

R ö k J b ´ x m ! x k k ¼ m J ´ Û  
0 m ! ž < Û § ! b § ö m



\* RRG 0RUQLQJ

:KLOH ZHBUH ZDLWLQJ WR JHW  
HQWHU \RXU

QDPH RUJDQLJDWLRQ  
TXDUDQWLQH SDVWLPH

<!m ö

-XQH

DP (67

:HOFRPH LQWUR PLQXWH

3UHVFHQWDLRQLQXWH

%UHDN PLQXWH

(QJJDJHPHQW 6XPPBUQXWH

\$FWLRQV 0DSSLQJ PLQXWH

1H[W 6WHSV PLQXWH

w!! 'Jm < „ [! 'JÔ!!

(ZRNCKP YJGTG YG CTG KP VJG RTQEGUU

2TQXKFG TGUWNVU CPCN[UKU QH VJG %\$2 TG

&QOOWPKV[ UVCMGJQNFGT HGGFDCEM VQ FC

\$UUGUU RQVGPVKCN NQY ECTDQP CEVKQPU

ʒ ʌ ʌ ʌ : À J k ! b J m ! F à D ! ž ! ö ž ! Õ ! M

2TQLGEV  
'CVC EQN

%CUGM  
/QFGNM

%WUKPG  
2NCPPGF

.QY  
&CTDQP 5E  
/QFGNNK

)KPCN 4  
5VTCV  
\$NKIPO

&QWPEKN 4G  
2TQLGEV &N

)CNN 9K

,CP /C[

5RTKPI

5WOOGT

)CNN 9K

5RTKPI

&KV[ 5\$&  
/GGVKPI

5VCMGJQ  
/GGVKPI  
&TQYFUQW  
%\$2 9GDK

&KV[ 5\$  
9QTMKPI  
\*TQWRU

8KTVWCN 2  
6QYP +CNN

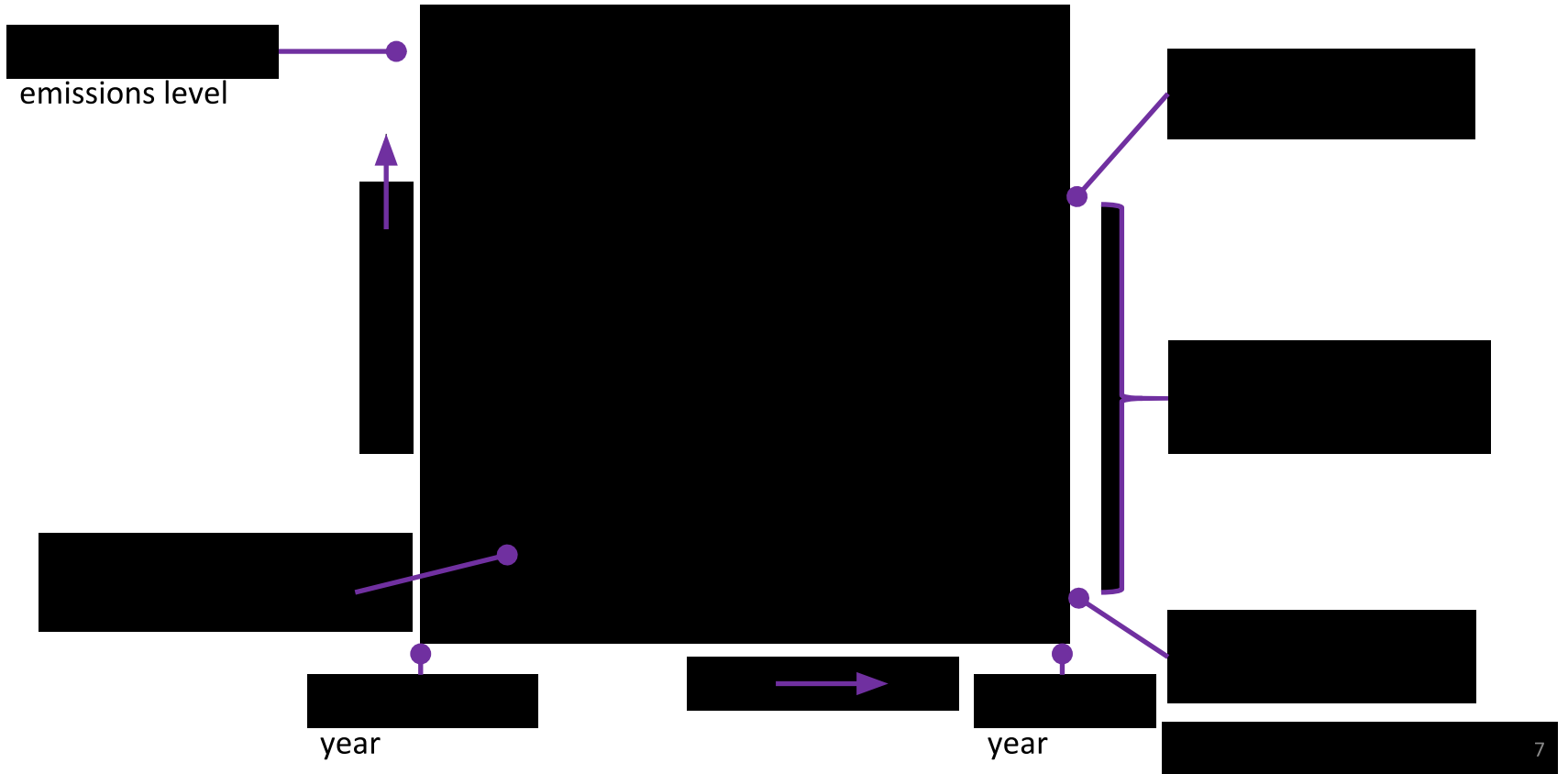
pORNGOGPVCVKQP

ö ! ! b J m !

¼ ! J m ! ! ! a ö ! a § b ö m m !



\$ D Q W V H W V W T G U E G P C T K



9 J C V K U V J G % \$ 2 "

2 T Q L G E V K Q P Q H ú D W U K P G U U C U R N C P P G F

" r P E N W F G U R N C P U R Q N K E K G U E W T T G P V  
W P F G T Y C [

" 0 Q V R G T H G E V R T Q X K F G U V J G D G U V K F  
O C [ J C R R G P

+ Q Y Y G T G C U U W O R V K Q P U F G X G N Q R G F "

" 3 W C P V K V C V K X G R T Q L G E V K Q P U

" 2 T Q L G E V K Q P U F G X G N Q R G F H T Q O R N C P U



j!Û (!kx<žö>DJ !

'GOQITCRJKEU C  
KORQTVCPV FTKX  
GPGTI[ EQPUWOR  
\*+\* GOKUUKQPU V

rP +COKNVQP UK  
RQRWNCVKQP  
GXGP ITGCVGT LC  
KU CPVKEKR

j!Û ( !kx < ž ö > DJ !

