Options for 2030 infrastructure targets

Infrastructure and the EU 2030 climate and energy framework

Discussion paper, December 2013

Highlights

- A major expansion of European grid infrastructure is foreseen to 2030 in order to capture the economic and security benefits of European power market integration and to facilitate higher proportions of variable renewables.
- The existing EU target for countries to develop interconnection equivalent to 10% of production capacity was set in 2002, at a time well before the current internal energy market framework was enacted and before variable renewables played a major part of the European power mix. The forthcoming EU 2030 package offers an important opportunity to update Europe's infrastructure targets to ensure they are aligned with EU objectives on renewables, decarbonisation and market integration.
- There are a number of viable design options for setting a new infrastructure target in the 2030. Key choices for target design include the metrics for calculating a target – on the basis of capacity, benchmarks or system flexibility indicators – and whether targets should apply at the EU, regional or national level.
- Five potential options for infrastructure target design are identified in this paper:
  - *Ending market isolation:* Member states to achieve interconnection capacity equivalent to at least 20% of peak demand by 2030.
  - *EU market objective:* The EU to double its cross-border net transfer capacity by 2030, supported by effort sharing arrangements.
  - *Regional markets:* Regional Groups to establish targets for intra-regional interconnection capacity or trading.
  - *EU benchmarks:* At least 80% of projects of European significance in the 2014 Ten Year Network Development Plan to be delivered by 2025.
  - *System flexibility:* European markets to double the capacity of flexibility resources (including interconnection, demand response and storage) by 2030.

1. Introduction[1]

The EU is currently developing its climate and energy framework 2030, in recognition that 'long investment cycles mean that infrastructure funded in the near term will still be in place in 2030 and beyond and investors therefore need certainty and reduced regulatory risk'.

'More and smarter' network infrastructure was identified as a 'no regrets' option in Commission's Energy Roadmap 2050 and in the 2030 Green Paper, as major upgrades of transmission networks and more flexible distribution grids are common across decarbonisation scenarios.

While specific proposals for inclusion of infrastructure within the 2030 framework have not yet been put forward, there are increasing calls for an updated target on infrastructure to be included within the package. This is driven by recognition of the need for network development European network development infrastructure to be aligned with the EU's goals for renewables and decarbonisation, in order to avoid damaging underinvestment or costly stranded assets. It also reflects the cost savings and competitiveness benefits an interconnected European power market could deliver in the 2030 context.

Choices will need to be made about how such a target is structured and delivered, and these choices will have a strong bearing on the success of the policies. This paper considers the drivers and objectives of an updated infrastructure target for 2030, the key design choices on metrics and level of governance, and identifies five promising options for infrastructure target design.

2. Design criteria, drivers and objectives: what a target must deliver

European targets in the energy sector can fulfil several different functions. They are used to help to establish a shared direction of travel and can stimulate or guide policies to ensure agreed objectives are met. Targets can facilitate investment planning and supply chain development, and may also help to reduce perception of regulatory risk. They can also form a benchmark to evaluate progress and increase accountability on outcomes.

European energy targets have had a mixed track record of delivery. To be successful, new targets on infrastructure will need to be easy to understand; as reflective as possible of the objective; linked to delivery mechanisms, with clear responsibilities; and mutually-reinforcing with other targets, policies and institutional arrangements.

[1] This paper was developed by E3G with helpful inputs from a number of industry and political stakeholders. Please send comments to luca.bergamaschi@e3g.org and jonathan.gaventa@e3g.org.

There are two underlying drivers for setting an infrastructure target in the 2030 context

1. Enabling the development of an integrated European energy market

Effective integration of European energy markets could enable considerable cost savings as well as additional security and competitiveness benefits, but will only be possible if sufficient physical infrastructure is developed to make the market work. By the same token, the creation of a truly integrated Internal Energy Market will only be achieved if weakly interconnected countries and regions increase their interconnectivity levels, in particular where more structural grid bottlenecks persist such as between the Iberian Peninsula and the rest of continental Europe.

