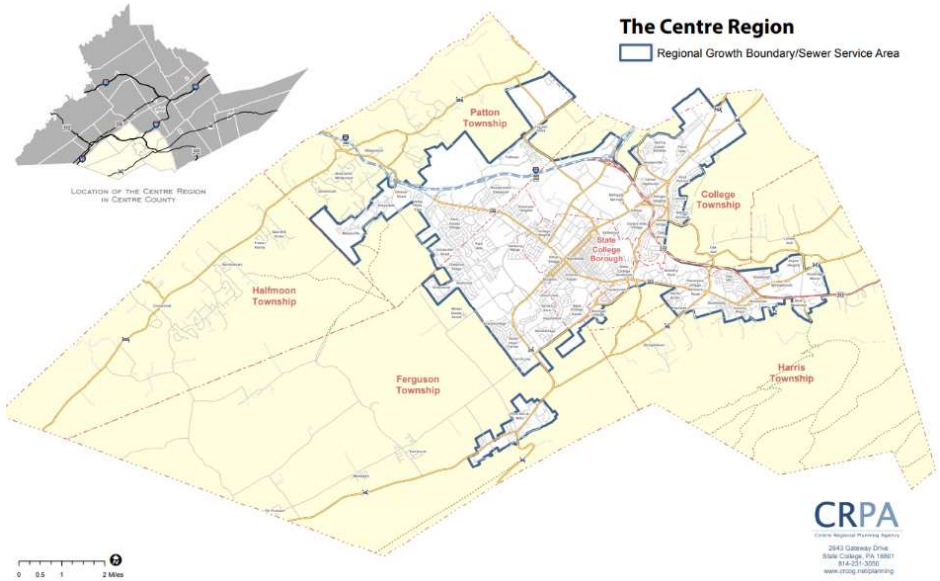

Figure 1. Map of Centre Region in Centre County, PA. Image credit (CRPA 2019)

the State College Area School District. The COG covers 150 square miles and serves 97,000 citizens (Steff 2019). These municipalities share several administrative and public service functions through COG, including code administration services, and coordinated planning efforts within a defined Regional Growth Boundary. The Centre Region Planning Agency (CRPA) is developing a Climate Action Plan (CAP) and identifying emission reduction targets in the fourth quarter of 2019. It will reach out to engage community members and stakeholder groups in the first quarter of 2020. By late 2020 the CAP should

have established action items for mitigation and adaptation, and this policy is intended for evaluation and inclusion in that CAP.

This document includes research supporting the recommended action of adopting model ordinances facilitating PV projects. Existing model ordinances are referenced, and future versions of this document will include model ordinances customized to the COG region.

BACKGROUND - CLIMATE ACTION

Greenhouse gases (GHG), such as methane (CH_4) and carbon dioxide (CO_2) exist naturally in the atmosphere and trap heat near the surface of the Earth by absorbing infrared radiation that would otherwise radiate into space. Human activities which generate GHG (called *anthropogenic*) increase their concentration in the atmosphere, trapping more heat and warming the planet faster than would otherwise occur (US EPA 2019). This global warming process is the main driver of climate change.

In response to a well-established consensus of scientific literature demonstrating the effect of human activity on global climate change (IPCC 2018), the Intergovernmental Panel on Climate Change (IPCC) recommends taking steps to reduce anthropogenic emissions of GHG, including carbon dioxide and methane (IPCC 2014).

