


KENTSEL MİMARİDE
RÜZGAR ENERJİSİ UYGULAMALARI




RÜZGAR ENERJİSİ TEKNOLOJİLERİ
SEMİNER SERİSİ-1

Ercüment Alyanak
Makina Y. Mühendisi
ENA Yelkapan Teknolojileri Ltd Şti
Urla, 13.Aralık.2012


KENTSEL MİMARİDE
RÜZGAR ENERJİSİ UYGULAMALARI



Düzenleyen
ISAWÉ - İYTE
RÜZGAR ENERJİSİ TOPLULUĞU

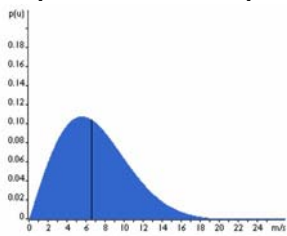


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RÜZGAR ENERJİSİ UYGULAMALARI




RÜZGARIN DOĞASI
[NATURE OF THE WIND]

RÜZGAR HIZI DEĞİŞKENDİR
[THE WIND SPEED CHANGES]



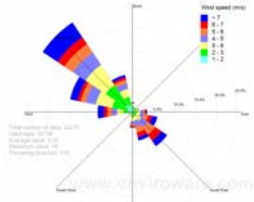
YILLIK RÜZGAR HIZI ESME FREKANSI DAĞILIMI
[ANNUAL WIND SPEED FREQUENCY DISTRIBUTION]

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RÜZGARIN DOĞASI
[NATURE OF THE WIND]

RÜZGAR YÖNÜ DEĞİŞKENDİR
[THE WIND DIRECTION CHANGES]



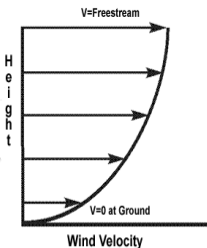
Çağları El Mısır Airport (2006,2012)
RÜZGAR GÜLÜ GRAFIĞI
[WIND ROSE GRAPH]

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RÜZGARIN DOĞASI
[NATURE OF THE WIND]

RÜZGAR HIZI
YÜKSELDİKÇE ARTAR
[THE WIND SPEED INCREASES BY ELEVATION]



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RÜZGARIN DOĞASI
[NATURE OF THE WIND]

RÜZGAR HIZI
PÜRÜZLERİ VE ENGELLERİ SEVMEZ...!
[THE WIND DOES NOT LIKE THE OBSTACLES]

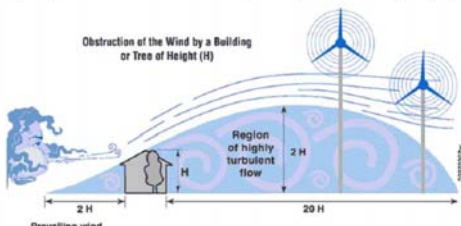


Figure 1-15: Schematic of the effect of obstacles on wind flow³²

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[THE WIND DOES NOT LIKE THE OBSTACLES]

Figure 1-8: Effect of step roughness change into an urban environment

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RÜZGARIN DOĞASI
[NATURE OF THE WIND]

RÜZGAR
DAR BİR BOĞAZDAN GEÇERKEN
HIZLANIR...!
[SPEED OF THE WIND INCREASES IN A DUCT]

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RÜZGARIN DOĞASI
[NATURE OF THE WIND]

BEŞ TEMEL ÖZELLİK
[FIVE BASIC PROPERTIES]

- 1 - RÜZGAR HIZI DEĞİŞKENDİR
[THE WIND SPEED CHANGES]
- 2 - RÜZGAR YÖNÜ DEĞİŞKENDİR
[THE WIND DIRECTION CHANGES]
- 3 - RÜZGAR HIZI YÜKSELDİKÇE ARTAR
[THE WIND SPEED INCREASES BY ELEVATION]
- 4 - RÜZGAR PÜRÜZLERİ VE ENGELLERİ SEVMEZ
[THE WIND DOES NOT LIKE THE OBSTACLES]
- 5 - RÜZGAR DAR BİR BOĞAZDAN GEÇERKEN HIZLANIR
[SPEED OF THE WIND INCREASES IN A DUCT]