2. Enabling and responding to a changing fuel portfolio including higher proportions of variable renewables

Decarbonisation scenarios show that significantly increasing quantities of renewables are common to all cost-effective pathways. The transmission system will need to adapt to enable and respond to increased deployment of renewables in order to enable balancing of variable production and to connect new power sources from different geographical locations. Higher levels of interconnection will enable optimisation of assets and a more efficient use of the power system and fleet in general.

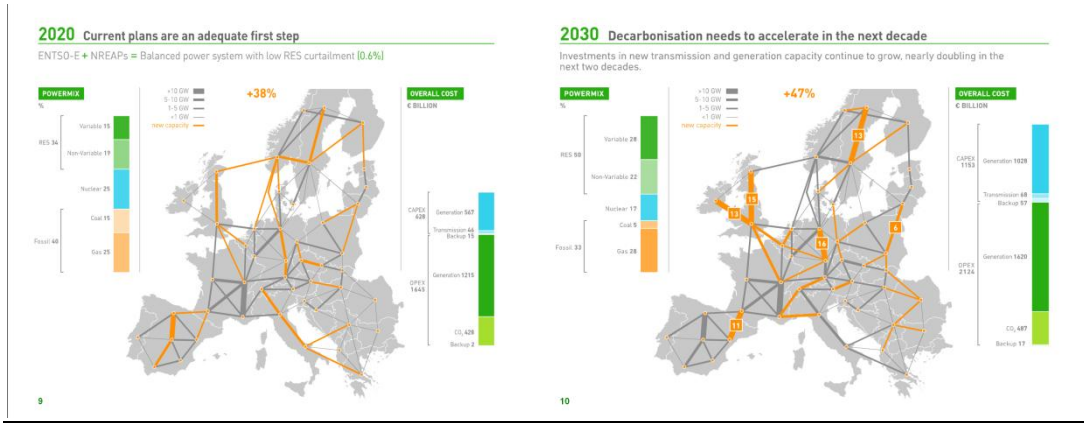

Figure 1: Projected transmission investment needs to 2030[2]

Within this broad context, an infrastructure target can be designed around meeting a number of specific objectives. Potential objectives considered in the options set out in this paper include:

> Enabling all Member States to fully participate in an integrated European power market, through connecting isolated regions

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[2] Source: ECF (2011) Power Perspectives 2030 http://www.roadmap2050.eu/project/power-perspective-2030

- Increasing the volumes of cross-border trading capacities across Europe
- Acceleration of interconnection development / increased confidence that projects will be delivered on a timely basis
- Catalysing the development of macro-regional energy markets as a stepping stone to a fully integrated European market
- Ensuring infrastructure systems are sufficiently flexible to enable a rapid deployment of variable renewables.

The specific objective selected will influence the design choices made on the metric and governance level of a target.

3. Current targets and key challenges

The EU has several existing targets and priorities relating to infrastructure. These include:

- In 2002, the European Council agreed the "target for Member States of a level of electricity interconnections equivalent to at least 10% of their installed production capacity by 2005"[1]. This target was reiterated by the European Council in May 2013.
- In 2011, the European Council agreed the target to eliminate 'energy islands' by 2015. This target was reiterated by the European Council in May 2013.
- The 2011 and 2013 European Council conclusions also re-affirmed a commitment for the completion of the internal energy market by 2014. In practice this has meant a focus on implementing market coupling and developing common network codes.

