



# Policy Instruments for Chinese Sustainable Future: Environmental Policy Integration and Strategic Environmental Assessment for the Energy and Transport Sectors

An Action under the  
European Union's Asia Pro Eco II Programme  
Project no. 122184

CHINA-EPI-SEA Paper No. 16

## Good practice principles for identification and assessment of alternatives in SEA

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TRL, UK, 2008

April 2008

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## Abbreviations

DfT	Department for Transport, UK
EC	European Commission
ECS	energy case study
EIA	environmental impact assessment
PPP	policies, plans and programmes
SEA	strategic environmental assessment
SSA	strategic siting assessment
TCS	transport case study

## 1. Introduction

‘Assessment of alternatives is at the heart of the SEA process’  
(Glasson et al, 2005)

### 1.1 Overview and structure

This paper is produced for the purpose of the CHINA-EPI-SEA project and provides a concise and up to date synthesis of the identification and assessment of alternatives in transport or energy policies, plans or programmes (PPPs) within Strategic Environmental Assessment (SEA). It is not meant to be an exhaustive analysis of all approaches to development of alternatives, but should help project team to identify, describe and analyze alternatives for the purpose of the Energy and Transport case studies.

Chapters 1 and 2 develop key concepts and definitions while Chapter 3 provides guidance on methods Chapter 4 considers approaches to assessment of alternatives using case studies from energy and transport plans. Finally, Chapter 5 concludes with a summary of the guiding principles.

### 1.2 Background

One of the weaknesses identified in project-level environmental impact assessment (EIA) was its inability to fully consider alternatives to a development, as strategic decisions on approach, location and development type had already been taken. For example, an EIA of a new road-X through a sensitive habitat can identify associated impacts and attempt to mitigate them at a local level. Whereas, an SEA of the plan containing the proposal to build road-X could have assessed alternative approaches that relocated the road to a less sensitive area, or avoided the need for the road in the first place.

Consideration of alternatives is a key element of SEA, just as it should be a key stage in the development of policies, plans and programmes (PPP). The feedback between PPP development and SEA centres on consideration of alternatives, to arrive at a preferred option that minimises adverse environmental effects and maximises opportunities for enhancement, as far as possible. However, in the UK alternative route selection is within EIA activities for highways.

Examining alternatives should help to ensure that the preferred PPP's likely significant environmental effects are highlighted and, where possible, addressed during the preparation of the plan. It also assists in explaining to decision-makers and stakeholders why a particular PPP approach is put forward and others rejected.

Last, but not least we have to say what is meant by alternatives in SEA. The EC Guidance on SEA Directive (EC, 2004) says that “an alternative can thus be a different way of fulfilling the objectives of the plan or programme”. Then the guidance provides example of alternatives, such as “for land use plans, or town and country planning plans, obvious alternatives are different uses of areas designated for specific activities or purposes, and alternative areas for such activities”.

The paper discusses the terminology (Chapter 2), provides methods of identification and development of alternatives (Chapter 3) and provides key guidance principles in identification and the assessment of alternatives in the focus sectors (Chapter 4). Some examples of alternatives in transport and energy sector planning are provided in the annex to the paper.

### 1.3. Benefits of identifying and assessing alternatives in SEA

#### More robust decision-making

Early assessment of appropriately-selected alternative approaches to a PPP broadens the evidence base for decision-making. This reduces the risk of unexpected issues arising during implementation of the PPP and causing expensive changes.

#### SEA effectiveness and legitimacy

Effectiveness of SEA can be judged by process and output criteria (McLauchlan and Joao, 2005). The consideration of alternatives relates to SEA process, in that a judgement can be made about the extent to which reasonable alternative PPP approaches were considered during the SEA.

Consideration of alternatives also concerns output, where the role of the SEA in the selection of the preferred alternative can be examined. Evidence of robust consideration of alternatives can be an indicator of SEA effectiveness and contribute to the legitimacy of a PPP development by demonstrating transparency, openness and clear justification for the decision.

#### Better environmental performance

Assessment of alternatives provides the decision-maker with details of the alternative with the best environmental performance.

#### Better intersectoral coordination

Discussing alternatives with administrations of other sectors, can bring the benefit of intersectoral coordination between different sectors of the economy and sustainability integration into planning. One should consider that some of the possible alternatives (at least at Plan level), might involve developments in sectors other than transport or energy (typical is land use planning, but also agriculture, industry...). Identifying alternatives can foster better intersectoral coordination.

## 2. Types of alternatives

Different levels of planning imply different sets of alternative approaches to a PPP. Additionally to the planning level, alternative setting is influenced by the sector development drivers identified in the process of planning. The UK Department for Transport (DfT) has developed a “hierarchy” of transport alternatives (TAG, 2004), which with some modification can be applied to the thinking and design of energy alternatives. These are set out in Table 2-1.