§x > ¼ bö 'Jxm !m!J'Û  
[>!x>b!RDö\

§x > ¼ bö 'Jxm !m!J'Û  
Döm < ! a

§ x > ¼ b ö ´ J x m ! m ! J ´ Û

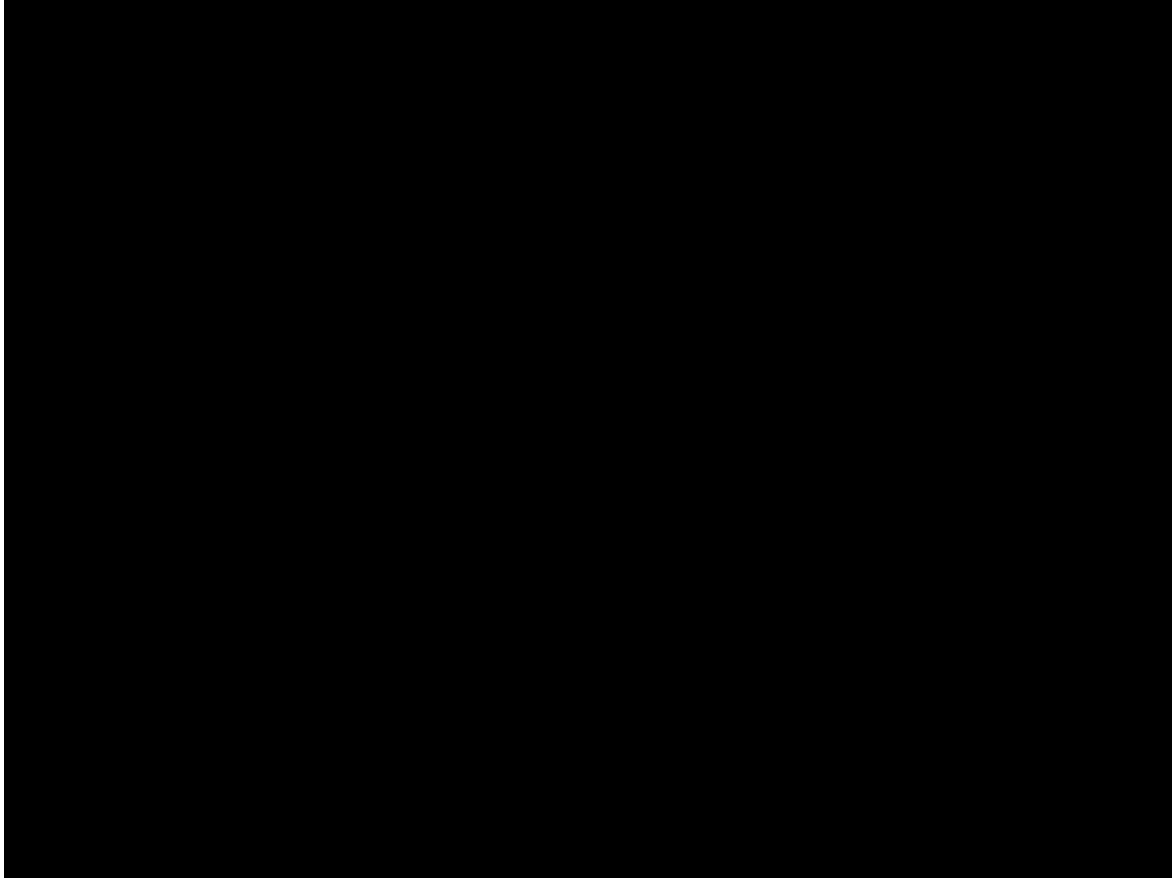
[ > ! x > b ! R D ö \

Ä

0 m ! ž < Ů Ć m J ' !

1 Petajoule (278,000 megawatt hours) =

J R J 0 k J ! ! J x m !