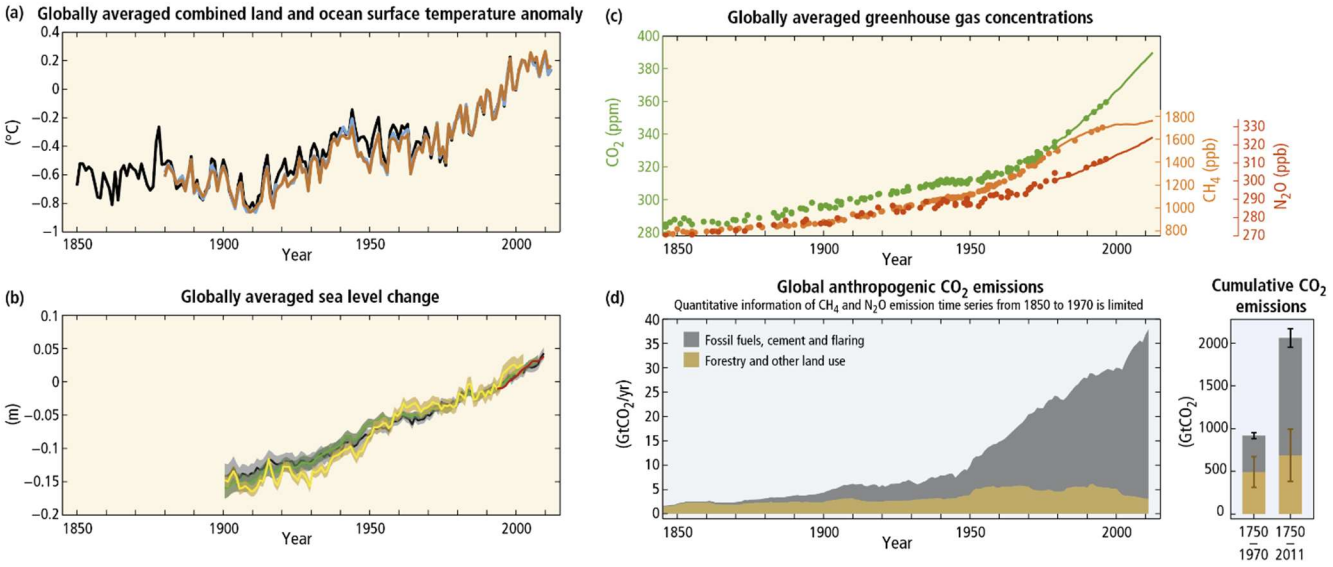

Figure 2. Global temperature and sea levels rise with anthropogenic emissions. See Appendix 1 for details.
Image credit (IPCC 2014)

The IPCC modeling suggests that reducing global CO_2 emissions to net zero by 2050 shows the most probable path for limiting global warming to 1.5^0 C by the middle of the 21st century (IPCC 2014). In 2016, U.S. GHG emissions totaled an estimated 5306.7 million metric tons (MMT) CO_2, and 6,492.3 MMT CO_2 equivalents (CO_{2e}) – with each gas represented by its relative global warming potential (GWP). Of that total, 1,808.9 MMT CO_2 were produced by combusting fossil fuels for the generation of electricity (US EPA 2019), or about 34% of total CO_2 emissions. Increasing the share of electricity generated by renewable sources, such as solar PV, reduces GHG emissions from that sector, therefore policies that support the growth of solar PV electricity generation also support the reduction of GHG emissions.

> *Pennsylvanians will be faced with worsened air quality, increased damage from flooding, agricultural losses, and expansion of vector-borne diseases like Lyme Disease due to climate change. (PA DEP 2019)*

Global to Local

Emissions inventories, which measure or estimate anthropogenic GHG contributions by sector, are a necessary step for setting and tracking GHG reduction targets. "Pennsylvania shall strive to reduce net greenhouse gas emissions 26 percent [below 2005 levels] by 2025 […], and 80 percent [below 2005 levels] by 2050" (PA DEP 2019) according to the Pennsylvania Climate Action Plan (CAP). Pennsylvania's 2016 inventory reports 264.41 MMT CO_{2e} total, with 80.5 MMT (30%) produced from electricity generation alone (PA DEP 2019). One identified strategy to reduce emissions from the energy sector is to increase the use of "clean, distributed electricity generation resources" (PA DEP 2019).

In 2018, Centre Regional Planning Agency (CRPA) began creating a local CAP, which includes a GHG emissions inventory, and during 2020 will also include: plans for targeted reductions of future contributions to climate change, action items for mitigation of future GHG emissions, and action items for adapting to the changing climate. The COG regional GHG inventory estimates the total contribution of anthropogenic emissions for the base year 2016 at 853,784 MT CO_{2e}, of which 52% results from electricity generated from outside the region for residential and commercial use (Adams 2019). Increasing the total installed generation of solar PV in the Centre region can contribute to mitigation of GHG emissions by reducing the demand for imported electricity generated by fossil fuels.

SOLAR RATIONALE

The benefits of increased solar PV generation include:

- Contributions to meeting regional and statewide goals for GHG emission reductions
- Increased revenue opportunity for landowners
- Increased resilience during electricity-disrupting disasters (when installed with energy storage).