Table 2-1. Types of alternatives (adapted from TAG, 2004)

Level of decision	Definition/guiding questions	
	Energy	Transport
Need or demand	Is it necessary?	
	<ul style="list-style-type: none"> <li>• Is the demand necessary or it can be achieved by efficiency measures?</li> <li>• Can energy demand be more balanced/coordinated in time?</li> <li>• Can the demand be met without new energy infrastructure?</li> <li>• Can charges based on time modify and solve the demand issues? Peak pricing?</li> </ul>	<ul style="list-style-type: none"> <li>• Can the need or demand for accessibility be met without new development / infrastructure at all?</li> <li>• Can the need to travel be reduced?</li> <li>• Can toll or road tax make changes in the transport and road demand?</li> </ul>
Input and supply	Can we use what we have now?	
	<ul style="list-style-type: none"> <li>• What alternative energy sources exist?</li> <li>• What kind of mix of energy sources is the most efficient?</li> <li>• How long will we have the existing energy supplies for?</li> </ul>	<ul style="list-style-type: none"> <li>• What types of existing infrastructure can be enhanced rather than building new infrastructure?</li> </ul>
Mode or process	How should it be done?	
	<ul style="list-style-type: none"> <li>• Can renewable technologies meet the demand?</li> <li>• What cogeneration strategies can be employed?</li> <li>• Can hydro or waste derived energy be used?</li> <li>• What more effective energy generation technologies be applied in the field?</li> </ul>	<ul style="list-style-type: none"> <li>• Are there technologies or methods that can meet the need with less environmental / sustainability damage than 'obvious' or traditional methods?</li> <li>• Can public transport system modifications meet the demand?</li> <li>• Can access to multi-passenger transport (public transport) be increased?</li> </ul>
Location	Where should it go?	

Level of decision	Definition/guiding questions	
	Energy	Transport
	<ul style="list-style-type: none"> <li>• What are environmentally suitable locations for renewable energy and energy generated from waste?</li> </ul>	<ul style="list-style-type: none"> <li>• How does the scheme accommodate environmental management needs?</li> </ul>
Detail	Timing and detailed implementation	
	<ul style="list-style-type: none"> <li>• When should it be built to meet the demand?</li> <li>• What technology can meet the demand faster and be sustainable for long term generation?</li> <li>• Increased interconnection as a short term solution?</li> </ul>	<ul style="list-style-type: none"> <li>• When, and in what sequence, should developments be carried out?</li> </ul>

It is important to stress that the Table 2-1 assumes that sectoral strategies and objectives have been clearly identified. In energy sector the issue of optimal energy mix, which is mentioned in the table as one of those that should be looked at in identifying alternatives, could be considered as a basic element of objectives and strategies (e.g. decreasing dependency from specific fuel sources...).

For the transport sector the examples of alternatives can be further elaborated and more clearly identified in the rail and water transport sectors, which are considered more efficient and sustainable compared to road and especially air transport.

### 3. Introduction to methods of development and identification of alternatives

#### 3.1. PPP development and SEA stages

This sub-chapter provides information at which stage of PPP making alternatives are being developed and how SEA steps into the process. Table 3-1 summarises the relationship between PPP development and the environmental input within the SEA.

Table 3-1: Relationship between PPP development and SEA input on each stage of planning (adapted from Glasson et al, 2005, p342)

Strategic decision-making hierarchy in a PPP	Environmental input at each level (SEA)
Identify problem, determine aim and strategic objectives	Determine assessment objectives and indicators
Develop alternatives to achieve the purpose and strategic objectives	Identify alternatives in the PPP
Determine means by which objectives will be achieved. Choose between alternatives.	Predict and evaluate impacts of alternative strategic actions
Refine chosen alternative. Determine how it will be implemented	Mitigate environmental impacts of chosen action; include criteria for lower-level decisions.
Formal decision	(SEA report and consultation with the public)
Announcement of PPP	Information on SEA report and the PPP to the public
Implementation of PPP and monitoring	Establish environmental guidelines for monitoring and implementation.

The conclusion from this general table is that SEA is a process which identifies the outputs of the plan making process and provides additional information on the environmental effects of those outputs. SEA is not in charge of the development of alternatives, but it has to help planners to choose between the alternatives by enabling to identify the most environmentally sound one. The decision makers then can use SEA information when choosing based on information and justification provided by SEA.

#### 3.2. Developing alternatives

In discussion of alternatives in SEA, there is a fine distinction to be made between the development of alternatives and their description. This is important since this defines the roles of the planners and SEA in this important element. The process of alternatives development is the responsibility of the planner and not the environmental assessor. Environmental assessor though has to be able to identify and assess the alternatives provided in the PPP. European Union legislation on SEA, as well as the literature, state that the SEA process identifies, describes and

assesses alternatives (EC (2001), Art 5.1)<sup>1</sup>. The EC SEA Directive does not say that alternatives have to be elaborated during SEA. Planners are the experts of the sector and therefore are in the position to elaborate the alternatives if any for the purpose of selecting the best option. SEA experts are in the best position to provide justification for environmental effects of the alternatives developed.

For SEA to be effective, the development of reasonable alternatives involves commitment by planners to avoid being a token exercise by environmental assessors. Alternatives should be distinct and clear and provide sufficient information for SEA experts to make environmental judgement in terms of environmental impacts.