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RÜZGARIN YAPILARLA ETKİLEŞİMİ
[INTERACTION OF THE WIND BY STRUCTURES]

RÜZGARLA UYUMLU YAPI FORMLARI
[APPROPRIATE SHAPES FOR MINIMUM TURBULANCE AND DRAG]

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RÜZGARIN YAPILARLA ETKİLEŞİMİ
[INTERACTION OF THE WIND BY STRUCTURES]

"AKIM İPLİKÇİKLERİ" VE "TÜRBÜLANS"
[FLOW STREAM-LINES AND TURBULANCE]

Fig. 17: Turbulences

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RÜZGARIN YAPILARLA ETKİLEŞİMİ
[INTERACTION OF THE WIND BY STRUCTURES]

"AKIM İPLİKÇİKLERİ" VE "TÜRBÜLANS"
[FLOW STREAM-LINES AND TURBULANCE]

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RÜZGAR ENERJİSİ UYGULAMALARI**
RÜZGARIN YAPILARLA ETKİLEŞİMİ
[INTERACTION OF THE WIND BY STRUCTURES]
"AKIM İPLİKÇİKLERİ" VE "TÜRBÜLANS"
[FLOW STREAM-LINES AND TURBULANCE]


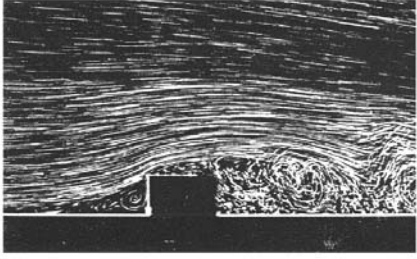

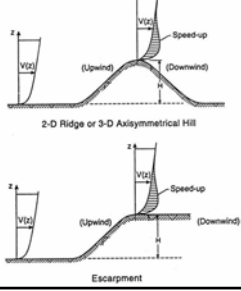

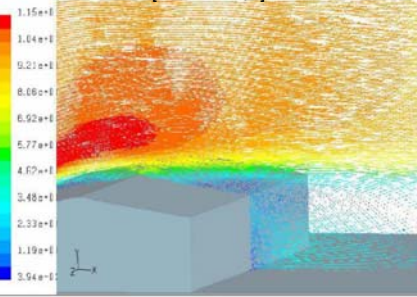



Figure 2-19: Visualisation of the turbulent separation at the leading roof edge of a flat roof⁶⁰

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RÜZGARIN YAPILARLA ETKİLEŞİMİ
[INTERACTION OF THE WIND BY STRUCTURES]
TEPE ETKİSİ
[HILL EFFECT]

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[INTERACTION OF THE WIND BY STRUCTURES]
TEPE ETKİSİ
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[INTERACTION OF THE WIND BY STRUCTURES]
TEPE ETKİSİ
[HILL EFFECT]




Figure 61 Artist impression of a spherical building with BAWT's.

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RÜZGAR ENERJİSİ UYGULAMALARI**
UYGULAMA ÖRNEKLERİ
[APPLICATION EXAMPLES]
MIAMI - USA




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UYGULAMA ÖRNEKLERİ
[APPLICATION EXAMPLES]
LONDON




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UYGULAMA ÖRNEKLERİ
[APPLICATION EXAMPLES]

CHINA





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UYGULAMA ÖRNEKLERİ
[APPLICATION EXAMPLES]

BAHRAIN





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UYGULAMA ÖRNEKLERİ
[APPLICATION EXAMPLES]

TASARI ÖRNEĞİ
[DESIGN EXAMPLE]





Figure 2-10: Conceptual architectural design of a skyscraper building with three integrated 35m diameter, 250 kW horizontal axis wind turbines

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UYGULAMA ÖRNEKLERİ
[APPLICATION EXAMPLES]

TASARI ÖRNEĞİ
[DESIGN EXAMPLE]

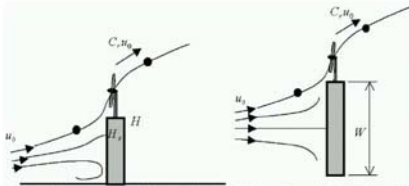




Figure 1.7: Project WEB

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ÇATI ÜSTÜ UYGULAMALARI
[ROOF TOP APPLICATIONS]






Figure 41 Streamline through the rotor of a wind turbine on the roof of a building (left) and besides a building (right).


