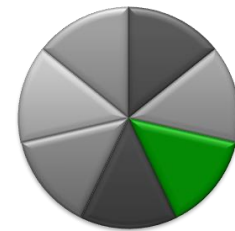


# Environmental evidence base: Geodiversity



- Air quality
- Biodiversity
- **Geodiversity**
- Landscape
- Land use
- Soils
- Water

ofgem

- Introduction:
  - A systematic review has been undertaken to characterise the impacts of the GB regulated energy system (primarily transmission and distribution) on the natural environment
  - There are seven issues that are seen to be important to address: Air quality, Biodiversity, Geodiversity, Landscape, Land use, Soils, and Water.
- Purpose of the evidence bases:
  - The intended use of the evidence bases is: to inform development of regulatory policy proposals, support internal/external advocacy, and support internal implementation of Ofgem’s strategic and sustainability assessment framework
  - This evidence base describes: the current state of geodiversity in GB, wider pressures on geodiversity in GB, and potential impacts from any pressure on geodiversity, factors leading to such impacts and relevant statutory legislation/regulation
  - The evidence base provides an initial ranking of the impacts and also gives more detailed consideration to those individual elements of the GB regulated energy system likely to have greatest impact on geodiversity and/or to arise most frequently
  - The evidence base identifies: how the significance of impacts may be affected by climate change, existing statutory legislation/regulation intended to prevent or minimise impacts, and management actions that prevent or minimise impacts and can be undertaken by a range of actors
- How to use:
  1. The environmental evidence bases should be used to identify the impacts associated with the policy/project using the matrix, ‘flag’ those that are high impact with high/medium confidence and those that are medium impact with high confidence requiring scrutiny / additional analysis.
  2. Undertake more detailed consideration of the significance of these impacts
  3. Undertake more detailed analysis of the interactions with climate change
  4. Consider potential prevention and mitigation measures
  5. Undertake additional qualitative and quantitative analysis, as required
- Case study:
  - A worked step-by-step case study has been included, considering the pressure on geodiversity with the most significant impacts, in order to help you use this evidence base

Slide	Title
4	State of geodiversity
5	Potential impacts on geodiversity
7	Instructions
8	Step 1: Initial rankings of impacts on geodiversity
12	Case study – Felindre to Tirley gas pipeline
13	Step 2: Significance of impacts on geodiversity
15	Step 3: Interactions with climate change
17	Step 4: Preventing or minimising the impacts
19	Step 5: Qualitative/quantitative analysis
20	Conclusions
21	Annexes
22	Annex 1: Roles and responsibilities of regulators of geodiversity
23	Annex 2: Relevant legislation and regulation references
25	Annex 3: Preventing or minimising the impacts

# The state of geodiversity

- Geodiversity is the variety of rocks, minerals, fossils, landforms, soils and associated natural processes. It underpins landscape character and the natural environment, and provides raw materials that have determined our cultural and built heritage and support our economy.
- The safeguarding of non-renewable resources is a key aspect of sustainable development. Britain's geodiversity provides a wide range of minerals, which are finite resources. Differences in minerals' occurrence, properties, and supply and demand result in different implications for land-use planning and safeguarding dependent on location.
- Britain is one of the most geodiverse places in the world. The best and most representative geological and geomorphological features in GB have been designated as [Sites of Special Scientific Interest](#). Locally significant sites may be declared as 'Regionally Important Geological and Geomorphological Sites'. [The UK Geodiversity Action Plan](#) links national, regional and local conservation activities.
- From a conservation perspective, many of the most important and best exposures of geodiversity are neglected, degraded, concealed by vegetation or over exploited.
- Land-use change (e.g. quarrying, urban and rural development, coastal protection and new infrastructure) has potential not only to remove or permanently cover geological exposures making them inaccessible for education, recreation and tourism but also to expose new geology.
- Mineral extraction can only take place where sufficient quantities occur of the desired quality. Mineral sterilisation can occur as a result of new development on the surface (e.g. urban and rural development, and new infrastructure) directly overlying the resource or being situated close to its boundary thereby preventing extraction.

# Potential impacts on geodiversity

- The following slides:
  - Identify and broadly categorise potential impacts arising from any pressure on geodiversity
  - Identify factors that lead to such impacts
  - Highlight relevant statutory legislation or regulation intended to prevent or minimise such impacts
- This information is then used specifically to consider impacts on geodiversity arising from individual elements of the GB regulated energy system.

For more information on roles and responsibilities of regulators for geodiversity, please refer to Annex 1.