EC developed the Guidance on Implementation of EC SEA Directive (EC, 2004), which provides the following assistance on alternatives in SEA:

- 1) The EC SEA Directive asks to identify, describe and evaluate the likely significant environmental effects of reasonable alternatives (Art. 5 §1). This means that alternatives should not be artificially developed for the purpose to fulfil the requirement of the Directive to assess them, but that alternatives should be a part of planning process helping to choose and develop the best solutions for a given purpose. False, misleading or dubious alternatives should not be created just to feed the SEA process.
- 2) The same guidance (EC, 2004) points out that alternatives have to be realistic. Deliberate selection of alternatives that had more adverse effects than the preferred option is not appropriate.
- 3) Alternatives have to fall within the jurisdiction of the planning authority and be relevant. The EC guidance says that “alternatives must [...] fall within the legal and geographical competence of the authority concerned”.
- 4) The assessment of the alternatives is worthy only if SEA provides timely input into the planning. Alternatives as well as the overall assessment are “to ensure that the effects of implementing plans and programmes are taken into account during their preparation and before their adoption” (EC, 2005, page 26).
- 5) Alternatives described for SEA must be distinct to enable a meaningful assessment between them to be carried out (EC, 2004).

### 3.3. Dos and Don'ts to generating and assessing alternatives

Several authors have identified “does and don'ts” in dealing with alternatives (EC, 2004; EC, 2005; TAG, 2004; ODPM, 2005). Table below

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<sup>1</sup> “Where an environmental assessment is required under Article 3(1), an environmental report shall be prepared in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme, are **identified, described and evaluated**” (EC (2001), Art 5.1).



summarized the most important aspects of alternatives in PPPs and how they have to be treated during SEA from (CEP et al., 2006) paper.

Table 3-2. Dos and don'ts in generating alternatives

DOs	DON'Ts
<p>⊙ Do identify and document the essential strategic choices that need to be made as part of the PPP making process, and discuss alternatives approaches to dealing with these early on (i.e. identify the essential strategic choices that need to be made).</p>	<p>⊙ Make up alternatives just to satisfy SEA requirements.</p>
<p>⊙ Do propose alternative ways to (a) deliver the PPP's objectives and /or (b) deal with further issues /problems identified during the scoping stage.</p>	<p>⊙ Define PPP objectives so narrowly as to preclude reasonable alternatives.</p>
<p>⊙ Do include whatever details are available on the likely range of alternatives that will be considered when consulting on the scope of the assessment, so that stakeholders (including the public) can comment on them.</p>	<p>⊙ Leave the identification and assessment of alternatives too late in the assessment process.</p>
<p>⊙ Do recognise that there may be alternatives within the PPP (e.g. alternatives for housing, employment, transport etc).</p>	<p>⊙ Suggest only one high level PPP-wide alternative (e.g. the PPP is either socially, or environmentally, or economically orientated).</p>
<p>⊙ Do consider, where appropriate, different tiers of alternatives: broad alternatives (which provide the underlying strategy for the plan /programme) /topic alternatives /alternative sites. When considering detailed alternatives focus on those that are consistent with the underlying strategy (e.g. sites which are consistent with the broad alternatives).</p>	<p>⊙ Don't unnecessarily produce alternatives for every minor issue or every permutation of every option.</p>
<p>⊙ DO consider the alternatives hierarchy, by asking:                      (i) Is development necessary? If so,                      (ii) How should it be done? Then,                      (iii) Where should it go? And finally,                      (iv) Timing and detail of implementation                      For high level strategic plans/programmes, 'need' may be more important than for lower level plans/programmes where alternatives for 'type, location or implementation' may be addressed in more detail.</p>	<p>⊙ DON'T confuse mutually exclusive alternatives (e.g. build X v. don't build X) with mix-and-match alternatives (e.g. build X, build Y next door). The sustainability of the former needs to be compared and a preferred option selected; the latter need to be individually tested and potentially combined as a preferred option. If using both approaches for different topics make this clear to stakeholders. Each alternative should be reasonably distinct.</p>
<p>⊙ DO use alternatives to illustrate issues and tensions which should be addressed as the preferred options are refined (e.g. use an environmentally focused alternative to highlight economic implications and an economically focused alternative to highlight environmental implications). Use these to help</p>	<p>⊙ DON'T present extreme or unrealistic alternatives in order to support a preferred middle alternative (e.g. avoid alternatives for targets for affordable housing simply based on (a) market driven levels, (b) 35% of housing (preferred option), or (c) 100% of</p>

DOs	DON'Ts
prepare a preferred alternative for the plan or programme that combines the best sustainability outcomes.	housing).
☺ DO consider alternatives that may be politically controversial or that contradict higher-level policies if you can show that doing so would clearly lead to a more sustainable solution. Sustainable development involves pursuing new and innovative approaches to future development.	☹ DON'T suggest alternatives that are clearly unrealistic or infeasible (e.g. technically, financially). Stakeholders should be presented with genuine alternatives.
☺ DO describe how the alternatives have been developed and identify constraints to generating alternatives.	☹ DON'T ... just accept constraints on alternatives as a given. Question how much room for manoeuvre there may be.
☺ DO proactively engage with the community and stakeholders (including those from neighbouring authorities) in generating and developing alternatives and be willing to consider new alternatives as they emerge through the plan/programme-making process.	☹ DON'T treat consultation as a public vote on which of the alternatives should be taken forward. The community is relying on decision makers to make informed decisions, taking into account community views as well as the full range of sustainability considerations.
☺ DO inform decision makers, including elected members, of the requirement to appraise the alternatives considered.	☹ DON'T just assume decision makers know or understand what is meant by alternatives.