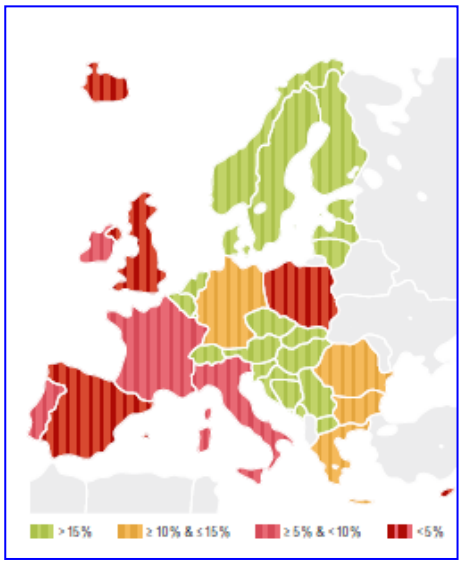


Figure 2: Progress towards the interconnection target in 2011

In addition to these high-level targets, the EU has also developed different categories for infrastructure priorities:

- *Projects of pan-European significance*: The European Network of Transmission System Operators for Electricity is tasked with publishing a bi-annual Ten Year Network Development Plan, which sets out projects of pan-European significance to be developed over the next 10 years. The 2012 Ten Year Network Development Plan set out over 100 projects of pan-European significance, of which around 40% were interconnectors.

- *Priority corridors*: The 2013 TEN-E regulation set out 12 broad 'priority corridors' for infrastructure development, including 4 geographical corridors for electricity (plus electricity highways and smart grids). Each priority corridor is associated with a 'Regional Group' of MS governments, regulators, system operators and project developers.
- *Projects of Common Interest*: The Regional Groups identify 'Projects of Common Interest' within each priority corridor. The PCIs benefit from swifter permitting regimes and are eligible for finance under the Connecting Europe Facility. Projects must have a cross-border impact and conform to a detailed set of criteria. The first PCI list in 2013 included 132 electricity projects (including electricity transmission, smart grids and storage).

This complex picture of objectives and priorities, however, faces a number of challenges:

- The target for interconnection capacity equivalent to 10% of production was designed in 2002, well before the current internal energy market provisions were put in place, and at a time when variable renewable made up a very small proportion of European power market. It may therefore be inadequate for the future shape of the market. Grid modelling in 'Power Perspectives 2030' showed all countries reaching at least 20% interconnection levels in the central scenario, with many countries achieving much higher levels. The target also lacks a clear link to a delivery mechanism and as a result has not been met. Despite the original target date of 2005, as of 2013 9 European countries had still not met the 10% objective, including 5 out of the 7 largest power systems in Europe. Finally, a single target number for all European countries has been criticised for being insufficiently attuned to the differences between highly-connected countries at the centre of Europe and more isolated peninsulas or energy islands at Europe's periphery.
- The Projects of Common Interest system was design help to facilitate project delivery through accelerated permitting and financial support. However it does not include quantified objectives for what the 'Priority Corridors' and PCI lists are expected to deliver. As a result the first PCI list was criticised for risking being out of line with other EU objectives on decarbonisation or renewables deployment – which could lead to a dangerous risk of underinvestment or costly stranded assets. For example, the assessment of the gas Projects of Common Interest assumed gas consumption levels 52-60% higher than the decarbonisation scenarios in the European Commission's own Roadmap 2050 study[3].

[3] Booz & co (2013) Market analysis and priorities for the future development of the gas markets and infrastructure under the North South gas interconnections in Western Europe, South Eastern Europe and the Baltic Sea Region.

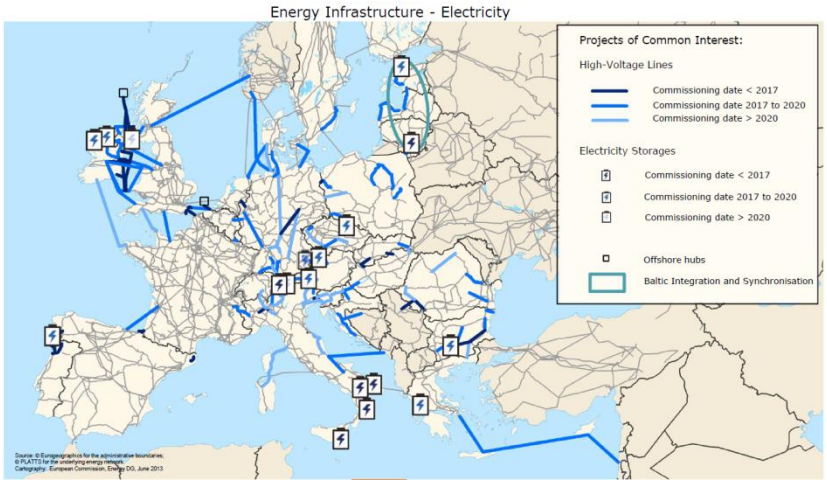


Figure 3: Electricity projects of common interest[4]