! x k k ¼ m J ´ Û 0 m ! ž < Û Ä 0 k J :: J x m : G a

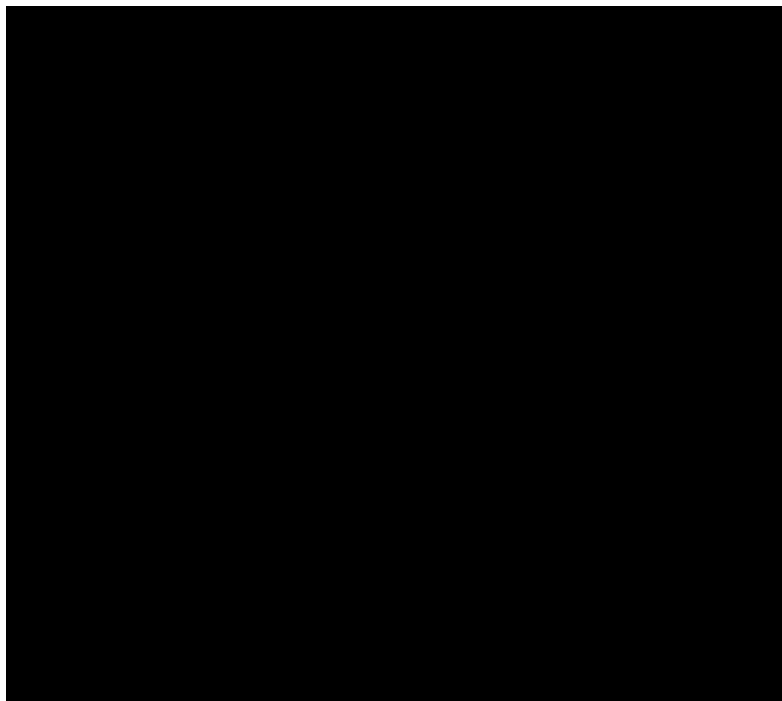
0 m ! ž < Û  
! x m : ¼ k > ´ J x m

a

! x k k ¼ m J ´ Û 0 m ! ž < Û Ä 0 k J ! ! J x m ! G a

0 m ! ž < Û (! m ! J ´ Û  
[ À h R D ö \

0 m ! ž < Û (! m ! J ´ Û  
[ À h R D ö \



0 m!ž<Ů (!m!J'Ů  
[ÀhRDö\ a



! x k k ¼ m J ´ Û 0 m ! ž < Û Ä 0 k J :: J x m ! G a

0 m ! ž < Û  
! x m ! ¼ k > ´ J x m

, Q G X V W U \