For more information on relevant legislation, please refer to Annex 2

# Potential impacts on geodiversity

Impact	Factor	Relevant legislation
<b>Geological exposures</b>	Factors that impact on existing geological exposures or expose new geology	<ul style="list-style-type: none"> <li>• World Heritage Convention</li> <li>• UNESCO Geoparks</li> <li>• UK Geodiversity Action Plan</li> <li>• The geological conservation review</li> <li>• Wildlife &amp; Countryside Act 1981 (as amended)</li> <li>• Natural Capital (2011) Strategic assessment of the value and state of Scotland's geodiversity</li> <li>• Scotland's Geodiversity Charter</li> <li>• Marine (Scotland) Act 2010</li> </ul>
<b>Mineral sterilisation</b>	Factors that restrict access to mineral resources	<ul style="list-style-type: none"> <li>• National Planning Policy Framework</li> <li>• Scottish Planning Policy (SPP)</li> <li>• Mineral Planning Policy Wales (MPPW)</li> <li>• Minerals Technical Advice Notes (MTANs) - MTAN1 and MTAN2</li> </ul>

- Case Study:
  - The steps are illustrated using a ‘real-life’ case study.
  - This considers the pressure “New gas transmission network and new transmission lines – underground”
  - Steps 2 to 5 have been applied to this case study. For general use, you will need to tailor these steps to your own policy/project
- Step 1: Initial rankings of impacts
  - This step applies to all policies/projects
  - The matrices illustrate the severity of each pressure on the various impacts and so can be used to highlight areas for additional scrutiny
- Step 2: Significance of rankings
  - In this step you develop a matrix specific to your given policy/project
  - This allows you to consider the significance of the identified impacts
- Step 3: Interactions with climate change
  - Another case-specific matrix is developed here analysing the interactions with climate change
- Step 4: Preventing or minimising the impacts
  - A final case-specific matrix is developed in order to consider potential prevention and mitigation measures
- Step 5: Qualitative/quantitative analysis
  - Within your policy/project development, you should undertake further analysis of the relevant impacts and mitigation measures

# Step 1: Initial ranking of impacts on geodiversity

Context

Impacts

Analysis

Annex

- Having identified and broadly categorised potential impacts arising from any pressure on geodiversity, the following tables provide an expert initial ranking of each of the individual elements of the GB regulated energy system:
  - Independent of other energy system-environment interactions
  - At the likely scale of an individual pressure (e.g. an individual transmission line or sub-station)
  - Irrespective of existing statutory legislation and regulation, and
  - Irrespective of potential timing
- Cumulative effects are considered in the same way in relation to each individual element of the GB regulated energy system
- The matrices should be used to ‘flag up’ significant impacts. This will allow you to conduct further investigation on those significant impacts, for which we have a high degree of confidence in the evidence available

- Impact is defined as:



High: national, permanent, irreversible

Medium: regional, semi-permanent, difficult to reverse

Low: local, temporary, reversible

- Confidence in evidence of such impacts is defined as:

<b>H</b>
<b>M</b>
<b>L</b>

High: robust evidence, high agreement

Medium: medium evidence, medium agreement

Low: limited evidence, low agreement



# Initial ranking of impacts on geodiversity (electricity transmission)

Context

Impacts

Analysis

Annex

Driver: Electricity transmission	Impact		
Issue: Geodiversity	Geological exposures	Mineral sterilisation	Cumulative effects
Pressures			
New transmission lines – overhead	N/A	M	N/A
New transmission lines – underground*	H	M	N/A
New distribution lines	N/A	L	N/A
New/extended substations	H	H	N/A
New marine interconnection	N/A	N/A	N/A
Marine interconnection – land base connection	H	H	N/A
Marine sub-sea lines	N/A	N/A	N/A
Marine sub-stations	N/A	N/A	N/A
Series compensation installations	N/A	N/A	N/A
Electricity storage – hydro	H	M	N/A
Electricity storage – compressed air	H	H	N/A
Electricity storage – batteries	H	H	N/A
Electricity storage – cryogenic systems	N/A	N/A	N/A
Smart grids	N/A	N/A	N/A

\* This is the pressure covered in the case study

# Initial ranking of impacts on geodiversity (gas transmission)

Context

Impacts

Analysis

Annex

Driver: Gas transmission	Impact		
Issue: Geodiversity	Geological exposures	Mineral sterilisation	Cumulative effects
<b>Pressures</b>			
New gas transmission network*	H	M	N/A
New compressors	H	H	N/A
New distribution network	H	M	N/A
New port infrastructure – gas reception facilities	H	H	N/A
New port infrastructure – LNG import	H	H	N/A
Marine interconnection	N/A	N/A	N/A
Biogas upgrading for injection to grid	N/A	N/A	N/A
Gas storage – underground storage in caverns or gas and oil fields	N/A	M	N/A
Gas storage – above ground connection	N/A	N/A	N/A
CCGT – district heating	N/A	N/A	N/A
Biomethane injection to grid	N/A	N/A	N/A
Shale gas – connection to grid	H	M	N/A