4. Design choices

Once the objectives for developing an infrastructure target have been established, decisions will be needed on how the target should be designed. The two key factors that will need to be resolved for setting an infrastructure target are the metric used to set the target and the governance level to which a target will apply.

4.1 Metrics

The first key decision is on how a target should be defined and measured. Potential approaches include capacity-based measures, benchmarks of infrastructure delivery, or new metrics on flexibility.

Metrics	Capacity	Targets for quantities of interconnection capacity, or interconnection levels proportional to generation or peak demand.
	Benchmarks	Targets for the completion of agreed priority projects within a set timeframe.
	System flexibility	Indicators of system flexibility and responsiveness, reflecting levels of interconnection, demand response, storage and flexible generation.

[4] Source: European Commission

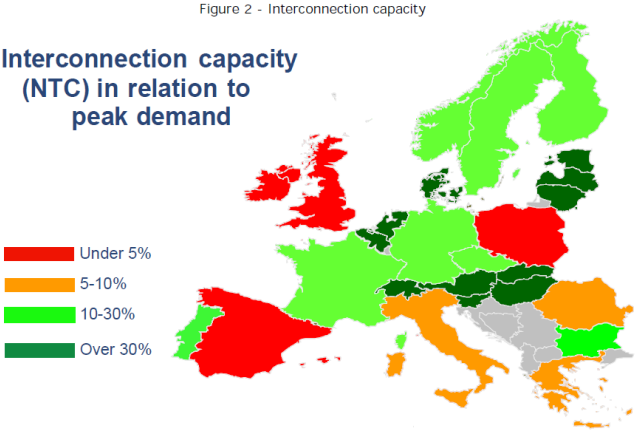
Capacity

Targets for capacity can be used to set out ambitions for the scale of infrastructure development envisaged for 2030. They have the advantage of being relatively straightforward to monitor and measure, and represent a tangible objective. The current 'Barcelona' target is based on a capacity metric.

There are several choices that will need to be made in elaborating a capacity target:

- Capacity targets could relate to either transmission or cross-border interconnection. Transmission-related targets could address internal bottlenecks as well as cross-border trading capacity but may be a blunter indicator. Interconnection targets by contrast are more focused on integrating power markets and can capture capacity for cross-border trade.
- Capacity targets can refer to either the nominal capacity of a line, or the 'net transfer capacity' which is made available taking into account security standards and other factors that may vary according to both meteorological conditions and market dynamics. The nominal capacity is easier to evaluate, while the net transfer capacity is more indicative of interconnector availability.
- Targets can also be set at an absolute level, or be proportional to another factor such as generation capacity. The current 'Barcelona' target for interconnection is proportional to 'installed production capacity' of electricity generation. The drawback of setting a target proportional to nameplate generation capacity is that it may be less suited to a system with high proportions of renewables with low load factors.
- Alternatively, targets could also be set proportional to peak demand. This would have the benefit of allowing the target to be met through demand-side response or demand reduction as well as interconnection. This metric may also focus attention on the energy security aspects of interconnection.

Figure 2 - Interconnection capacity



Source: ETSO and own calculation

Figure 4 Interconnection capacity compared to peak demand, 2008

Benchmarks

A second approach to setting targets for infrastructure is to establish a benchmark for delivery of priority projects. Such benchmarks could be used to track progress over time, and to help focus attention on implementation. The advantage to such approaches is that it focuses on timely delivery of existing plans, and that the objectives are set according to existing system planning methods rather than external calculations.