### 3.4. Introduction to alternatives and tiering

Because of the variations in planning systems in different sectors, the feasible alternatives considered in decision-making may also vary. At any level of planning, the following options in transport sector may be available to reduce environmental impacts (adapted from EC, 1999):

- the infrastructure capacity and traffic in different corridors;
- the relationships between different corridors and different modes (see transport case study 1 (Note: please, look for case studies in the annex));
- the transport mode (road, rail, air, water, pipeline);
- the location and its sensitivity;
- the design, construction methods and measures to mitigate adverse environmental, social and health impacts for individual transport infrastructure projects;
- through clearly set environmental objective and identified strategic goals aimed towards sustainability and environmental integration (transport case study 2);
- by addressing transport issues in a sustainable manner (e.g. social – health and safety, economic – congestion issues and leisure travel; and environmental – air quality and climate change (transport case study 3).

For energy sectors the considerations include:

- energy demand and the areas of the biggest energy uptake (see energy case study 3);
- fluctuation of energy consumption;
- availability and sustainability of existing conventional energy resources (see case energy case study 4);
- availability and sustainability of renewable energy resources, sensitivity of location of those resources and remoteness from energy demand areas (potential of production of energy/fuel, which is more transportable);
- availability of energy distribution networks;
- the design, construction methods and measures to mitigate adverse environmental, social and health impacts for energy production projects (e.g. nuclear, coal, gas, hydrogen, wind, solar energy) (see energy case studies 1 and 2)

Other sector plans and programmes influence both transport and energy infrastructure planning. Examples are spatial planning PPPs, natural conservation plans, and climate change or sustainable development plans and programmes. These PPPs should themselves be subject to SEA wherever possible. Energy and transport PPPs should take into account general environmental and sustainability objectives.

### 3.5. Tiering and transport

Tiering is about how the different levels of planning within on sector relate to each other (J. Arts et al., 2005). Some sectors such as housing, transport, water management, waste management, spatial planning have multiple levels of planning based on planning traditions, administrative management systems and geography. Energy sector has fewer planning levels and spatial dimensions, though here one can distinguish energy tiering based on the source of energy (i.e. geography of the sector). Another reason for rarity of tiering in energy sector is its ownership (often it is a private but not public owned) as well as transferability of the product through long distances. A classic example of tiering application to planning is transport sector, which is discussed below.

#### Transport networks

Transport infrastructure plans at a network level often determine the corridors in which the improvement of the transport infrastructure is necessary, and they often also determine which mode is to be employed (there may be only one option) (EC, 1999). The planner (for example, a road administration) may not have competence with respect to other transport modes, in which case multi-modal issues may be considered at higher tiers. Another solution for multi-modal planning is integrated spatial urban, rural or regional planning, where integration is of the land use and transport planning actions. They are very important in offering environmentally friendly alternatives. Typical issues at the transport network level are:

- In which corridors does further development have the highest priority?
- Which corridors are functionally linked, and should be considered together?

- Which corridors have environmental risks that need special attention?
- What political provisions are necessary in relation to infrastructure proposals?

### Transport corridors

Decisions at corridor level involve consideration of alternative transport modes (if they are not foreclosed by plans at network level) and the major corridor alternatives. The corridor assessment may be limited to determining the indicative route of the proposed infrastructure. Typical issues at corridor level are (EC, 1999):

- Can objectives be met by demand management or redistributing traffic?
- Would it be sufficient to upgrade existing infrastructure, or is a new route unavoidable?
- Broadly, what routing options are available? Are there ways to avoid sensitive sites (e.g. with tunnels)?
- Are there specific options which encourage the use of environmentally friendly modes in the corridor?
- Can the environmental conditions which may have been set at previous tiers be met? Can remaining impacts be mitigated, e.g. by habitat compensation?

### 3.6. Tiering and indicators

Different indicators for comparing alternatives at different tiers can be used depending on the decision level. The table below provides an example of indicators, which can be used, which have been identified based on their sensitivity to different impacts as well as alternative level.