6 Q V C N K P

6 Q V C N K P

! x k k ¼ m J ´ Û 0 m ! ž < Û Ä 0 k J :: J x m ! G a

0 m ! ž < Û  
! x m ! ¼ k > ´ J x m

% X L O G L Q J V

6 Q V C N K P

6 Q V C N K P

! x k k ¼ m J ´ Û 0 m ! ž < Û Ä 0 k J :: J x m ! G a

0 m ! ž < Û  
! x m ! ¼ k > ´ J x m

À ž ö m ! > x ž ´ ö ´ J x m

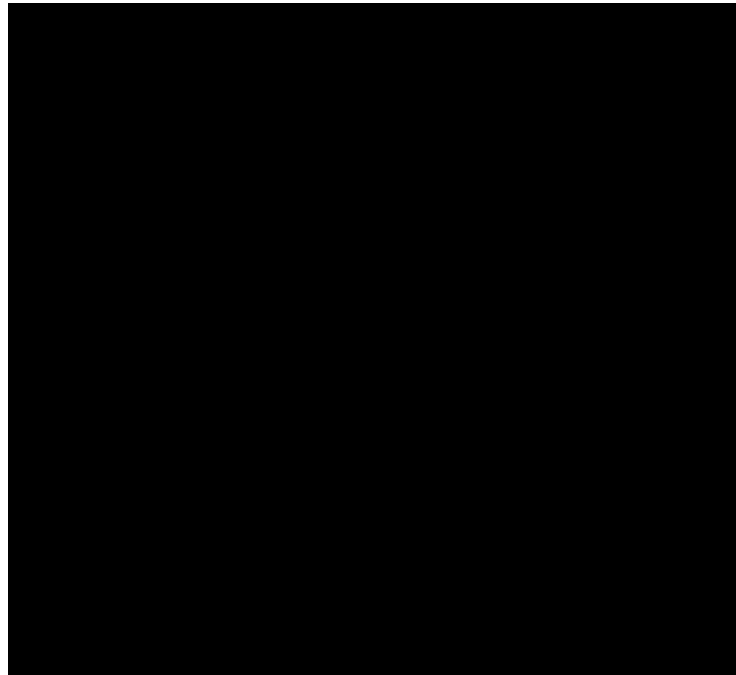
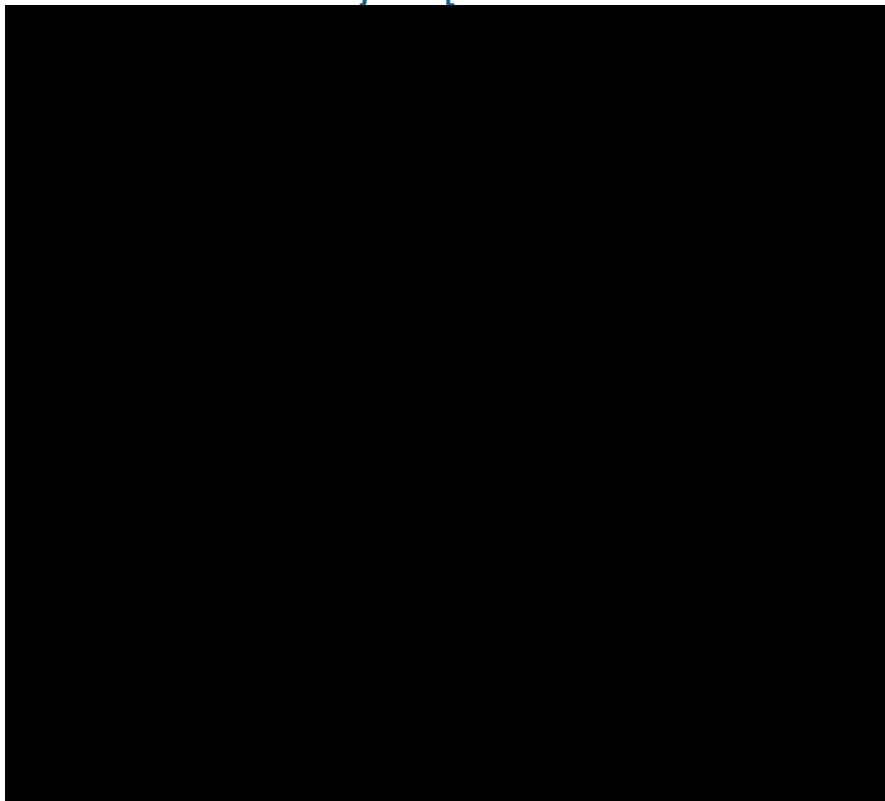
À x ´ ö b [ \ F h  
À x ´ ö b [ \ F h