Two options for benchmarking include delivery of the Ten Year Network Development Plans or delivery of Projects of Common Interest. The TYNDP includes both internal and cross-border transmission, while the PCIs are limited to projects with a significant cross-border impact. The Projects of Common Interest are assessed and agreed by Regional Groups of MS governments, while the TYNDP is produced by the European Network of Transmission System Operators.

ENTSO-E already monitors progress of implementation of the Ten Year Network Development Plan and has noted that 37% of projects from the 2010 plan have faced delays or cancellation. However there is currently no European-level benchmark setting objectives on the proportion of projects to be delivered.

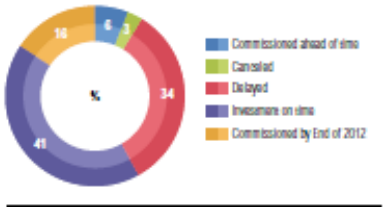


Figure 5: Progress on implementation of 2010 TYNDP

Flexibility

A final approach is to set targets relating to system flexibility. Such targets could be met through a combination of interconnection, demand response, storage and flexible generation. This approach would have the benefit of focusing on the capabilities of the system rather than capacities alone.

A number of methodologies have been developed for evaluating system flexibility. The IEA for example has developed the 'FAST' Flexibility Assessment method and associated indicators such as the FIX Flexibility Index and the PVP method for Potential Variable Renewables Penetration[5]. However such indicators are often complex and may be more difficult to communicate as a high level target.

A more basic metric would be to target the sum total of flexibility resources on the system including interconnection capacity, demand response and storage. This is a considerably

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[5] IEA 'Harnessing Variable Renewables' http://www.iea.org/publications/freepublications/publication/Harnessing_Variable_Renewables2011.pdf

blunter calculation as it does not take into account the different timeframes and characteristics of differing demand response and storage technologies; however it would also be much more straightforward to calculate.

4.2 Governance level

As well as metrics for calculating targets, decisions will also be needed on what the level of governance to which a target should apply. Options include EU, regional or national level.

This is a critical decision as it will determine who is ultimately tasked with delivery of a target and how accountability for outcomes can be assured.

Governance level		
EU	**Regional**	**National**
Europe-level objectives; Responsibility on EU institutions (incl. ENTSO-E, ACER, European Commission) to ensure delivery	Objectives set regionally, with responsibility on Regional Groups or other regional initiatives	Objectives apply nationally, with responsibility on member state governments, TSOs and/or regulators

EU level

Targets set at EU level can be used to reflect overall European objectives. They are most useful when the objective applies to the whole of the EU and can be delivered by European-level institutions such as the European Commission, ACER and ENTSO-E. Examples of European-level targets include the current (non-binding) objective for the EU to improve its energy efficiency by 20% by 2020.

The drawback of EU level targets is that they may overlook different national and regional circumstances. In addition, if targets are set at EU level alone and not made binding on member states, there may be a lack of clear delivery responsibilities. For this reason, targets set at European level are often accompanied by national targets determined through an effort sharing approach.

Regional level

A second possibility is to establish regional-level infrastructure targets. Regional market integration is often seen as a stepping stone to an integrated European market. Regional

approaches may offer the potential to access the gains from cross-border resource sharing while still being able to accommodate differing national contexts.

There are a number of regional level initiatives underway on infrastructure planning and market integration. These include the Regional Groups established under the 2013 Energy Infrastructure Regulation, the ENTSO-E system development regions, and the ACER Electricity Regional Initiatives. Each of these initiatives, however, has different borders, and in many cases a single country can be part of multiple regions. Regional institutions also currently tend to be relatively weak with less delivery capability than national or European level, and can also lack transparency and accountability.

Targets set at the regional level would act as a steer for the Regional Groups in determining projects of common interest and would also signal to project developers the objectives that each region seeks to achieve.