Table 3-3. Examples of indicators for comparing alternatives

Impact	Types of alternatives for which the indicator is sensitive		
	Construction methods, design, detailed alignment	Indicative routing or siting	Modal alternatives
Resource depletion/waste	Resource intensity	- resource intensity - energy use (if modes are compared)	- resource intensity - energy use
Climate change	Not sensitive to project adjustments	In cases where significant differences in route length arise) - emission of CO <sub>2</sub> - vehicle kilometres	- emission of CO <sub>2</sub> - vehicle kilometres by vehicle type -modal share in passenger kilometres and tonne kilometres -congestion -fuel consumption
Acidification	Not sensitive for project adjustments	In cases where significant differences in route length arise)	-emission of SO <sub>2</sub> and NOx -vehicle kilometres by vehicle

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Impact	Types of alternatives for which the indicator is sensitive		
	Construction methods, design, detailed alignment	Indicative routing or siting	Modal alternatives
		<ul style="list-style-type: none"> <li>- emission of NOx or SO<sub>2</sub></li> <li>- vehicle kilometres.</li> </ul>	<ul style="list-style-type: none"> <li>type</li> <li>-modal share in passenger kilometres and tonne kilometres</li> <li>-congestion</li> </ul>
Local air pollution	Exposure of the population to above standard pollutant concentrations	Exposure of the population to above standard pollutant concentrations	<ul style="list-style-type: none"> <li>-emission of pollutants</li> <li>-likelihood that a large number of people will be affected</li> <li>-congestion</li> </ul>
Photochemical smog	Not sensitive for project adjustments	<p>In cases where significant differences in route length arise)</p> <ul style="list-style-type: none"> <li>- emission of NOx or SO<sub>2</sub></li> </ul>	<ul style="list-style-type: none"> <li>-modal share in passenger kilometres and tonne-kilometres</li> <li>-vehicle kilometres</li> <li>-emission of NOx and hydrocarbons</li> </ul>
Biodiversity	Land take and fragmentation of ecologically sensitive sites	Land take and fragmentation of ecologically sensitive sites	<ul style="list-style-type: none"> <li>-length of infrastructure</li> <li>-land take and land fragmentation of ecologically sensitive areas</li> <li>-distance from ecologically sensitive areas</li> <li>-risk of affecting key species populations</li> </ul>
Landscape	Land take, visual and other impacts on character of valued landscape areas	Land take, visual and other impacts on character of valued landscape areas	Land take, visual and other impacts on character of valued landscape areas
Noise/tranquillity	Exposure of the population to above standard noise level	Exposure of the population to above standard noise level-area affected by noise above a certain level	<ul style="list-style-type: none"> <li>-vehicle type and speed</li> <li>-vehicle kilometres</li> <li>-likelihood that a large number of people or tranquil areas will be affected</li> </ul>
Land take/proximity	Land take in, or in proximity to, different categories of land (including heritage areas)	<ul style="list-style-type: none"> <li>-land take in different categories of land</li> <li>-distance from sensitive areas</li> </ul>	Total land take per category
Impacts on water	Distance from sensitive sites	Distance from sensitive areas	Distance from sensitive sites
Accidents	Number of accidents	Number of accidents or	Number of accidents or

Impact	Types of alternatives for which the indicator is sensitive		
	Construction methods, design, detailed alignment	Indicative routing or siting	Modal alternatives
	or casualties Environmental damage caused by accidents	casualties Environmental damage caused by accidents	casualties Environmental damage caused by accidents

Source: A. Ricci, adapted from EC (2005)

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## 4. Guiding principles

The guiding principles and recommendations for identification of alternatives are:

- Alternatives are set by planners, not by the SEA practitioners.
- SEA contributes to the effectiveness of the decision-making process by facilitating the selection of a strategic alternative;
- For both energy and transport, demand forecasts are crucial in resolving the problem description adequately and therefore as a basis for developing alternatives;
- Consultation can assist in identifying alternatives – include stakeholders, public;
- Look for different ways of achieving the strategic objective. This should include the alternative of avoiding development (look at reducing demand rather than meeting demand) – i.e. include behavioural alternatives or alternative actions in other sectors;
- Alternatives need to be realistic, reasonable and relevant. They need to be distinct to allow meaningful assessment between them;
- In setting alternatives, where possible and feasible, establish intersectoral coordination for the establishing and assessing alternatives. Some of the possible alternatives (at least at Plan level), might involve developments in sectors other than transport or energy (typical is land use planning, but also agriculture, industry...).

The guiding principles and recommendations for the assessment of alternatives:

- Consider “do nothing” or baseline alternatives alongside alternative futures – i.e. ‘do nothing’ and ‘business as usual’ alongside ‘do something’;
- The best alternative may not be ‘either /or’ but a combination that takes elements of more than one alternative;
- SEA may be only one of a series of assessments of a policy, plan or programme. Other assessments may evaluate social, economic, technical issues and thus the sequence of the assessments should not prejudice other assessment otherwise, for example, initial economic or technical assessment may first reject environmentally preferable alternatives;
- Use of a series of topic-based indicators to assess alternatives. Core issues in relation to transport schemes will be severance, noise, biodiversity, visual impact, land take and the effects of harmful emissions on air /water /soils /flora /fauna.

For a transport plan a “do nothing” alternative certain principles from (TAG, 2004) could be considered:

- Is based on current Government policies;
- Assumes that other adopted PPPs will deliver as planned - establishing the implications for the plan being developed is a source of uncertainty;
- Assume continued implementation of strategies and measures planned in the previous plan, unless time limited (for example, a measure planned to be implemented for five years should not be assumed to be implemented beyond the planned five year period);

- Do not assume any new strategies or measures. For example, enhanced public transport provision to complement a planned new hospital should not be included in the “do nothing” scenario. These should be included in other alternatives being considered.



