Decision making criteria in adopting renewable energies in the built environment.

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DECISION MAKING CRITERIA IN ADOPTING RENEWABLE ENERGIES IN THE BUILT ENVIRONMENT

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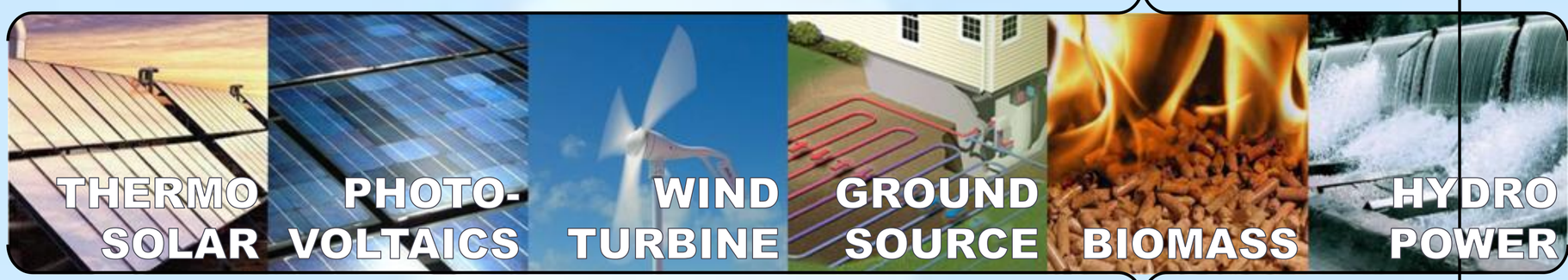
START
Question: Which system is the **most suitable and cost effective?**



1. OCCUPANT'S NEEDS

Energy demand
The best system for a particular property is strongly linked to the occupiers. User's energy needs vary depending on type and size of building they occupy.
A deeper analysis of the heating and electricity demand should include detailed assessment of activities carried out in the building.

DEGREE OF SUITABILITY TO OCCUPANTS' NEEDS

		SOLAR	PV	WIND	GSHP	BIOMASS	HYDRO
RESIDENTIAL Small family	Space Heating	Low	Low*	Low*	High	High	Medium*
	Hot Water	High	Medium*	Medium*	High	High	Medium*
	Electricity		High	High			High
RESIDENTIAL Large family	Space Heating	Low	Low*	Low*	High	High	Medium*
	Hot Water	Medium	Low*	Low*	High	High	Medium*
	Electricity		Medium	Medium			High
COMMERCIAL Buildings	Space Heating	Very Low	Very Low*	Very Low*	High	Low	Low*
	Hot Water	Medium	Medium*	Low*	High	Medium	Medium*
	Electricity		Medium	Medium			High
EDUCATIONAL Buildings	Space Heating	Very Low	Very Low*	Very Low*	High	Medium	Low*
	Hot Water	High	Low*	Low*	High	High	Medium*
	Electricity		Medium	Medium			High

*Only where space heating and domestic hot water systems are electric

Q1. Does the technology meet the occupants' needs ?

NO → New solution

YES

2. SITE CONDITIONS

Physical constraints
Physical constraints due to the site's characteristics will determine the viability of the different technologies.
A complete assessment will require a detailed evaluation of location and orientation of the buildings and the potential obstacles that might reduce the solar radiation or wind speed.
The assessment should also include the evaluation of the visual, sound and environmental impact.

REQUIRED SITE CHARACTERISTICS

		SOLAR	PV	WIND	GSHP	BIOMASS	HYDRO
SUN	Direct access	**YES**/NO	**YES**/NO				
	Radiation	**OK**/NO	**OK**/NO				
WIND	Direct access			**YES**/NO			
	Speed			**OK**/NO			
WATER	Access						**YES**/NO
	Flow						**OK**/NO
	Head						**OK**/NO
GROUND	Access				**YES**/NO		
	Depth				**OK**/NO		
VISUAL IMPACT		**OK**/NO	**OK**/NO	**OK**/NO			**OK**/NO
SOUND IMPACT				**OK**/NO			
ENVIRONMENTAL IMPACT					**OK**/NO		**OK**/NO

Q2. Is the technology compatible with the site conditions ?