! x k k ¼ m J ´ Ũ 0 m ! ž < Ũ Ä 0 k J :: J x m : G a

À ž ö m ! › x ž ´ ö ´ J x m  
ß j À [ \

À ž ö m ! › x ž ´ ö ´ J x m  
ß j À [ \



!xkk¼mJ´Û 0m!ž<Û Ä 0kJ!!!Jxm!G a

JRJ !kJ!!!Jxm!

&RPPXQLW\ (PLVVLRQ

7RWDO LQ

7RWDO LQ 0W&2 H

a

3HU &DSLWD (PLVVL

!xkk¼mJ´Û 0m!ž<Û Ä 0kJ!!!Jxm!G a

JRJ !kJ!!!Jxm!  
[´!„ !RDö\

JRJ !kJ!!!Jxm!  
[´!„ !RDö\

!xkk¼mJ´Û 0m!ž<Û Ä 0kJ!!!Jxm!G a

JRJ !kJ!!!Jxm!

,QGXVWU\ \*+\* (PLV

7RWDO LQ

7RWDO LQ 0W&2

' a

!xkk¼mJ´Û 0m!ž<Û Ä 0kJ!!!Jxm!G a

JRJ !kJ!!!Jxm!

%XLOGLQJ \*+\* (PL

7RWDO LQ

7RWDO LQ 0W&2

, a



!xkk¼mJ´Û 0m!ž<Û Ä 0kJ!!!Jxm!G a

JRJ !kJ!!!Jxm!

7UDQVSRUWDWLRQ  
(PLVLRQV

7RWDO LQ 0W&2  
7RWDO LQ 0W&2

CY

!xkk¼mJ'Û 0m!ž<Û Ä 0kJ!!!Jxm!G a

JRJ !kJ!!!Jxm!

Àx'öb JRJ! [ \F  
Àx'öb JRJ! [ \F

Àx'öb [ \F  
Àx'öb [ \F

Àx'öb JRJ! [ \F  
Àx'öb JRJ! [ \F

0 m ! ž < Ů I b x Ō J m R ö k J b ´ x m G

X m ! J < D ' ! J m ' x R ö k J b ' x m ! ! § ž x [ ! ' ! § I ¼

§ ' ž ! m !

" 0 ; ë J ! m Û J k > ž x Ô ! k ! m ' ! G ¼ ' bö ž < !  
ö m [ x ! < ž x Ö ' D - ! m ! ž < Û Ä ! k J ! ! J x

" 0 b ! ' ž J ö b < ž J G ž ! b ö ' J Ô ! b Û b ! ö m  
' x y J [ > ! ö ^ ! ž > b ö m ' ! \

" a x ; J R J ! k J ! ! J x m ! ; ž x k ; x ! ! J b ; ¼

" b ! ! ! ' D ö m a x ; ! m ! ž < Û F b x ö b ž !

" ' a > ! ž ! m ' x ; ! m ! ž < Û ¼ ! ! x m Ô ! ž ! J

" X m ¼ ! ' b Ô F < ! ! ' ! x ¼ ž ! x ; ! k J ! ! J x m ! G ! ! > L  
x ö b a > x Ö ! ž ! ! ' ! ! b ! k ! b ' ! ž !