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## Annex: Alternatives assessment case studies

### A.1. Energy sector

Alternatives in energy sector are dealt with on the highest strategic decision making level (governmental level), since the investments needed for energy production are large (at least with conventional energy generation sources such as coal and gas).

Below there are four energy case studies presented for the purpose of the demonstration of alternatives in the sector. The first energy case study (ECS) demonstrates the highest level decision (national government) making tier and shows alternatives for nuclear power energy and siting of possible nuclear power plans in the UK. It provides a range of alternatives that are compared both for environmental and sustainability effects. The ECS-2 is on the development and investment into the reviewable energy and alternative use programme in the US, while the third ECS is on the national policy of energy development in the Czech Republic. The fourth ECS presents alternatives within a national Energy Development Strategy and provides an example of alternatives with different investment and construction scope (i.e. generating more energy and needing more investment vs. less energy and less investment).

The case studies demonstrate variety of issues including renewable energy (ECS-2), nuclear power (ECS-1) as well as issues such as siting (ECS-1), energy sources (ECS-3) and energy generation capacities (ECS-3 and ECS-4). ECS 1 and 2 also demonstrate how to establish alternatives rather than alternatives' assessments.

#### Energy Case Study 1: National Policy Statement for the New Nuclear Power (UK) (BERR, 2008)

Alternatives identified for the purpose of the SEA of the National Policy Statement for the New Nuclear Power and analysed in the Environmental (SEA) Report are presented below. The alternatives were described in the National Policy Statement (BERR, 2008). The case example suggests alternatives within and Energy related strategic document as follow:

- The no National Policy Statement scenario;
- Publish a National Policy Statement that includes Strategic Siting Assessment (SSA) criteria only and does not invite site nominations or include a list of potential sites for new nuclear power stations;
- Publish a National Policy Statement that only identifies sites from a nominations process that does not use criteria;
- Publish a National Policy Statement that includes SSA criteria and includes a list of sites that meet the criteria;
- Publish a National Policy Statement that defines criteria which are used to assess the existing nuclear power station sites as potential locations for new nuclear power stations.

Above case study demonstrates that alternatives for energy sector can include "no action" alternative (1<sup>st</sup> alternative). There are alternatives developed and proposed for consideration by the planner combining siting proposal as well as list of criteria for choosing future nuclear energy potential sites.

### Energy Case Study 2: Renewable Energy and Alternate Use Programme (USA) (Argonne, 2007)

The US Department of Interior is responsible for the development of the Renewable Energy and Alternate Use Program for the U.S. Outer Continental Shelf (OCS) through wind, wave, and ocean current energy. The Environmental Assessment considered the following alternatives:

- the proposed action "alternative": development of a program and regulations governing activities related to granting of a lease, easement, or right-of way for production of alternative energy on the OCS; and regulations for alternate use of existing oil and gas facilities on the OCS;
- a case-by-case alternative: no program or regulations related to granting of a lease, easement, or right-of way for production of alternative energy on the OCS and for the use of existing facilities; however, the above mentioned actions would occur and would be assessed on a case-by-case basis; and,
- a no action alternative: no program or regulations on granting of a lease, easement, or right-of way for production of alternative energy on the OCS and for the use of existing facilities, including no development of an alternative energy facility on the federal OCS and no alternate use of existing offshore facilities.

The above ECS-2 demonstrates how to identify alternatives in the energy sectors for the programme to deal with alternative-energy projects and applications.

### Energy Case Study 3: Energy Policy of the Czech Republic (Dalal-Clayton et al., 2005)

The following three basic alternatives, each of which meets the following presumptions, have been identified and assessed in the case of Energy Policy of the Czech Republic (2005):

- Annual GDP growth is 2-4%;
- Energy demand of the economy (expressed by index of primary energy sources per GDP unit) steadily decreases;
- The Czech Republic meets all international obligations, including Kyoto targets;
- All alternatives are fully aligned with EU legislation.

Alternative A suggests development of energy sector which is based on locally available sources of fossil fuels (black and brown coal). Previously established limits of coal mining are not enforced and economic burden of current energy process does not increase (i.e. there is no further internalising of external environmental costs, carbon tax and energy tax are not introduced). Use of primary energy sources will slightly increase. Growth of energy use is higher than growth of primary energy sources. Both blocks of the second nuclear power plant will be finalised by 2004-2005.

Alternative B suggests development of energy sector based on locally available sources of fossil fuels, yet previously established limits of coal mining are enforced. This is compensated by import of electricity and gas. Energy prices will be probably higher than those under Alternative A – this will trigger changes in structure of existing energy sources. There will be more use of energy saving schemes and alternative energy sources will increase. Growing use of cogeneration units will further support of growth in gas importation. Use of primary energy sources will not increase. Energy use may slightly increase. Both

units of the second nuclear power plant will be finalised by 2005.