NO → New solution

YES

3. TECHNICAL FEASIBILITY

Installation restrictions
The chosen solution should be compatible with the building typology, structure, fabric and type of roof.
Moreover, some microgeneration technologies can work well even if a property has relatively low insulation and air tightness levels while others will not.
When installing new systems in existing buildings, care must be taken to avoid damage or excessive loss particularly where the materials are fragile.

TECHNICAL SOLUTION FEASIBILITY

		SOLAR	PV	WIND	GSHP	BIOMASS	HYDRO
COMPULSORY PERMISSIONS	Planning	**YES**/NO	**YES**/NO	NEEDED	**YES**/NO	**YES**/NO	NEEDED
	Warrant	**YES**/NO	**YES**/NO	NEEDED	**YES**/NO	**YES**/NO	NEEDED
	Listed building	NEEDED	NEEDED	NEEDED	**YES**/NO	NEEDED	NEEDED
	Other	Other(1)	Other(1)	RSPB(2)	SEPA(3)	AQMA(4)	SEPA(3)
ROOM FOR INSTALLATION	System	Low	Low	High	High	Medium	High
	Storage	Medium	Low	Low	Medium	High	Low
BUILDING APPRAISAL	Roof	**OK**/NO	**OK**/NO	**OK**/NO			
	Structure	**OK**/NO	**OK**/NO	**OK**/NO			
	Insulation				**OK**/NO	**OK**/NO	
	Air tightness				**OK**/NO	**OK**/NO	
FUEL SUPPLY					**YES**/NO	**YES**/NO	

(1) If panels are installed on a shared roof, neighbours must be notified; (2) Royal Society for the Protection of Birds; (3) Scottish Environment Protection Agency; (4) Air Quality Management Areas

Q3. Is the solution technically compatible with the building ?

NO → New solution

YES

4. COST EFFECTIVENESS

Economic assessment
The financial viability of a renewable energy system depend not only on the efficiency of the technology, but also on the available budget, the maintenance costs or the estimated lifespan.
To evaluate the effectiveness of any system would be necessary to include both the grants funding and the feed-in tariff available for each system.

COST EFFECTIVENESS

		SOLAR	PV	WIND	GSHP	BIOMASS	HYDRO
COSTS	Installation	Low	Medium	Medium	High	Medium	High
	Maintenance	Low	Low	Medium	Low	Low	Low
	Running	Very Low	Very Low	Very Low	Low	Medium	Very Low
PREDICTABILITY		Moderate	Moderate	Poor	Excellent	Excellent	Good
CORRELATION WITH DEMAND	Space Heating	Moderate	Moderate	Poor	Good	Good	Good
	Hot Water	Moderate	Moderate	Moderate	Good	Good	Good
	Electricity		Poor	Good			Good
ENERGY STORAGE		Moderate	Poor	Poor	Moderate	Good	Poor
FUNDING (Grants and/or loans)*		**YES**/NO	**YES**/NO	**YES**/NO	**YES**/NO	**YES**/NO	**YES**/NO
FEED-IN TARIFF			**YES**/NO	**YES**/NO			**YES**/NO
LIFESPAN		25 years	25 years	20 years	20 years	15 years	50 years

*Grants and loans may vary dependent on size, location, type of building, etc.

Q2. Is the solution cost-effective ?

NO → New solution

YES

Hybrid solutions
Technologies could be mixed to achieve better results.
Combining different renewable systems allow to ensure the generation during the whole year and the energy mix necessary to satisfy all types of demand.

OUTCOME
Solution: A suitable and cost effective system **according to the specific needs and conditions**