One mechanism for increasing clean energy generation is the establishment of Pennsylvania's Alternative Energy Portfolio Standard Act of 2004 (PENNAEPS). Using the regulatory authority of the Pennsylvania Utility Commission (PUC), the law mandates an increasing percentage of Pennsylvania's retail electricity supply be derived from alternative energy sources, and defines those sources to include solar PV (AEPS 2004). The law, as amended in 2017, further defines the minimum required percentages of solar PV and electricity generated in Pennsylvania (PENNAEPS 2019). The AEPS also requires the PUC to establish an Alternative Energy Credits (AEC) program, as a mechanism to track and trade alternative energy generation, and to develop rules so "generation from net-metered customer-generators shall receive full retail value for all energy produced on an annual basis" (AEPS 2004).

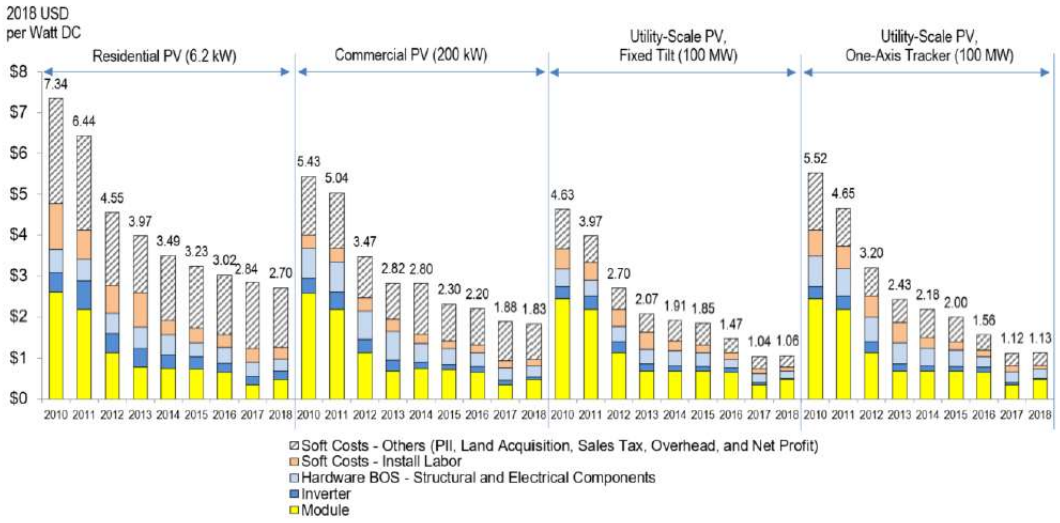

Figure 3. 2018 estimated costs for PV hardware under $1/watt. Image credit (Fu, Feldman and Margolis 2018).

With the price of solar photovoltaic (PV) panels dropping worldwide, and the additional revenue potential of clean electricity generation, the economic considerations of installing PV on private property become attractive on their financial merits. In 2010, AECs reached a peak average price over $300, and as a market response, Pennsylvania and Centre County saw an increased rate of PV installations. Over 25,000 facilities currently registered in Pennsylvania sell AECs, with 178 generators, ranging in production from 0.001 MW to 2.6 MW, in Centre County alone (PENNAEPS 2019).

Solar electricity generation is, by its nature, intermittent. Studies show, however, that U.S. electricity grids can accommodate a significant portion of solar PV generation and maintain required reliability levels. Cook et al. estimates one studied grid can supply over 13% of electricity needs from solar PV with existing technology and without disruption (Cook, Shaver and Arbaje 2017). Pennsylvania energy supplier PJM estimates that up to 30% of energy can be provided by wind and solar, with adequate transmission upgrades (GEII 2014). It is unlikely that any increase in solar PV installation rates in the Centre Region would cause disruption to the regional electric grid.

ZONING AUTHORITY

In Pennsylvania, all land use must be permitted (allowed) through zoning ordinances by the local municipality in order to “promote, protect and facilitate any or all of the following: the public health, safety, morals, and the general welfare” [Pennsylvania Municipalities Planning Code, cited in (CRPA 2015)]. Land uses not specifically accommodated are prohibited, unless added through special exception or new permit.