Alternative C suggests energy savings schemes (including increased efficiency in energy use) and rapid increase of alternative energy sources. Increased efficiency in energy use and energy savings schemes are supported by stimulation of business dealing with energy savings, by targeted state actions (.e.g. major energy savings in state-own facilities, funding and technical assistance programmes for technological changes in private enterprises). The target is to reduce use of primary energy sources by 1,5% annually, i.e. by 16% by 2010. Energy use will decrease. The following alternative energy sources will grow: biomass (by maximum of 90 PJ (petajoule (PJ =  $10^{15}$  J)), small water plants (by 4 PJ), wind (up to 5 PJ), solar collectors (by 3 PJ) and there will be limited use of photovoltaic cells. Energy prices increasingly internalise external environmental costs – this leads growing use of cogeneration units. Second nuclear power plant will not be constructed. Previously established limits of coal mining are enforced.

#### Energy Case Study 4: SEA of the Montenegro draft Energy Development Strategy (EDS)

The draft Energy Development Strategy aimed to set out objectives for the direction of Montenegro's energy supply to 2025. Following analysis of the energy supply potential from all different sources, a series of alternatives for the strategy were developed based on a combination of energy related measures and supply sources. These were as follows:

- Do Nothing: Continuation of existing trends, no development of thermal or hydroelectric power plants and no government intervention in the energy market.
- Moderate Construction (N2): Series of energy supply sources with a principal focus on the construction of new electricity generation facilities in the form of hydroelectric and thermal plants.
- Limited Construction (N1): As N2 with fewer new hydroelectric plants.
- Expanded Limited Construction A: As N1 with upgraded hydroelectric plants
- Expanded Limited Construction A+B: As N1 with additionally upgraded thermal and hydroelectric plants
- Enhanced Limited Construction C: As N1 with greater focus on renewables.

The assessment was based on the approach suggested by the OECD (2006) in development cooperation and therefore considered the full range of sustainability issues.

The major finding of the SEA was that Montenegro may be able to meet its future energy needs without the construction of large new hydroelectric schemes, which were predicted to have significant biodiversity impacts.

The case studies presented above demonstrate alternatives setting in Energy sector and should provide good practice examples for application in Chinese context. More articles on energy cases studies can be found at:

<http://sea.unu.edu/wiki/index.php/Category:Energy>

## A.2. Transport sector

Transport planning as it was already mentioned above can take place on different levels and at level of alternatives are being proposed and evaluated. Two transport case studies presented below demonstrate alternatives on local level transport planning in the UK and at the national level through Scotland's National Transport strategy.

The first case study (TCS) is the North Somerset Local Transport Plan (LTP) in which alternatives were derived from the Regional Transport Strategy, the Provisional LTP, the transport plan for the Avon area 1994- 2013, the Joint Replacement Structure Plan for the former Avon area and the public participation and consultation process (NSC, 2000). Most of the alternatives were considered on a corridor basis to address the strategic movements in North Somerset. Some alternatives have been identified for further study and some were rejected. Alternatives discussed in the TCS-1 involve multiple options to the improvement of infrastructure, modal alternatives and improvements of individual infrastructure types (see more in the section 3.3).

The Scotland's National Transport strategy does not have clear alternatives and thus the case study describes the approach without alternatives given the need to comply with the SEA regulations to reasonable alternatives assessed.

The third transport case study presents alternatives in the Devon Local Transport Plan. It shortly demonstrates the logic behind 4 alternatives identified for the purpose of planning and assessment. TCS-3 is an example on the local level where for each alternative has a focus on different aspects of suitability, such as alternative A is focused on transport and roads as economic driver, alternative B is looking at transport from health and environment prospective and alternative C is driven by social and economic aspects.

### Transport Case Study 1: Weston-Super-Mare/Bristol corridor within the North Somerset LTP (from NSC, 2000)

#### A38/ A370 Link Road alternative

The A38/ A370 link road would improve access to Bristol International Airport from Bristol and the M5. It would also provide relief to Winterstoke Road in Bristol and Barrow Gurney. Its construction would enable bus priority measures along A38 in Bristol to be introduced. Previously, independent consultants recommended that Bristol City Council and Bristol International Airport develops and pays for the scheme as most of the benefits accrue to them.

#### New Road linking M5 junction 21 with A38 and Bristol International Airport

A new road linking the M5 at junction 21 with the A38 would improve access to Bristol International Airport. However this would have major environmental impact and generate significant increases in car use and worsen congestion at existing pinch points i.e. Junction 21 of the M5.

#### Improved Bus Services to Bristol International Airport

A number of options have been identified:



- Further enhance BIA to Bristol City Centre services;
- Improve existing local Weston-super-Mare/ Bristol International Airport/ Bristol services; and
- Introduce Weston-super-Mare to Bristol International Airport express bus service. This could continue to Bristol.

#### Improvements to Railway

a Improve basic infrastructure i.e. small improvements to physical environment and better information etc;

b Major upgrade of stations: These were suggested frequently in the participation exercises

c. Provide 20-minute clockface service between Westonsuper-Mare and Yate at peak times and a 30-minute service during the off-peak. Would require significant improvements to track and signalling infrastructure; and

d Open new stations at Flax Bourton or Long Ashton or Ashton Vale.