5 Q W T E G & C \* % &

# X m ! J < D ' ! L L L § '

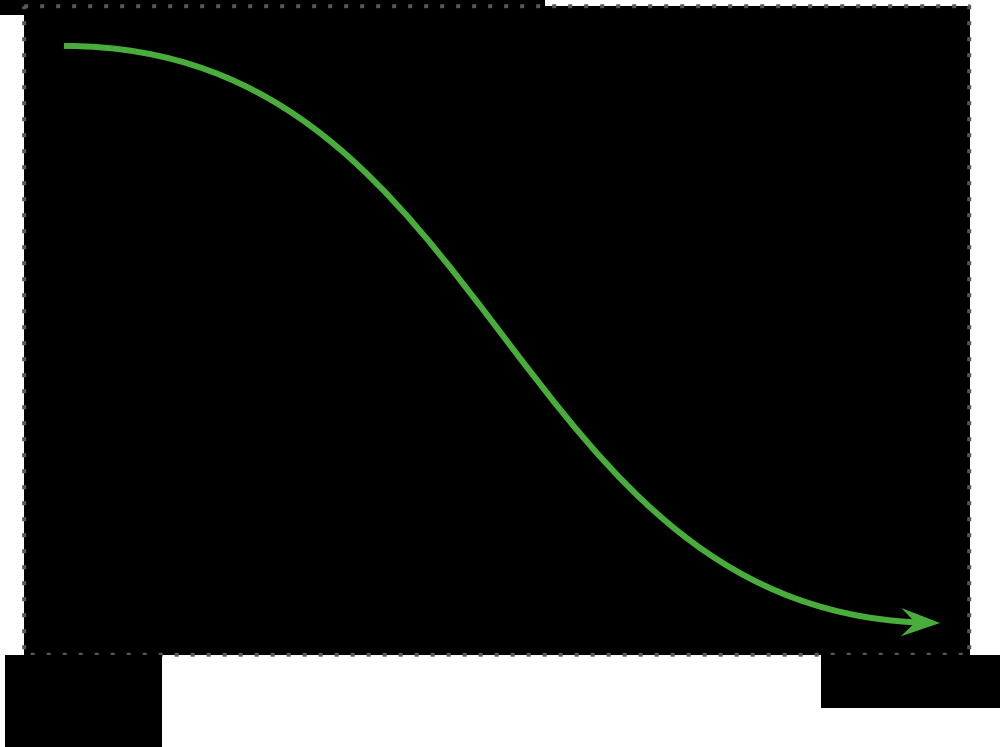
## § À ž ! m !

” À ž ö m ! › x ž ' ö F J Å x m ö b ß j À ! Ú › ! ' ! ' x

” ¼ J b J m × k F ž x Ô ! ! m ! ž < Û ! ; ë J ! m  
m ! Õ ¼ J b J m < ! G J m ž ! k ! m ' ö b ž ! '  
ž ! ¼ ! m ! ! ; x ž ! › ö ! D ! ö ' J m < ö ž !  
' D ö m x ; ; ! ! ' Û › x › ¼ b ö ' J x m < ž x Õ '  
L

” à ö ! ' ! Æ k J ! ! J x m ! ; ž x k Õ ö ! ' ! Õ J b b  
< ž x Õ Õ J ' D ö < ž x Õ J m < › x › ¼ b ö ' J x

y 0 å À º À „ § H H L  
m x Õ a ö ž x m  
k x ! b J m <



© ¼ ! ! ' J x m ! M

k J m  $\frac{1}{4}$  ' ! ž

! x k k ¼ m J ´ Û 0 m < ö < ! k ! m ´





§ D ö ! ! F w ! ! ' J m < ! Õ J ' D ! ' ö ^ !

7 K U R X J K R X W W K H I L U V W K D O I R K H  
K D G V H Y H U D O P H H W L Q J V Z L W K M N H

" + \ G U R 2 Q H

" \$ O H F W U D

" + D P L O W R Q & R P P X Q L W \ ( Q H U J M

" ( Q E U L G J H

" + D P L O W R Q 7 U D Q V S R U W D W L R Q L Q

" 1 5 & D Q ¶ V 0 F 0 D V W H U , Q Q R Y D W L R Q W H D P

& D Q D G L D Q 6 W H H O 0 D Q X I D F W X U H U V \$ V V R F L D W L

§ D ö ! ! F ! ž x Õ ! x ¼ ž J m <

RQOLQH VXUYH\ V ZHUH SUHV\ /R  
LQ 0D\ WR GHYHORS

&ULWHULD IRU VHOHFWLQJ ORZ EDUERQ

3XEOLF SUHIHUHQFH IRU ORZ DF