\* This is the pressure covered in the case study

# Initial ranking of impacts on geodiversity (carbon capture/storage)

Context

Impacts

Analysis

Annex

Driver: CCS	Impact		
Issue: Geodiversity	Geological exposures	Mineral sterilisation	Cumulative effects
<b>Pressures</b>			
Redeployment of gas pipelines for CO2	N/A	N/A	N/A
New CO <sub>2</sub> pipelines	H	M	N/A
CCS process	N/A	N/A	N/A

# Case study – Felindre to Tirley gas pipeline

The pressures with the most significant impacts, identified in the previous matrix are:

- New transmission lines – underground
- New gas transmission network

The case study hence considers an example of those pressures.

- Completed in 2007, this pipeline stretches over 196km, crossing the Brecon Beacons National Park.
- To construct the pipeline, National Grid was required to make an application to the Secretary of State for Trade & Industry under the *Public Gas Transporter Pipe-line Works (Environmental Impact Assessment) Regulations 1999*.
- The application was supported by an Environmental Statement, which considered the location of mineral resources.
- The pipeline route avoids areas of existing mineral extraction and has been routed to minimise the length within the former South Wales coalfield. However, the pipeline route crosses three areas safeguarded for possible future sand and gravel extraction because, following assessment, sterilisation of these minerals was found to be acceptable.



## Felindre to Tirley pipeline crosses the A449

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## References

[http://www.nationalgrid.com/NR/rdonlyres/7215F121-FC8B-4DB1-B4E8-7C25F1831F88/0/FelindretoTirleymapsouth\\_large.jpg](http://www.nationalgrid.com/NR/rdonlyres/7215F121-FC8B-4DB1-B4E8-7C25F1831F88/0/FelindretoTirleymapsouth_large.jpg)  
<http://www.nationalgrid.com/NR/rdonlyres/9775222B-BC21-41A8-9801-FC1A2C349E72/9406/3275FelinTirNTSFinalPDF.pdf>

# Step 2: Significance of impacts on geodiversity

Context

Impacts

Analysis

Annex

- Now you will need to undertake further analysis, which is illustrated here utilising the case study on the previous slide
- The following tables go on to provide more detailed consideration of the significance of impacts from those individual elements of the GB regulated energy system initially ranked highest and/or that are likely to arise most frequently
- To do this you use a case-specific matrix. An example is shown on the next slide.
  - This allows you to see which impacts should be given priority in your analysis
  - In this case, both impacts should be treated severely
- Ranking of magnitude is based on extent, duration, reversibility and frequency of impact
- Confidence in the evidence is defined in the same way as for the initial ranking

- A combined ranking of the significance of impacts is based on magnitude x confidence:

Magnitude	High	Yellow	Red	Red
	Medium	Green	Yellow	Red
	Low	Green	Green	Yellow
		Low	Medium	High
		Confidence		

- Significance:

	High
	Medium
	Low

# Significance of impacts on geodiversity



Context

Impacts

Analysis

Annex

Issue: Geodiversity	Impact		
<b>Pressure:</b> New gas transmission network and new transmission lines – underground. (Covered as one).	<b>Geological exposures</b>	<b>Mineral sterilisation</b>	<b>Cumulative effects</b>
<b>Positive or negative</b>	+/-	-	N/A
Extent	Local	Local	N/A
Duration	Permanent	Permanent	N/A
Reversibility	Irreversible	Difficult to reverse	N/A
Frequency	During construction	During construction	N/A
<b>Magnitude</b>	Medium	High	N/A
<b>Confidence</b>	High	Medium	N/A
<b>Significance</b>			N/A

# Step 3: Interactions with climate change

- Having provided more detailed consideration of the significance of impacts from those individual elements of the GB regulated energy system initially ranked highest and/or that are likely to arise most frequently, the evidence base goes on to review their potential interactions with climate change.
- This is done through developing another case-specific matrix
  - This allows you to see how the impacts of your policy/project relate to climate change and whether they are going to be amplified, remain neutral or reduce with climate change
  - In the case that is being considered here, it is shown in the matrix on the next slide that climate change is unlikely to amplify the geodiversity impacts
- The following tables identify how the significance of impacts may change as a result of:
  - Direct impacts of climate change on geodiversity
  - Climate change adaptation actions identified by key energy infrastructure providers under the Climate Change Act 2008 adaptation reporting power