#### Significant bus priority measures along A370

Discussions with the principal public transport operator in North Somerset (First Badgerline) identified bus priority measures along the A370 as an option for the LTP. In particular, they suggested that one of the lanes along the entire length of the Long Ashton bypass be used as a bus lane. While the benefits to bus users would be considerable, it is considered that the impact of this option on other road users would be unacceptable with very significant increases in congestion and queuing and consequently reductions in local air quality and possible rat-running on other local roads. Comprehensive improvements to bus infrastructure are also planned.

Park and Ride at St George's to serve Weston-super-Mare and Bristol  
A bus-based Park and Ride has been suggested at St. George's to serve Weston-super-Mare and Bristol. This has been rejected in the North Somerset parking study, as there is insufficient demand into Weston-super-Mare to support such a service without very significant levels of revenue support. A service to Bristol is unlikely to be attractive to car drivers from this location. Hence, this option is rejected for the LTP. However, it is recognised that an informal service may be attractive to a few car drivers and mechanisms to facilitate this, either at this location or elsewhere in North Somerset will be considered.

#### National Cycle Network

Two alternative routes were considered for the National Cycle Network in North Somerset. One route connected Weston-super-Mare with Bristol via Backwell. In discussion with Sustrans it was decided not to include this route as part of the National Cycle Network because of its relative state of readiness. However, a route from Backwell to Bristol is included in the LTP so as to improve the link to and between the intermediate villages and provide opportunities for cycle commuting.

For more details, please, check the reference<sup>2</sup>.

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<sup>2</sup> [http://www.n-somerset.gov.uk/NR/ronlyres/536792E0-2C2E-4974-BCC0-BC660D864AA2/0/plan\\_LocalTransportPlanJuly2000.pdf](http://www.n-somerset.gov.uk/NR/ronlyres/536792E0-2C2E-4974-BCC0-BC660D864AA2/0/plan_LocalTransportPlanJuly2000.pdf)

## Transport Case Study 2: Scotland's National Transport Strategy (2006)<sup>3</sup>

An SEA of Scotland's National Transport Strategy (NTS) was undertaken in 2006. As a high level policy document the NTS did not decide on new infrastructure, but rather provided a framework of principles and priorities for lower-level planning papers. The NTS would have fallen outside the scope of the SEA Directive, however the Scottish Government applies SEA to 'Strategies', which are above plans and programmes in the decision-making hierarchy.

Although the NTS did not explicitly identify alternative policy options, an assessment of alternative policy objectives was undertaken. The approach involved disaggregating overall policy objectives into a series of elements that described different and occasionally conflicting strategy goals. Overarching objectives, strategy goals and constituent elements of the strategy goals were then subjected to SEA and presented in the context of a consultation paper on the NTS.

Overarching policy objectives:

- Promote economic growth;
- Promote social inclusion;
- Protect the environment and improve health;
- Improve safety of journeys; and
- Improve integration.

Strategy goals:

- Facilitate economic growth;
- Promote accessibility;
- Promote choice and raise awareness of the need for change;
- Promote modal shift;
- Promote new technologies;
- Manage demand;
- Reduce the need for travel; and
- Promote road safety.

SEA of each of these elements of the overall strategy revealed a range of environmental (and social) impacts. The approach allowed decision-makers, and consultees, to better understand the balance of impacts between the different facets of the draft NTS and thereby to provide higher quality input into its subsequent development.

This approach highlights the point made in the guiding principles that the 'best' alternative may not be exclusive, but may in fact combine the best features of a series of alternatives.

The above case represents an example of transport plan, which consists of a range of objectives which have been assessed for their compatibility with environmental and sustainability objectives at the national level. Here alternatives are alternative ways of formulation of the sector objectives, strategy goals and constituent elements, which is an output of the SEA process.

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<sup>3</sup> <http://www.scotland.gov.uk/Topics/Transport/NTS/WiderAssessments>



More articles on transport and cases studies can be found at:  
<http://sea.unu.edu/wiki/index.php/Category:Transport>.

Transport case study 3: the Devon Local Transport Plan (DLTP)

National policies	New	Alternative B: national priorities applied at regional level	Alternative C = Alternative B + regional priority options  Alternative D= Alternative C with more funding
	Old	Alternative A: no Plan	
		Old	New
Regional policies			

- Alternative A (baseline scenario)
  - Improvements to the strategic road network
  - Rail network investment
  - Investment in public transport infrastructure
  - Investment in airport facilities
  - Improvement in the national cycle network
  - Road maintenance
- Alternative B (applying national priorities at the County level): more emphasis on
  - Congestion
  - Road safety
  - Accessibility
  - Air quality and climate change
- Alternative C (incorporating regional priorities): additional emphasis on:
  - Health and wellbeing
  - Liveability
  - Economy, leisure and tourism
- Alternative D: enhanced Alternative C

Source: A. Ricci, adapted from Devon County Council - Scoping Report (November 2004 )

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How to cite this CHINA-EPI -SEA Paper:

Jurkeviciute, A et al., (2008) Good Practice Principles for Identification and assessment of alternatives in SEA, Paper No. 16, TRL Ltd.