Property owners that wish to install privately-owned PV may find their ability to do so limited by restrictive or absent governmental regulations, which may differ between neighboring communities. Enacting consistent zoning ordinances and construction codes can simplify and expedite installation of PV and privately-funded sustainable development.

Failure to encourage the growth of PV installations on existing and planned building construction could limit property owners' access to sustainable development and financial opportunities, impact the ability to reach regional GHG reduction targets, increase local susceptibility to negative impacts from electricity-disrupting disasters, and expose municipalities to legal challenges over land use and zoning

COG municipalities adopt zoning ordinances independently, with access to professional local and regional planning services through the Centre Regional Planning Agency (CRPA). The CRPA provides planning services in several areas, including: land use, land development, transportation, water use, recreation, cultural, and sustainability. If a property owner wishes to install solar facilities on existing buildings, the PA Uniform Construction Code governs the construction permit process (CRCOG 2019); municipal permitting may be redundant. If a property owner wishes to install new structures for ground-mounted solar projects, the development falls under the jurisdiction of municipal zoning ordinances. To support the goal of facilitating solar PV projects, the CRPA should forward a recommendation for a model solar zoning ordinance to the COG General Forum, for independent municipalities to consider for adoption.

Zoning considerations

The American Planning Association identifies nine sustainability principles, including "reduce the use of fossil fuels/ encourage the use of fossil fuel alternatives" and lists the regulatory item "Solar energy systems or projects" as a tool for planners to consider in their regions (Jepson and Haines 2014).

In fact, the CRPA has already begun the process of streamlining ordinances regulating solar PV installations with a document titled "SUPPORTING SOLAR ENERGY" (CRPA 2018). That document describes the potential benefits of solar PV in the region and lists resources for interested property owners seeking to install solar on their property. The "Supporting Solar Energy" document also includes example ordinances used to permit solar power generation in other municipalities and recommends best practices for writing ordinances that promote solar PV installations.

The major zoning considerations the CRPA emphasizes are as follows:

- Clear definitions of solar components
- Permit small solar arrays in all land-use zones and consider them accessory usage
- Remove aesthetic restrictions
- Reduce permitting fees and requirements (while maintaining adopted construction and safety codes)
- Account for changing technologies by regulating installations based on impact and size rather than kilowatt production.

The CRPA also encourages supporting solar access rights through property easements, and designing new construction to be "solar ready" to maximize the potential gains from solar energy systems (CRPA 2018).

One unnecessary zoning restriction, listed by some COG municipalities, is the aesthetic requirement to prove the low-reflectivity of PV panels (other than controlled airport districts). Solar panels reflect very little light due to their design requirement to absorb light to convert into electricity (CRPA 2018).

Amendments to zoning ordinances are adopted by the governing body of each municipality. COG has no authority to mandate such changes, and only serves an advisory role. However, the CRPA has demonstrated the desire to coordinate the zoning language through the creation of the "Supporting

Solar" document, and can advocate for such policies to the General Forum or to COG standing committees.

Creating a uniform, permissive solar zoning policy is a very cost-effective method to encourage development of solar energy projects. The only expense should be the employee hours devoted to the project, and the COG has a full-time Sustainability Planner on staff already.

Existing ordinances

Of the COG municipalities, only Ferguson, Patton and College Township's zoning ordinances contain detailed language describing the permitted use of solar arrays. College Township's ordinances include clear definitions of solar components, and the following example of language enabling solar installation:

> *§ 200-11Use regulations. Solar energy systems as an accessory use. All lots containing a primary permitted use in all zoning districts shall be permitted to install and maintain a solar energy system to provide some, if not all, of the primary use's energy needs with the following regulations.(Township of College, PA / Part II: General Legislation / Zoning).*

Patton township includes zoning ordinances for solar power as a primary use (utility scale), as well as permitting accessory use. However, it requires a zoning permit for all solar projects (in addition to the required COG construction permit). (Township of Patton. § 142-3 Accessory solar energy systems.)

Ferguson Township includes an interesting incentive for solar (and wind) energy systems within its *Terraced Streetscape* District - it increases allowances for height and commercial usage on buildings that include such systems. This is a creative example of zoning language which encourages two sustainable development features, increasing land-use density and promoting renewable energy, at no additional cost to the township.

The other COG municipalities have no, or no significant, permitting language in their zoning or land development ordinances at the time of this writing.