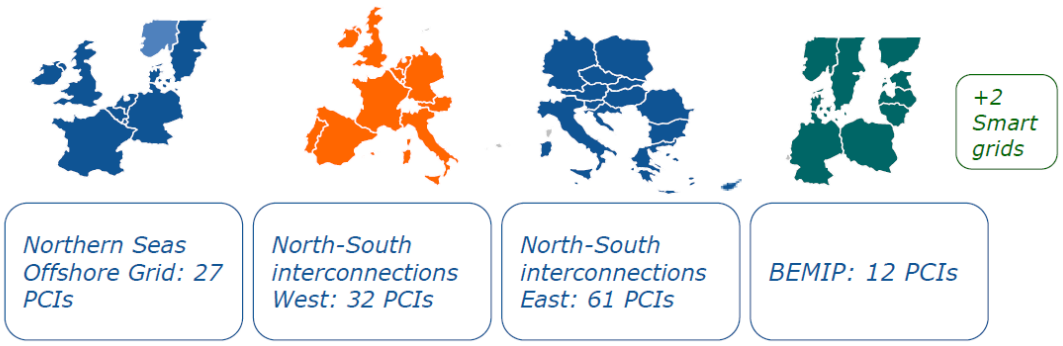

Figure 6: Regional Groups for electricity and numbers of PCIs

National level

Targets can also apply at a national level, either through having the same target for all countries (as is the case with the current interconnection target) or through differentiated targets for different countries (e.g. through an effort-sharing approach, such as those for renewables and non-ETS GHGs). Targets set at a national level can be binding on national governments, and can also act as public objectives to guide the approaches of TSOs and regulators.

The benefit of national targets is that there is clear delivery responsibility and established structures for implementation. National targets may however be harder to design for cross-border issues and may sometimes miss the opportunities associated with a regional or European approach.

5 High level options for target design

Combinations of the design choices mapped out above lead to a number of different options for infrastructure target design.

Metric	Governance level			
		European	**Regional**	**National**
	Capacity	*Option 2*	*Option 3*	*Option 1*
	Benchmark	*Option 4*		
	Flexibility			*Option 5*

Based on the choice dimensions set out in the previous section, five high level options representing different combinations of metrics and governance levels are set out below. These option are non-exhaustive (a number of other approaches would be possible) but represent a spread of different viable options for implementing new targets for infrastructure as part of the 2030 package.

Option 1: 'Ending market isolation'	
Target	Each member state should have a level of interconnection capacity of 20% compared to peak electricity demand by 2030
Objective	Ensure all countries are able to fully participate in the internal energy market.
Metric	Net transfer capacity as a proportion of peak electricity demand for each country.
Governance level	Calculated on a national basis.
Delivery mechanism	ENTSO-E, Regional Groups and the Commission should take target into account when designing the Ten Year Network Development Plan, selecting Projects of Common Interest and allocating
Strengths	A simple objective that builds on the model of the existing 10% target.
Challenges	A number of EU countries will not be directly affected as they already have considerably more than 20% interconnection capacity.
Comments	The 20% figure is in line with Power Perspectives 2030 analysis.

	An alternative approach would be to establish different target levels for 'core' and 'periphery' countries – for example 30% for countries with more than two electricity borders, and 20% for other countries. The metric could also be adjusted to take into account demand management and storage capacity.

Option 2: 'EU Market Objective'	
Target	Double total EU net transfer capacity between 2010 and 2030
Objective	Increase capacities for cross border trading across the EU
Metric	Overall available net transfer capacity on cross-border interconnections in Europe
Governance level	European objective supported by burden sharing – with national or regional allocations.
Delivery mechanism	Burden sharing mechanism could make the target incumbent on member states to deliver. The target could also be used to inform TYNDP and PCI list development and provide a shared objective for European infrastructure development policies.
Strengths	Simplicity and flexibility.
Challenges	There is a risk that some countries would remain isolated, depending on how overall target is allocated.
Comments	'Power Perspectives 2030' shows doubling of transmission capacity between nodes between 2010 and 2030 in its central 'On Track' scenario, and the suggested target of doubling NTC is based on this analysis. Cross-border NTC increased by 9% between 2008 and 2012[6], so the target would imply doubling this growth rate until 2030.