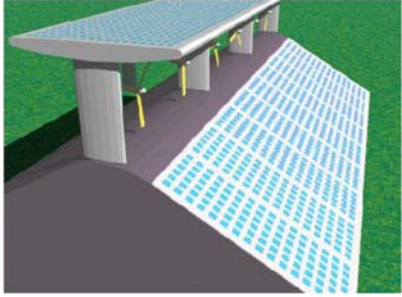
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ÇATI ÜSTÜ UYGULAMALARI
[ROOF TOP APPLICATIONS]






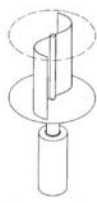
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ÇATI ÜSTÜ UYGULAMALARI
[ROOF TOP APPLICATIONS]


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DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]



Savonius Rotor



Darrieus Rotor



H Rotor



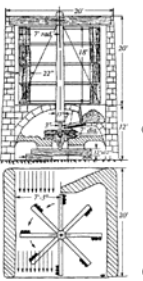




Figure 2.4. Rotor concepts with a vertical axis of rotation

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DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]
İRAN'DAKİ TARİHİ YELKAPANLAR
[ANCIENT PERSIAN WINDMILLS-VERTICAL AXIS]



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DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]
VARİL TİPİ PERVANE
(SAVONIUS ROTOR) - DESIGN OF ENA LTD/URLA




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DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]
DARRIEUS ROTOR




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RÜZGAR ENERJİSİ UYGULAMALARI**
DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]
DARRIEUS ROTOR






Figure 2.46. Flowind wind farm with vertical axis Darrieus turbines on the Tehachapi Mountains, 2006

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DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]

DARRIEUS ROTOR





Figure 3.5.11: 11-meter wind turbine (tower diameter) of 30, 300 kW rated power (Hindberg)



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DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]

DARRIEUS ROTOR

KENTSEL MİMARİDE
RÜZGAR ENERJİSİ UYGULAMALARI

DÜŞEY EKSENLİ YELKAPANLAR
[VERTICAL AXIS WIND ROTORS]

DARRIEUS ROTOR




KENTSEL MİMARİDE
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DÜŞEY EKSENLİ YELKAPAN
UYGULAMALARI

[APPLICATIONS OF VERTICAL AXIS ROTORS]

Animationsvideo, RWT Proof of concept model:



3 kW installeret, estimeret 650 kWh/år



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UYGULAMALARI

[APPLICATIONS OF VERTICAL AXIS ROTORS]



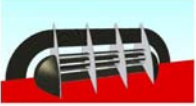

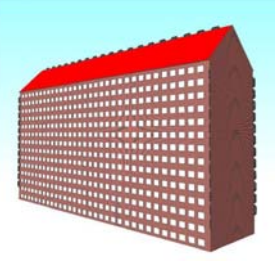


Standard modulopbygning
gør systemet billigt.



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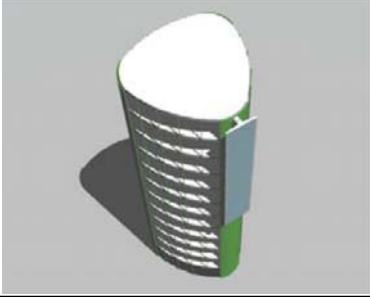


Figure 62 Artist impression of cylindrical building with BAWT's.