Legal challenges

Without clear language defining the components and permissible use of PV projects, property owners and zoning authorities may risk facing legal challenges.

For example, a Massachusetts property owner has been ordered to tear down a barn, and the included PV array, based on neighbor's complaints. The property owner is suing the zoning authority due to unclear definitions of accessory and primary use, according to current use and plans for future development of the property (Legere 2019).

Also, in New Hampshire, a corporate property owner sued the zoning board for rejecting their planned 10MW solar PV farm, claiming the ordinance definition of "impervious surface" contradicts state law governing renewable energy projects. If the surface area of the panels is counted as impervious, the project does not meet local restrictions. However, considering only the support structure and footings "impervious" would allow the project to continue (Brooks 2017).

Finally, Northampton Area School District sued the zoning board of Lehigh Pennsylvania after being denied approval for a PV project, again due to unclear definitions for "accessory use," and "solar energy

unit" (Northampton Area School District v Zoning Board of the Township of Lehigh 2012). In this case, the zoning board tried to stop the construction of the solar panels, in order to keep more open land, contrary to existing permissive language.

MODEL ORDINANCE

This policy encourages the COG municipalities to make use of the CRPA professional planning services to customize existing model ordinances for use in the COG region, and adopt them as amendments to existing zoning and land development ordinances. Several municipalities and regional planning commissions have put forward model ordinances for consideration.

Following is a brief summary of materials available from other planning commissions, and a note on unique perspectives provided by each. Referenced model ordinances are listed in *Appendix 2.* Future versions of this document will include model ordinances customized for the Centre Region.

The CRPA document *Supporting Solar* includes a set of model ordinances from The Western Pennsylvania Rooftop Solar Challenge partners (Environmental Planning & Design, 2012) as part of the United States Department of Energy's (DOE) SunShot Initiative. That model suggests all ground-mounted PV projects be considered impervious ground cover, which is not the recommendation of this policy.

Cumberland County presents a model ordinance which permits accessory and principal solar energy systems, defined by energy output in kilowatts (kw). It also defines the required decommissioning process at the end of a project's operational life.

Delaware Valley Planning Commission shares a detailed framework for designing ordinances, including definitions and best practices, which does not present example ordinances to customize.

Lancaster County Planning Commission shares a planning framework for regulating several alternative energy systems, including solar, wind, biogas, and geothermal. It does not present example ordinances to customize.

Tri-county (Cumberland, Dauphin and Perry) Planning Commission shares a framework for designing ordinances, which includes sections on fire safety and on solar easements, as well as providing example ordinances to customize.

York County Planning Commission provides a complete model ordinance, which includes language describing the differences between pervious and impervious sections of a solar array.

SUCCESS METRICS

Procedural targets for a successful policy include presenting the suggestion and rationale for a unified ordinance to General Forum, either through COG standing committees or the CRPA. Each municipality would then discuss the proposal independently, and modify the model ordinances as required. Adoption of a more uniform set of zoning ordinances across the COG municipalities will be considered a complete success.

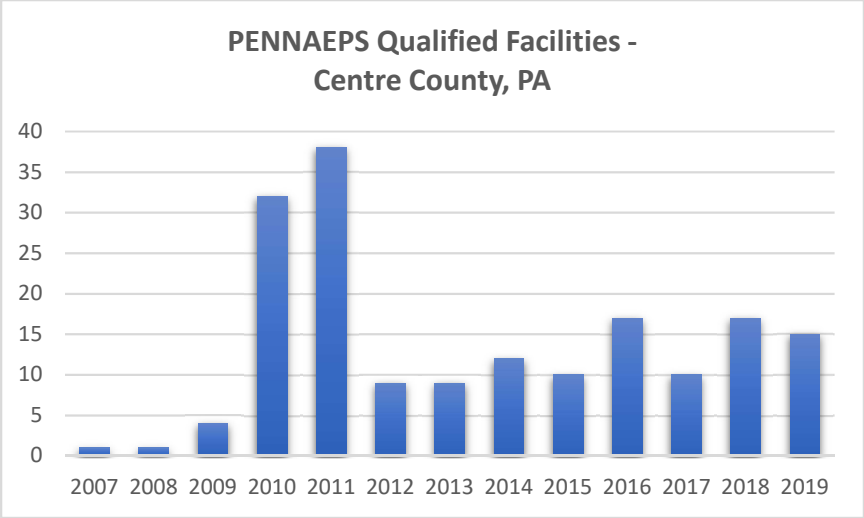

Figure 4. Solar generators in Centre County by year of activation. Source (PENNAEPS 2019)

Results of a successful zoning ordinance policy should help increase the installation of solar PV projects in the COG region, which can be measured by registrations on PENNAEPS to sell alternative energy credits. A 50% increase from 2020 registrations in 2021, after the adoption of the ordinance, would show evidence of a positive impact of the policy compared to the almost constant rate of installations (mean and median 12/year) from 2014-2019.