Option 3: 'Regional market'	
Target	Regional Groups to agree targets for increase in intra-region transfer capacity. For example, the North Seas regional group could establish a target to increase intra-regional interconnection capacity by 85% by 2030, or to increase interconnection as a proportion of generation

[6] ACER/CEER Market Monitoring Report 2013

	capacity in the region to 25% (in line with 'Power Perspectives 2030')
Objective	Catalyse the development of macro-regional energy markets as a stepping stone to a fully integrated European market
Metric	Metric to be determined by Regional Groups in reflection of regional objectives. Metrics could include increase in net transfer capacity within a region, or interconnection as proportion of generation capacity.
Governance level	Regional Groups agree and implement targets, including any burden sharing responsibility.
Delivery mechanism	Targets form objectives for regional groups and will steer PCI selection and financing. They could also be supported by regional interconnection strategies showing how countries will work together to meet the target objectives. Burden sharing mechanisms are also possible.
Strengths	This approach builds on the regional governance architecture established through the Energy Infrastructure Regulation, and so would align with existing delivery mechanisms
Challenges	Regions may overlap and so approach may be difficult for countries in multiple regions.
Comments	This target could be set in conjunction with a headline European target.

Option 4: 'EU Benchmark'	
Target	At least 80% of projects from the TYNDP 2014 should be delivered by 2025
Objective	Increase confidence that network plans and priority projects are delivered on a timely basis.
Metric	Fulfilment of TYNDPs within a particular timeframe.
Governance level	A European objective – but it should also be possible to evaluate member state performance or set objectives at other levels.
Delivery mechanism	Functions as an indicator that will help to steer future policy initiatives and financing mechanisms, and may also encourage regulators, governments and project developers to accelerate

	delivery.
Strengths	The target builds on existing grid planning structures and institutions; grid plans have been shown to be beneficial. Allows some flexibility if some projects face insurmountable obstacles.
Challenges	It is hard to determine what target level should be, as all projects within the TYNDP should already be cost effective.
Comments	Fulfilment of PCIs could also be used in place of TYNDP.

Option 5: 'System flexibility'	
Target	Each member state to achieve an agreed system flexibility standard (incorporating interconnection, demand response, storage and flexible generation).
Objective	Ensure infrastructure systems are sufficiently flexible to enable a rapid deployment of significant variable renewables.
Metric	Increase in overall flexibility resources (interconnection, responsible demand, storage).
Governance level	Standard to be established at European level but will apply nationally.
Delivery mechanism	Member states to produce national system flexibility strategies (similar to National Renewable Energy Action Plans) setting out how objective will be met.
Strengths	Equivalent treatment for interconnection, demand response, storage and flexible generation. Potential to be oriented towards the performance characteristics of future markets as well as capacity.
Challenges	Potentially complex or challenging to communicate. Attention needed to design of the metric.
Comments	Metrics require further elaboration.

5. Conclusions

The forthcoming 2030 European framework on energy and climate offers and important opportunity for reflection on how Europe's existing infrastructure targets and priorities can be updated to reflect the EU's long term goals on market integration, decarbonisation and renewables.

Targets are only ever part of the story. Additional structural measures will be required for a successful package that meets the objectives. These may include (inter alia): market design and system operation measures to ensure cross-border market access; attention to internal bottlenecks as well as cross-border capacity; financing and cost sharing arrangements for infrastructure development; and cooperation and accounting mechanisms for cross-border renewables trading.

Nevertheless, updated infrastructure targets may play an important role in articulating European objectives, driving policy development, facilitating forward planning and increasing accountability.

A number of viable designs are possible for setting a target for network infrastructure within the EU 2030 Energy and Climate Framework. Five headline approaches have been set out in this paper. Important choices will be needed on metrics and level of governance, and these will shape how the targets are framed and delivered. Ultimately, the target design selected will need to align with the priority objectives pursued.