# Interactions with climate change

Issue: Geodiversity	Impact		
Pressure: New gas transmission network and new transmission lines – underground. (Covered as one).	Geological exposures	Mineral sterilisation	Cumulative effects
Significance			N/A
Climate change	=	=	N/A

**References**

- Adaptation Reporting Power received reports (2012) Adaptation plan reports: electricity distributors and transmitters and gas transporters.  
<https://www.gov.uk/government/publications/adaptation-reporting-power-received-reports>



# Step 4: Preventing or minimising the impacts

- Finally, the evidence base considers prevention of impacts from those individual elements of the GB regulated energy system initially ranked highest and/or that are likely to arise most frequently, and whose significance and interactions with climate change have been reviewed
- The following tables identify:
  - Relevant existing legislation or regulation
  - Management actions that prevent or minimise impacts and can be undertaken by a range of actors
- The prevention and mitigation measures should be considered in any analysis undertaken in your policy/project development

# Preventing or minimising the impacts

Issue: Geodiversity	Impact		
<b>Pressure:</b> New gas transmission network and new transmission lines – underground	<b>Geological exposures</b>	<b>Mineral sterilisation</b>	<b>Cumulative effects</b>
<b>Significance</b>			N/A
<b>Climate change</b>	=	=	N/A
<b>Legislation/regulation</b>	<b>1, 2, 3, 4.</b>	<b>2, 5, 6, 7, 8</b>	N/A
<b>Management</b>	<b>9</b> Aim to achieve and maintain an acceptable level of exposure and access for educational purposes while minimising degradation of the exposed feature.	<b>10, 11, 12</b> Minimise the area that is rendered inaccessible by the transmission infrastructure.	N/A

*\*Numbers are referenced in Annex 3*

# Step 5: Qualitative/quantitative analysis

- After using the matrices to identify relevant impacts for your policy/project, identifying their significance, considering their interactions with climate change and potential prevention and mitigation measures, you should undertake further analysis to feed into any Impact Assessment being developed
- The analysis can be either qualitative or quantitative (if available)
- For the case study we are considering, further analysis should be given to the following impacts:
  - Geological exposures
  - Mineral sterilisation

# Conclusions

Context

Impacts

Analysis

Annex

- Individual elements of the GB regulated energy system likely to have the greatest impact on geodiversity and/or to arise most frequently are:
  - New transmission lines - overhead
  - New transmission lines - underground
  - New distribution lines
  - Electricity storage - hydro
  - New gas transmission network
  - Gas storage - underground storage in caverns or gas and oil fields.
  - Shale gas – connection to grid
  - New CO<sub>2</sub> pipelines
- Their most significant potential impacts relate to:
  - Geological exposures
  - Mineral sterilisation
- Climate change is likely to be neutral in relation to many of these impacts.
- Existing statutory legislation or regulation preventing or minimising such impacts includes:
  - Wildlife & Countryside Act 1981 (as amended)
  - National Planning Policy Framework (England)
  - Scottish Planning Policy
  - Marine (Scotland) Act 2010
  - Mineral Planning Policy Wales
- Management actions to prevent or minimise impacts that can be undertaken by a range of actors can be identified as follows:
  - Natural England: Conservation principles for geology
  - British Geological Survey: Mineral resources maps to assist protection against sterilisation
  - British Geological Survey (2011) Mineral safeguarding in England: good practice advice.

# Annexes

## Roles and responsibilities of regulators for geodiversity

- Development of national planning policy guidance, including in relation to conservation of geological exposures and mineral safeguarding, is devolved to a country level. Responsibility resides with the Department for Communities and Local Government (in England), the Welsh Government and the Scottish Government.
- Most land-use planning decisions are made by local planning authorities.

## Relevant legislation and regulation

The statutory legislation and regulations identified here provide the legal framework in relation to geodiversity.

### International

- [World Heritage Convention](#): sets out the duties of countries that are party to the convention in identifying potential World Heritage Sites (WHS) and their role in protecting and preserving them. The Dorset and East Devon (Jurassic) Coast is designated a WHS for its outstanding geology and geomorphology.
- [UNESCO Geoparks](#): internationally recognised as areas with outstanding geological heritage and gain from exchange of knowledge, expertise and experience. There are currently six Geoparks in Britain, which are included within the European Geoparks Network and the Global Network of Geoparks

### UK

- [UK Geodiversity Action Plan](#): sets out a framework for geodiversity action, providing a shared context and direction through a common aim, themes, objectives and targets which link national, regional and local activities
- [The Geological Conservation Review](#): systematically selected the best and most representative geological and geomorphological features of Britain, and underpins their designation in Sites of Special Scientific Interest, SSSI. GCR sites that are not designated as SSSIs are usually declared as Local Nature Reserves or Local Geodiversity Sites, also known as 'Regionally Important Geological and Geomorphological Sites' (RIGS).
- [Wildlife & Countryside Act 1981 \(as amended\)](#): the main piece of legislation relating to nature conservation in Britain, provides for designation of SSSIs based on their geological and geomorphological features. The Act has been amended in various ways at a UK and country level.