The CRPA will continue to conduct regular GHG emissions inventory after the adoption of the suggested ordinances. A decrease in measured emissions from the electricity sector would also show evidence of the success of the policy. Any potential emissions reduction would be counted toward the, as of yet undefined, Centre Region CAP goals for targeted reductions.

CONCLUSION

Adopting unified, permissive zoning ordinances for solar photovoltaic projects benefits landowners, contributes to climate action goals, and reduces the possibility of legal challenges. This document addresses the rationale behind the identified benefits, and provides resources and examples of model ordinances to customize for use in the Centre Region.

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APPENDICES

Appendix 1 IPCC AR5 Summary for Policymakers p 3

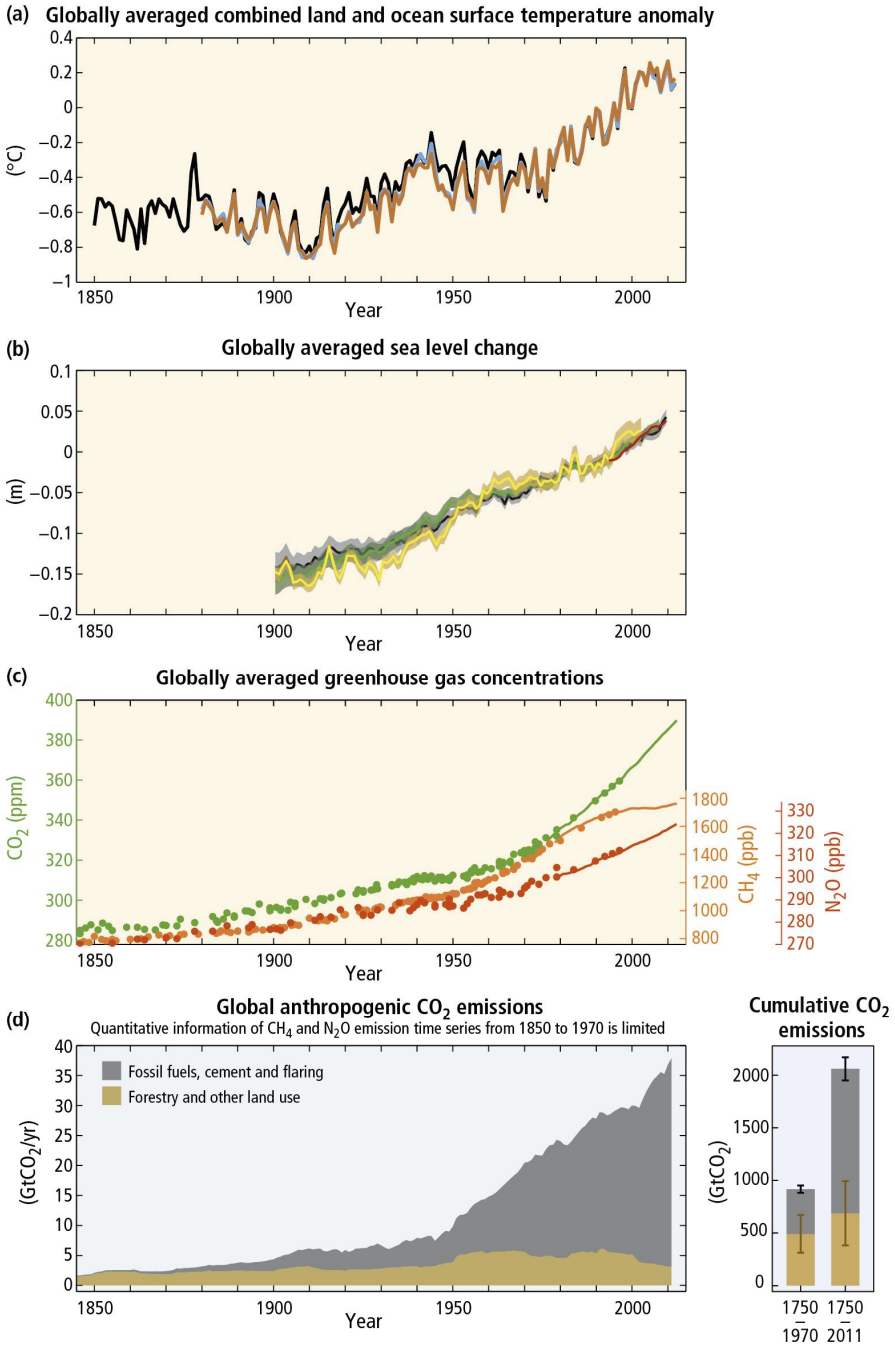

Figure SPM.1

The complex relationship between the observations (panels a, b, c, yellow background) and the emissions (panel d, light blue background) is addressed in Section 1.2 and Topic 1. Observations and other indicators of a changing global climate system. Observations: **(a)** Annually and globally averaged combined land and ocean surface temperature anomalies relative to the average over the period 1986 to 2005. Colours indicate different data sets. **(b)** Annually and globally averaged sea level change relative to the average over the period 1986 to 2005 in the longest-running dataset. Colours indicate different data sets. All datasets are aligned to have the same value in 1993, the first year of satellite altimetry data (red). Where assessed, uncertainties are indicated by coloured shading. **(c)** Atmospheric concentrations of the greenhouse gases carbon dioxide (CO2, green), methane (CH4, orange) and nitrous oxide (N2O, red) determined from ice core data (dots) and from direct atmospheric measurements (lines). Indicators: **(d)** Global anthropogenic CO2 emissions from forestry and other land use as well