BROAD AIR CONDITIONING

District Air Con Proposal

Type	Objective	Primary Energy	Facilities Matching	Operation Mode and Function	Main advantages	Disadvantages or Limitations	Energy Efficiency	Investment Ratio
1. natural gas CHP*	vast energy-saving	natural gas	1. turbine 2. exhaust non-electric air con	• the generator supplies electricity to buildings or grid • air conditioning system provides cooling/heating utilizing exhaust from power generation	no fuel for cooling/ heating	Power generation and cooling must be simultaneous; if only electricity is needed, the exhaust will not be utilized; if electricity is not needed, there is no energy source for air conditioning.	power generation: about 33%,cooling: about 64% (exhaust volume 67% x utilization ratio 0.7 x cooling efficiency 137%=64%)	3
2. CHP with backup fuel	vast energy saving & supplying electricity, cooling/ heating separately	natural gas	1. turbine 2. exhaust & gas non-electric air con	• the generator supplies electricity to buildings or grid • air conditioning system provides cooling /heating utilizing exhaust from power generation • when the generator is off, natural gas can be used for cooling /heating	no fuel is needed when the generator runs at full load; cooling/heating available when the generator is off or runs at low load	high investment and maintenance cost	power generation: about 33%, cooling: about 64% (cooling by natural gas only: 134%)	3.5
3. solar air conditioning	no fuel input	solar, natural gas as backup	1. parabolic trough solar collector 2. hot water non-electric air con	• solar collector produces hot water at 180°C • gas fired non-electric air con provides cooling / heating utilizing solar energy on sunny days and natural gas on rainy days and at night	low operational cost; most environmental friendly (although the field coverage of solar collectors is large, house or car park can be built beneath it)	field coverage of the solar collector is large; investment is high for those areas with relatively short sunshine duration and poor air quality	no fuel is needed on sunny days; on rainy days and at night, fuel cooling 134% and heating 91%	3
4. waste heat CHP	waste heat utilization no fuel input	industrial waste streams, high temperature exhaust (> 240°C) from garbage incineration or other sources	1. garbage incinerator 2. heat recovery boiler 3. steam turbine 4. steam non-electric air con	• heat recovery boiler powered by exhaust from garbage incineration produces high pressure steam to drive the steam turbine • non-electric air con utilizes the low pressure steam from the turbine to produce cooling (and cool down the generator at the same time)	no fuel is needed for cooling/heating	restricted by heat source	cooling: 139%	0.85 (only for the non-electric air con)
5. biogas air con	garbage disposal no fuel input low	organic garbage	1. digester 2.desulphurization & purification device 3. gas non-electric air con	• 3-8 digesters produce biogas alternatively • the produced biogas is purified & desulphurized • non-electric air con provides cooling /heating utilizing biogas	no fuel is needed for cooling and heating; the garbage is treated harmlessly and by-produces organic fertilizer restricted by garbage volume	restricted by garbage volume	cooling: 134% heating:91%	2.5
6. gas air con	investment high flexibility	natural gas	gas non-electric air con	natural gas as fuel for cooling/heating	low investment, simple system and high flexibility	unable to utilize waste heat and solar energy	cooling:134% heating:91%	1

Approaches in this table cover all the most energy saving and most edge-cutting technologies in the world, which have already been successfully implemented by BROAD in Europe, the USA and Asia with many –year operation.

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