# Relevant legislation and regulation

Context

Impacts

Analysis

Annex

## England

- [National Planning Policy Framework](#) identifies that the planning system should:
  - Contribute to and enhance the natural and local environment by protecting and enhancing geological conservation interests
  - Recognises secure the long-term conservation of minerals through mineral safeguarding

## Scotland

- [Scottish Planning Policy \(SPP\)](#) contains minerals policies for Scotland
- [Natural Capital \(2011\) Strategic assessment of the value and state of Scotland's geodiversity: links with the current policy framework](#). Scottish Natural Heritage Commissioned Report No. 416 – Includes a review of relevant current policies in Scotland and selected policies elsewhere in the UK.
- [Scotland's Geodiversity Charter](#): recognises geodiversity as an integral and vital part of our environment, economy, heritage and future sustainability, and includes recommended actions for different stakeholders with case studies.
- [Marine \(Scotland\) Act 2010](#): enables conservation of geological or geomorphological features inside 12 nautical miles in Marine Protected Areas (MPAs). A survey has identified 32 key geodiversity areas but none have yet been selected as MPAs

## Wales

- [Mineral Planning Policy Wales \(MPPW\)](#), sets out the land use planning policy guidance of the National Assembly for Wales in relation to mineral extraction and related development
- *Minerals Technical Advice Notes* (MTANs) support MPPW:
  - [MTAN1](#), *Aggregates* includes advice on protecting areas of importance
  - [MTAN2](#), gives advice in relation to coal



# Preventing or minimising the impacts

## References

### Legislation/regulation

1. Wildlife & Countryside Act 1981 (as amended) (<http://jncc.defra.gov.uk/page-1377>).
2. National Planning Policy Framework (<https://www.gov.uk/government/publications/national-planning-policy-framework--2>)
3. Commissioned Report No. 416 ([http://www.snh.org.uk/pdfs/publications/commissioned\\_reports/416.pdf](http://www.snh.org.uk/pdfs/publications/commissioned_reports/416.pdf))
4. Scotland's Geodiversity Charter:  
([http://scottishgeodiversityforum.files.wordpress.com/2011/12/geodiversity\\_charter\\_web.pdf](http://scottishgeodiversityforum.files.wordpress.com/2011/12/geodiversity_charter_web.pdf))
5. Scottish Planning Policy (SPP) contains minerals policies for Scotland  
(<http://www.scotland.gov.uk/Publications/2010/02/03132605/0>)
6. Mineral Planning Policy Wales  
(<http://wales.gov.uk/topics/planning/policy/minerals/mineralsplanning/;jsessionid=643D3D2E5AD40BFE63BC9AE22254EBE7?lang=en>)
7. MTAN1, Aggregates (<http://wales.gov.uk/topics/planning/policy/mineralstans/2888891/?lang=en>)
8. MTAN2, Coal (<http://wales.gov.uk/topics/planning/policy/mineralstans/2877461/?lang=en>)

### Management

9. Natural England: Conservation principles for geology  
(<http://www.naturalengland.org.uk/ourwork/conservation/geodiversity/protectandmanage/conservation.aspx>)
10. The British Geological Survey (BGS) has produced a series of mineral resources maps to assist protection against sterilisation:
  - England <http://www.bgs.ac.uk/mineralsuk/maps/maps.html>
  - Scotland's Central Belt <http://www.bgs.ac.uk/mineralsuk/maps/maps.html>
  - Wales <http://www.bgs.ac.uk/downloads/start.cfm?id=1665>
11. The Crown Estate has commissioned BGS to produce maps of mineral resources for the UK Continental Shelf. The first map and accompanying report, for the East Coast (Dogger Bank to the Outer Thames Estuary) have been completed  
<http://www.thecrownestate.co.uk/energy-infrastructure/aggregates/>
12. Mineral safeguarding in England: good practice advice (BGS, 2011) provides information on how current national mineral safeguarding policies in England can be implemented <http://www.bgs.ac.uk/downloads/start.cfm?id=2069>

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