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UYGULAMALARI

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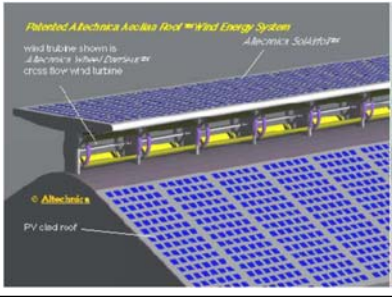


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[APPLICATIONS OF VERTICAL AXIS ROTORS]




Reinforced Altechnica Anclava Roof = Wind Energy System
Altechnica SkyLight™
wind turbine shown in Altechnica SkyLight™ captures cross flow wind turbine
Altechnica
PV-cled roof

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UYGULAMALARI

[OMNIDIRECTIONAL STATOR APPROACH]

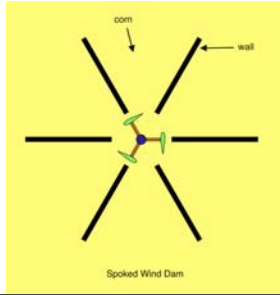


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DÜŞEY EKSENLİ YELKAPAN
UYGULAMALARI

[OMNIDIRECTIONAL STATOR APPROACH]



com
wall
Spoked Wind Dam

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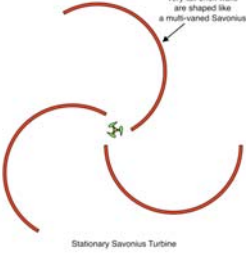
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DÜŞEY EKSENLİ YELKAPAN
UYGULAMALARI

[OMNIDIRECTIONAL STATOR APPROACH]

the actual turbine is in the center, and it is any kind of WWT (including a Savonius)

very tall brick walls are shaped like a multi-bladed Savonius



Stationary Savonius Turbine

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DÜŞEY EKSENLİ YELKAPAN UYGULAMALARI

[APPLICATIONS OF VERTICAL AXIS WIND ROTORS]

OMNIDIRECTIONAL
MULTI-BUILDING
APPROACH

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DÜŞEY EKSENLİ YELKAPAN UYGULAMALARI
[APPLICATIONS OF VERTICAL AXIS WIND ROTORS]

[OMNIDIRECTIONAL MULTI-BUILDING APPROACH]

BENEFITS OF THE APPROACH

- SUITABLE FOR WIND DIRECTION CHANGES
- SUITABLE FOR LOW WIND POTENTIAL REGIONS
- BUILDINGS ARE NOT "OBSTACLE"; THEY ARE PART OF THE WIND FARM SYSTEM

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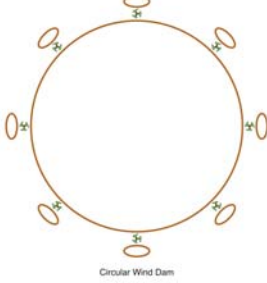
DARRIEUS ROTOR



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[OMNIDIRECTIONAL APPROACH]

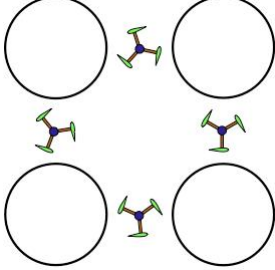


Circular Wind Dam

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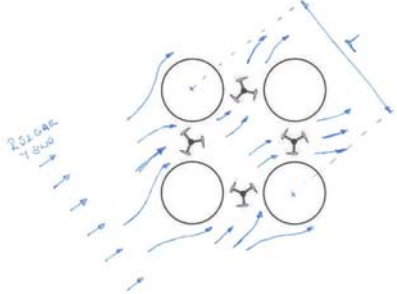
[OMNIDIRECTIONAL MULTI-BUILDING APPROACH]



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[OMNIDIRECTIONAL MULTI-BUILDING APPROACH]

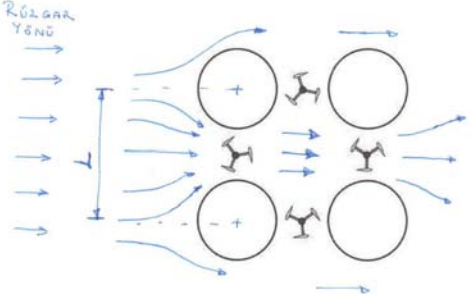


RÜZGAR YERİNE

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[OMNIDIRECTIONAL MULTI-BUILDING APPROACH]



RÜZGAR YANO

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İYTE'DE KURULACAK OLAN YELKAPAN
[WATER PUMPING WIND TURBINE FOR İYTE CAMPUS]




SU POMPALAYAN
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