as from burning of fossil fuel, cement production and flaring. Cumulative emissions of CO2 from these sources and their uncertainties are shown as bars and whiskers, respectively, on the right hand side. The global effects of the accumulation of CH4 and N2O emissions are shown in panel c. Greenhouse gas emission data from 1970 to 2010 are shown in Figure SPM.2. {Figures 1.1, 1.3, 1.5}

Appendix 2 - Additional Resources

Model Ordinances

Centre Regional Planning Agency Supporting Solar Energy
https://www.crcog.net/index.asp?Type=B_BASIC&SEC={A1A3A3A1-D78A-4114-AAEC-7AEA912E6415}&DE=
https://www.crcog.net/vertical/sites/%7B6AD7E2DC-ECE4-41CD-B8E1-BAC6A6336348%7D/uploads/Solar_Energy_Report(1).pdf

Cumberland County Planning Department Alternative Energy Series
https://www.ccpa.net/4141/Model-Ordinances
https://www.ccpa.net/DocumentCenter/View/7947

Delaware Valley Regional Planning Commission Renewable Energy Ordinance Framework Solar PV
https://www.dvrpc.org/EnergyClimate/ModelOrdinance/Solar/
https://www.dvrpc.org/EnergyClimate/ModelOrdinance/Solar/pdf/2016_DVRPC_Solar_REOF_Reformatted_Final.pdf

Lancaster County Planning Commission Municipal Guide to Planning for and Regulating Alternative Energy Systems.
https://lancastercountyplanning.org/161/Publications
https://lancastercountyplanning.org/DocumentCenter/View/153/Alternative-Energy-Guide

Tri-County Regional Planning Commission Solar Energy Systems Model Ordinance
https://www.tcrpc-pa.org/model-ordinances
https://www.tcrpc-pa.org/s/SolarEnergySystems.pdf

York County Planning Commission Solar Energy Systems Model Ordinance
http://www.ycpc.org/396/Model-Ordinances
http://www.ycpc.org/DocumentCenter/View/316/Solar-Energy-Model-Ordinance-PDF

Centre Region municipal codes

College Township Codes https://www.ecode360.com/CO1052

Ferguson Township Codes https://ecode360.com/FE3697

Halfmoon Township Codes https://ecode360.com/HA1360

Harris Township Codes https://www.ecode360.com/HA3583

Patton Township Codes https://ecode360.com/PA1476